Right To Be Wrong: What Caused The Universe, God, Or Nature?

Jason Allen Pluebell Jr.

Chapters

You Have A Right To Be Wrong

Introduction And Reason Why

This book is a collection of articles that I have written concerning the question, "Where did everything come from?" These articles went over philosophical arguments and observational evidence concerning the existence of God on the basis of the beginning and fine-tuning of the universe we live in today. More articles like the ones this book is built upon can be found at ptequstionstoeden.com, an online blog that offers apologetic and educational articles about Christianity. During my time writing and researching these articles, I eventually decided to combine them into a single volume for the layman to read. I, too, represent the common layman, and by no means am I an academic at some university. No, I am but a technician from the North-Eastern United States who has a love for reading and defending the faith.

If somebody found themselves desiring to investigate the idea of a God existing in the first place, and who that God may be, I believe the best place to start is to answer the very first step of asking if God can exist in the first place, at least more so than just nature. By examining the current evidence, we have concerning whether our universe had a beginning, we can determine if the task of searching for God is even worth considering. After all, if the universe never began, why would we ever be led to believe it had a creator? Indeed, the idea of a being that is external to the material world, and the material world running down and having a beginning, seems to imply that the universe has a cause grounded in that transcendent being. Or does it?

By using abductive reasoning, we can compare the explanatory power of the different answers to the ultimate question of cosmic origins. By examining what each answer holds, we can extrapolate the expectations each one most reasonably has, considering nature, to determine which one best explains the beginning and fine-tuning of our universe.

What I have done is taken the time to read from the very scholars at the head of these issues. I am by no means a genius or polymath. Stephen C. Meyer has written a fantastic volume that any person can pick up and read (though some may find it technical). His book The Return of the God Hypothesis offers an amazing, wonderful, and in-depth discussion of the idea of God's existence and the evidence for it. I have used this book extensively throughout this volume, along with other books and authors cited as needed. I must also thank popular voices and authors like Hugh Ross, Frank Turek, J. Warner Wallace, William Lane Craig, John Lennox, James M. Tour, William A. Dembski, Durwood B. Hatch, Michel-Yves Bolloré, and so many others, to whom I suggest you look. Without the hard dedication these God-fearing men have shown, neither this volume nor my blog would have been possible.

So why write this? Isn't there a plethora of books out there written by far smarter and academically recognized people? Absolutely, and I think it would be in your best interest to go and read those books. I am writing this to show normal, God-fearing people that it doesn't take a PhD to understand our faith and defend it from critics. You are not limited in this respect, as we live in an age with more access to knowledge than ever before! Out of all times in human history thus far, this is the time to get out there and learn something that matters. It takes time, and not even I am close to being a perfect follower and defender of Christ (not that any one person can become perfect to begin with). Just know that even the most limited person can grasp these concepts and make a defense for the reason he/she is a Christian. Yes, even you.

I am not saying that you should be able to write a book, read for hours on end, or start a blog. What I am saying is that if I, certainly a layman, can set time aside to learn from some great minds and write this book, then you can most surely set some time aside to read your Bible and spend time with Jesus. Even ten minutes a day in His word can make an impact on one's life. Moreover, the issue at hand is no subjective matter. Yes, you can still believe in an eternal universe, but if the universe itself had a beginning, then you are doing so on no basis of sound reasoning. God created you with free will, and that means that you have a Right to be Wrong. So without further ado, let's see if we can discover what caused the universe to come into existence.

Chapter 1
The Role Of Logic And Epistemology In This Analysis

Does Truth Exist? Is Seeking God Even Logical? How The Three Modes Of Reasoning Will Aid Us In Searching For God.

If we are to tackle the question of whether God exists, and with reference to the finitude of the universe, we need to be certain that we are even able to know the truth about the universe to begin with. If truth is relative, subject to a person's opinions and tastes, then it is utterly pointless to try to utilize it in pursuing this question. But if truth does exist, and it is binding to all people in all places (being objective), then we have every right and reason to investigate the nature of the universe. "Wait," you may say, "what do you mean by subjective and objective truth? Why do those even matter?" To this, we shall take a brief review of what truth is, if it exists, and whether or not we can know it.

If truth is subjective, and whatever you think is true, no matter what it is, really is true; then this would render any investigation into anything pointless. Let me elaborate. If whatever you think is true, actually is true, by virtue of the fact that you have decided it is, then any communication about objectiveness vanishes. You cannot actually claim that gravity is an active and real force, because the antithesis is equally true by virtue of people believing it. You can't even claim a word means something. This makes any debate over the "realness" or truth value of anything completely fly out the window—taken to its logical conclusion. But, as we will see, it is extremely easy to demonstrate that there are true truths, and their opposites being false, no matter a person's opinion, location on Earth, or period in time.

Does Truth Exist?

So, does truth exist? If we can find a definition of "truth," we can kick-start this investigation into whether God exists. So what is the truth? Truth, simply put, is telling it like it is. It is that which corresponds to its object, or source of grounding (or what it relates to in reality).[1] Another way to word it is those beliefs that we hold that *correspond to something in reality*. If something is true in an objective sense, it is true for all people, at all times, and in all places, doing or feeling anything. Now, there is a subjective side to truth that is grounded in the tastes of a person or subject. But for now, let's focus on expanding our understanding of objective truth.

Communication is the basis of discovering truth between individuals. Without some form of communication and record-keeping, science itself would never have developed. One of the requirements for performing it is a system of numbers and mathematical logic, along with a writing system to keep records and data. In this development of communication through speaking and writing, there was always an underlying, concrete foundation that unified all human thought: the idea of a real "objective" truth and that it can be known. The Law of Identity and Non-contradiction, that "*A is A and if you have A, it is not non-A*," has been the rock on which reason and discovery of truth were based.[2] If one person has a different definition of truth, then communication between views completely crumbles. Definitions are very important, and thus having an agreed-upon definition of truth also aids us in conversing about what the truth is when two differing opinions are involved. Modern culture mainly focuses on one side of the coin of truth, namely, subjective truth.

It takes the idea of "truth claims grounded in a person's preferences" and applies it to all areas of life (which is why we have wild ideologies being pushed onto younger and younger audiences). But this view of truth is sorely mistaken because there are two sides to truth: subjective and objective. Still, when speaking about one or the other with reference to their grounding, such as objective reality, then subjective opinion is always trumped by objective facts.

A Practical Example of Subjective Truth

Suppose you get a call from your buddies (*situation a*), and they want you to go out to get donuts from *Krispy Kreme*. You happily oblige and tag along. While you guys are ordering, you get into a discussion about which donut flavor is the best. Your friend genuinely tries to argue that Apple Cinnamon is the best flavor, no matter what you think. You heavily disagree, defending your donut's flavor as the best. Can you actually make an objective case that your favorite donut is the best? In this case, a subject holds a truth claim grounded in herself. Thus, she is making a subjective truth claim where the validity of the claim is grounded in what the person's preferences are on the object of focus.

But what if something different happened? What if you decided to make the case that your friend's favorite donut, Apple Cinnamon, is actually not a donut, but a type of Pop-Tarts (*situation b*)? Now, the truth value of the claim is not grounded in the opinion and taste of the subjects, but in the qualities of the dessert in question. We can now examine the Apple Cinnamon donut—observe its qualities and properties—and conclude that it is not a type of Pop-Tart, but indeed is a donut. It exhibits all of the qualities of a donut, and not the qualities of a Pop-Tart. Therefore, the truth value of that claim is false, as it is not grounded in your opinion of what a Pop-Tart may be (in this scenario, it is identical to a donut, when it is not), but rather it is grounded in the object of the Apple Cinnamon donut.

A Practical Example of Objective Truth

Let us entertain another hypothetical. Suppose you went to the hospital, and an Oncologist has diagnosed you with leukemia or lung cancer. The doctor informs you that the only cure available for you may be to undergo chemotherapy, blood transfusion, or some other treatment. But you don't want to go through the treatment and say, "I don't need that! I think Advil will work better as a cure!" Is the claim of a cure for your illness grounded in your opinion? Does your belief that Advil is the cure for cancer make it work as the cure for cancer? The claim of the best cancer treatment is not grounded in a person's personal preferences and beliefs; it is grounded in the human body, cancer, and which treatments actually get rid of or limit it.

Another example could be that you get another call from your friend, and they inform you that they just bought a brand-new black *Honda CR-V*. The claim he is making is not grounded in a subject *(you)*; the claim that his car is black is grounded in the object of his car, an entity separate from you. The validity of the claim is now grounded in an object, which makes it an objective truth claim. If there were no objective truth, then we would all be dead by now. It is simply impossible to fully live out a subjective/relative truth-based worldview; people will always fall into an objective system to carry out anything meaningful. Truth is not wholly grounded in subjects.

Responses to Objective Truth

When you establish the fact that there is truth grounded in objects in reality, a relativist will usually respond with an argument similar to the ones in this section. Many of these are circular and self-contradictory, and it is crucial to be able to identify when someone is committing these logical fallacies and to correct them when necessary. Our culture is so affected by the various philosophical theories of truth that have long been around and have been proven invalid on a larger scale. Often, people respond with slogans that have been thrown around since the dawn of these very theories, many of them unaware of the logical inconsistencies in their defenses. So, what do the proponents of relativism say in defense of their position?

The first response I will cover is the flat claim that "Objective truth simply does not exist!" Proponents of relativism love to say that there is no objective truth, almost always completely ignoring examples of objective truth (such as those already provided). Another way of saying this is "All truth is relative," essentially claiming that the source of truth is the self: "My lived experience is different than yours, so my truth is different." As well as "I have my truth, and you have yours," "Believe only what you think, I believe…," and "Believe only what you decide is true." But these are all *self-refuting statements*. To believe there is no objective truth, you must reject the claim that there is no objective truth because the claim is claiming to be the only objective truth apart from opinions. The claim that there is no truth is itself affirming itself to be a truth. It contradicts itself; therefore, it is not logically valid. If it is objectively true that there is no objective truth, then the objective truth that there is no objective truth is not objectively true and is thus a false statement under its own rules. To affirm this, you must break its own rules. And if your worldview is based on this assumption, then you must break the rules of your entire worldview to affirm your worldview. It makes zero sense!

The second response is that “Objective truth cannot be discovered or known.” People who use this argument are usually also saying that you are too arrogant even to think you know something is true. Often, their only supporting argument for this is that others can form different opinions. They claim that objective truth is oppressive and restricts people’s freedom, but is living in delusion truly freedom, or slavery to your emotions and neurotic impulses?

“Believe those who are seeking the truth; doubt those who find it.” [3]

If nobody knows the truth, how can anyone say what they believe is true? How can you believe the claims of those who don't know what is true? How can anybody say anything is wrong? If there is no objective truth, then nothing is objectively wrong, and thus, asserting one’s truth as objective cannot be wrong under this very view of objective agnosticism. Do you see how nobody can truly live in a relativistic worldview? Worse yet, this is also another self-refuting claim. It says that no objective truth can be known, while being the only objective truth that can be known. This, too, makes no sense!

The third response people have is to accuse you of being intolerant. For some reason I myself cannot fully explain, it seems that everybody believes tolerance means accepting, believing, affirming, and promoting any belief, true or false. That is not what tolerance is. Many a time, someone may say that you're being intolerant by not accepting and agreeing with differing views, but this claim makes zero sense; however, I can see where it comes from. Popular culture uses emotional and moral rhetoric to more or less guilt-trip a person into accepting an untrue belief. What I do not understand is how people can so easily believe that. Western culture has redefined tolerance to mean that "all views have equal merit and no one view is better or more true than another". Everyone must accept everyone else's view.

This response is self-contradictory, as one must accept all views as equally valid—yet some beliefs and views regard other views as less true and hold differing beliefs. All views, except the ones that see themselves as true, are true, which contradicts this definition of tolerance. How can all views be equal except those that don't see others as equally true, if, again, all views are equally meritable? How can you see all views and opinions as equal, but reject one view? That's hypocrisy. Wouldn't that make you intolerant? Indeed, you must break the rules of tolerance to affirm them. So, if this definition of tolerance makes no logical sense, what does tolerance really mean? Tolerance is a fair, objective, and permissive attitude towards those opinions, positions, preferences, people, and worldviews that may differ from one's own. To be tolerant, disagreement and differences are also not surrendered to full agreement. This is because tolerance is a permissive agreement with differences; there cannot be hate towards a person, only towards ideas.

So simply disagreeing with someone's idea does not immediately mean they hate you or look down on you. We are called to hate wrong and evil ideas as Christians, but to love the person and attempt to inform them of their wrong ideas. Informing someone that they are wrong is not hate, nor does it express it, because people's identities are not grounded in their opinions and feelings, unlike what modern culture will lead you to think. People are far more than mere opinions. If you truly loved people, you would want the best for them, and the best for them is to know what is real. Part of loving people is permission for difference, but respectful conversations about those differences to find truth. But how can we find truth if we have no definition of it? Can we find a theory of truth that works all the time? One that applies to all situations and areas of life? One that is absolute?

What Is Truth? A Survey Of Truth Theories

If we want to converse about differences in opinion, we must have an agreed-upon definition of truth. If we were to investigate the nature of the universe, an agreed-upon definition would benefit us greatly! If we were to decide which view is true, then truth must be grounded in reality and not mere opinion. An example would be you not believing your friend's new Honda CR-V is actually black. This view can be proven by observing the car in reality. So can we find a theory of what truth is? First, let's look at some alternative theories of truth proposed throughout human history.

Empirical Truth Theory

This theory of truth states that "I can only believe what can be discovered through the five senses and scientific investigation," and finds its birth in the 17th century with figures like *Francis Bacon*. Over the next four centuries, it has now been popularized into a widely held form of *scientism, naturalism,* or *empiricism*. It reduces methods of finding truth to those that can only be confirmed via inductive investigation (the scientific method). Proponents of scientism believe science is the only real path to truth.

But this theory is self-refuting. Believing that the only avenue for the discovery of truth is science cannot itself be proven by science. This is a philosophical assumption that is already in view before performing science. It is an a priori view that is presupposed before ever using the scientific method to discover truth. Somebody holds this position logically before science. Moreover, the foundation of science is rational/logical, but can only be proven by using reason and logic under this theory of truth. It is a self-refuting statement to think science is the only avenue to truth.

Pragmatic Truth Theory

Pragmatic theory originates in the 1870s with the philosopher *Charles Sanders Peirce* in his article titled "*How to Make Our Ideas Clear*." This theory suggests that the truth is whatever can be demonstrated to work for whatever application is of interest. We can observe and test a cure for a disease, and the truth of "what is the cure" will be whatever drug or treatment works best. But does this theory apply to all areas of life? Have you ever told a small or large lie that made a situation work out for your best interests? Maybe your partner tells you that weird scratchy turtleneck looks great on you only to get you out to dinner with their parents on time; or maybe you blamed a mess on the dog and that worked out for you; or perhaps you told your grandfather that those white hairs are barely visible and that he actually looks no older than 30. Successful lies do exist, and just because a statement works, it does not necessarily mean it is true or right.

Emotivist Truth Theory

The last theory I will mention originated in the early 20th century with figures such as *A. J. Ayer* and *Charles L. Stevenson*, and is the most popular and widely held view today. It states that the truth is whatever you feel is true based on your life experience. But this view has some obvious issues.

Something about stinkbugs flying makes me terrified of them. Even though I know

they are harmless! Even looking at this picture makes me uncomfortable.

Which brings us to the main issues with *Pragmatic Theory*. First, every person has at least one irrational fear; we all harbor a fear for which we have no good reason. Personally, I am terrified of stinkbugs; something about the way they fly just triggers a primal fear inside of me, and I turn into an 8-year-old girl! Some people are afraid of daddy longlegs, despite them being harmless; others may be scared of the smallest amount of water, or just being wet entirely; some people are afraid of small holes. The point is that we all have many fears that we have no real reason to hold, but we hold them anyway (often called *phobias*). They are not true fears. Second, there are also plenty of truths that have nothing to do with what we feel. The color of your friend's *CR-V* has no basis in what you feel at the moment.

Also, the truth of whether duct tape is adhesive or whether a drink coaster protects a tabletop from water damage has no grounding in your preferences. These truths will be the same for everyone, regardless of their feelings about them. Another issue is a person's life experience. What if somebody's life experience leads them to a false belief? Flat-earthers mainly believe what they do based on what they experience by looking at the sky and horizon, despite never having left the troposphere or looked at mathematics and physics. Or what if someone has a bad experience with a specific person, but then extrapolates and generalizes that experience to mean all people in a group are inherently bad? [4] A good modern example of this is extremist feminists, who believe that all men are terrible solely based on the handful of experiences they've had with bad men.

Life experience and feelings do not determine what is true.

Correspondence Truth Theory

This theory of truth is the actual definition of truth. A theory of truth that applies to all areas of life is that the beliefs we hold have a one-to-one correspondence to reality. Essentially, those truth claims that may initially be subjective, that we hold, are confirmed by the objects they are grounded in, in reality. Remember, truth is telling it like it is. An example of this is harkening back to the *CR-V* example above. You end the call with your buddy, still in disbelief that his car is actually black. You think he would have bought a blue car, because he has a history of playing jokes on you, and his favorite car color is blue. So you drive over to his house, and there is a blue *Honda CR-V*, and he's standing in the driveway holding the keys, laughing. Something quite different has now happened.

What you believed about the car did turn out to be true. What you believed about the car corresponded one-to-one to what the car actually was, which made your opinion true. It is the correspondence between an opinion and what really is that determines what is actually true. Therefore, truth is a *relationship* between what you believe and what really is. Individuals' feelings or mental states do not alter truth: an ignorant person can make a true statement, and an angry person can as well. Truth is true for all people, in all places, at any point in time—2+2 has equaled 4 for all people, at all times, and in any location or situation. Truth does not magically change because people believe otherwise: If I believe my car is pink but it is really blue, it will not turn pink, no matter how badly I want it to. All truth is absolute truth, even a subject's truth.

If I go on a skiing trip to Alaska but forget to bring my gear, I may say I am really cold. That subjective feeling is true for all people, namely that I am cold in Alaska. Likewise, my obsession for Alfredo. If somebody thinks I actually do not like Alfredo… they are objectively wrong.

Is Truth Knowable?

“Okay,” says the relativist, “Truth may exist, but nobody can know it.” Does it make sense to believe truth exists, but that nobody can know it? Is complete skepticism or agnosticism logical? In fact, it is not. Once again, this view contradicts itself. It is self-contradictory to say that no truth can be known, because every negation begs for an affirmation. So when somebody says that nobody can know the truth, they are placing themselves in a position of knowing something about the truth… namely that nobody can know it. So to make the claim, you must know at least some truth.

Maybe an example would help. Say you walk into a room and overhear a conversation. Somebody is informing another that they are a driver's education teacher. As they continue, they tell a story about an incident that occurred the other day while they were driving. They were entering a four-way intersection, turning left, and the traffic light was green. Another driver was coming from the other direction, turning right. The supposed driver's education teacher then complains that the other driver proceeded to cut them off by entering the intersection first. You notice something: they are entirely incorrect about the logic of this situation. Under most traffic rules, a left-turning driver yields to oncoming traffic, which includes those turning right from the other direction. You continue the conversation and confront the supposed teacher, saying they are wrong and know nothing about traffic rules.

For you to say that they were wrong, you had to know something about traffic rules that enabled you to identify their error. The same goes for claiming truth is not knowable, and that those who think they know it are wrong. You must know something about the truth to say somebody is wrong about it and cannot or does not know it. So at least some truth is knowable. Finally, the skeptic will say that the truth cannot be known, but then, in the very next breath, claim that their view is the true one. It can't go both ways. Complete agnosticism seems to breed a "rules for thee but not for me" situation. Truth is knowable, for to say it isn't, you must know it isn't knowable, which is a contradiction.

Does Truth Matter?

Truth may exist, and we may know what it is, but why does that matter? Does it even matter? It absolutely does. Truth provides us with the foundation for all other human faculties. We need an unchanging collection of truths to reason as the laws of logic do not vary from person to person. We need truth to perform science—expecting the external world to be objective, ordered, and logical is the foundation of scientific reasoning. We need truth to understand morality and ethics; i.e., humans having inherent value: therefore murder is absolutely wrong. We need unchanging truths to communicate with one another, because if a word or signal has a different meaning for each person, all human communication ceases.

It is therefore of the utmost importance to consider an objective truth and to pursue what that truth is actively. If you did not know the objective truth about gravity, you very well may have leaped to your death without ever suspecting that you would plummet to the ground.

A Brief Review Of Reasoning: Deduction, Induction, And Abduction

We know what truth is: that which corresponds to what really is in reality. We also know its importance and that we can discover and know it. So that if we want to know anything about the finitude or infinitude of the universe, we now know to observe the things within the universe that we can to discover the truth about it. We can now turn our attention to the modes of reasoning and how they will aid us in this investigation. In general, reasoning begins with one mode and then naturally flows into the other two. These modes include Deduction, Induction, and Abduction. A short overview of each is provided below.

Deduction

Deduction, to state it in simple terms, is reasoning via the laws of logic. If we are to form an argument or idea, we can use the laws of logic to see if it is logically valid. There are three laws of logic, each crucial to remember moving forward (and in general). As already mentioned, the Law of Non-contradiction states that a claim cannot be both true and false at the same time. Statements like “there is no absolute truth” violate this first law. It claims to be the only absolute truth, that there is no absolute truth. It is both absolutely true and absolutely false at the same time. Its own rules do not apply to itself. The second law is the Law of Excluded Middle, which says that either a statement is true or its negation is true, and there is no in-between or middle ground between these two. Something must either be or not be. God must either exist or not exist. There can not be a middle ground where God is true for you if you want it to be. The third law of logic is the Law of Identity, or the Law of Identicals. It says that a thing or proposition is identical to itself; if two things share all the same properties and qualities, they are identical (X is X and not Y).

Harken back to our donut *situation b*. We were able to look at the Apple Cinnamon donut and examine all of its properties to decide that it was not a Pop-Tart. A Pop-Tart uses a shortcrust dough; donuts use a yeast-leavened bread-like dough. Pop-Tarts are baked in an oven;

donuts are fried. A Pop-Tart has a dry, crumbly, or flaky shell with a gel-like filling, whereas a donut has soft, moist, and elastic, cake-like properties. Therefore, the Apple Cinnamon donut is not identical to a Pop-Tart pastry. Another way to explain deduction is to say it's like reasoning from the whole down to the parts of a concept or idea. Now, we can use the laws of logic to confirm the logical validity of an argument. Suppose we are to say something like: *All X are Y, Z is X, therefore Z is Y*

Premise 1: All mammals can fly.

Premise 2: Whales are mammals.

Premise 3: Therefore, whales can fly.

This syllogism is perfectly logical. It follows the "All X is Y, Z is X, therefore Z is Y" structure and does not violate the three laws of logic. However, it is an unsound argument. The first premise is false, making the conclusion false as well. We need another mode of reasoning in order to confirm our premises to formulate a sound argument.

Induction

The next mode of reasoning is induction, and it is used to confirm a premise. An argument can be logically valid, but its premise(s) may be false, making the argument invalid and unsound. With deduction alone, we have no way to know whether a premise is false. In the case of our syllogism above, we can observe all mammals to see whether any of them can fly. We can observe and gather data to confirm the validity of *Premise 1*. That is induction: observing, repeating, and recording data to test the truth value of a premise. Another term used synonymously with induction is the scientific method. When you create a hypothesis and then set up experiments to repeatedly test it, you gather enough data to reasonably conclude if it is true or false. A sound deductive argument produces certain conclusions.

Induction, on the other hand, produces probable conclusions, but with enough data, they are rendered, without a doubt, probabilistically certain. This is because induction is based on repeatability, which will never produce absolute certainty. Another way to describe induction is to start with the parts and work to the whole.

Abduction

Abduction is when you compare the explanatory power of multiple hypotheses for some event to make an inference to the best explanation. When we have evidence but multiple competing explanations that account for the evidence, we cannot use observation alone to validate the hypotheses. The different hypotheses represent different explanations for the phenomenon in question. We then examine each hypothesis and extrapolate the predictions and expectations it provides regarding the effect/phenomenon. By comparing the explanatory power and scope of each hypothesis, the simplest one comes out as the most likely explanation.

These three modes of reasoning help us discover (*epistemology*) what is true about existence (*metaphysics*). As you continue this book, keep in mind these three modes of reasoning. Deduction, or concluding from the laws of logic. Induction, or observing reality to confirm premises that lead to conclusions. And abduction, or comparing multiple explanations to make an inference to the best explanation.

The Roles In Formulating And Validating Arguments

All three modes of reasoning will be utilized in this volume, so a small demonstration of how they are generally used would be helpful. If I were to say,

(1) Rain causes the ground to become wet.

(2) The driveway is wet.

(3) The ground is wet because it rained.

(4) Therefore, it has just rained outside.

Using deduction, we can see that there is nothing strictly illogical about premises *(1)-(4)*: if the ground is wet, it has just rained; behold, the ground is wet, so it must have just rained. But we do not know whether the premises are true using the three laws of logic alone, as it very well could not have rained because Dave was outside earlier washing his truck before leaving for work. We need to use induction to confirm these premises.

By induction, we observe that whenever it rains, the ground becomes wet. This means that *(1)* is generally true. We can also observe the ground in the driveway being wet, so we can confidently say *premise (2)* is also valid as of now. But as we continue to gather more information, we notice that the sky is clear (it cannot rain without clouds), the sidewalks and streets are dry (it never would have rained only in the driveway area), and there are kids outside in the neighborhood wearing t-shirts and shorts. Using induction, we can now see that *(3)* is probably not true, as it is unlikely to have just rained on the driveway alone, leading to *(4)* being probably false as well. Now we are left with two possibilities: Dave washed his car, or it rained only in the driveway (as it can rain in a small area). But which one is the most probable?

We can then take all our data and evidence, and consider the expectations of the two hypotheses (it rained or Dave washed his car and left for work) to see which one has the most explanatory power and scope to represent the simplest explanation (*abduction*). We see that if Dave washed his car in the driveway, we should expect only the driveway to be wet, with no other part of the environment wet, the sky to be sunny, and kids outside playing in the sun. If it really did rain, it most likely would have covered the entire neighborhood, making it wet and cloudy, with kids in raincoats or not outside at all. It is very improbable that it rained only on the driveway, as we have a familiar experience with Dave washing his truck often. By using abduction, we can see that the "Dave washing his car" explanation represents the more probable and simpler explanation for the evidence we have. It is much more likely that Dave washed his car, so, given the parsimony of this explanation and the statistical likelihood of it raining on the driveway alone, we can confidently say that Dave washed his car before leaving for work.

In the same manner, we will attempt to see if a sound argument can be made for the beginning of the universe, first, by reviewing the premises of the main cosmological argument for the existence of God (Chapter 2). Then we will use induction to confirm this argument by examining the evidence for each position: if the universe is eternal, or had a beginning (Chapter 3). We will also investigate evidence that this universe bears the characteristics of design (Chapter 4), then examine the other hypotheses proposed to explain the cause of the universe, assess their expectations, and compare their explanatory power (Chapters 5-7). Finally, we will see which one represents the simplest explanation: God or Nature? (Chapters 8-9).

Chapter 1 Notes

[1] This is also known as *Correspondence Theory*

[2] (Schaeffer, *Francis A. The Francis A. Schaeffer Trilogy: Three Essential Books in One Volume,* Wheaton, IL: Crossway Books, 1990, pg 6)

[3] (Gide, André. *So Be It: Or The Chips Are Down*, Translated by Justin O'Brien. New York: Alfred A. Knopf, 1954)

[4] This type of thinking has cancerously pervaded Western culture and social media. Isolated incidents and anecdotes are used to generalize an entire population or group of people. Marxist ideologies push this type of thinking, generalizing everything to an oppressor vs oppressed political narrative.

Chapter 2
An Argument For A Cosmic Beginning? The Kalam Cosmological Argument

Does It Make Sense To Make The Statement That The Universe We Observe Is Actually Eternal And Self-Existent?

There are a plethora of philosophical deductive arguments for the existence of God, such as those based on objective moral grounding (the Axiological Argument), or from the greatest conceivable being (the Ontological Argument). These arguments are formulated into a syllogism that has given or assumed premises that, if true, logically necessitate its conclusion. An example of a simple deductive syllogism is *(1)* all Ford F-150s are trucks, *(2)* all trucks have four wheels, *(3)* therefore all Ford F-150s have four wheels. If all trucks have four wheels, and a Ford F-150 is a truck, it has to have four wheels. The conclusion follows necessarily if the premises are true. The argument that best fits our pursuit is the Kalam Cosmological Argument. If we are asking the question of whether God created all things, with the word universe referring to all contingent spacetime reality, then we should expect to see evidence of such an act within creation that can help us in determining if the most likely explanation for why there is something rather than nothing actually could be God. In this chapter, I want to give you a general rundown of the leading philosophical argument concerning God's creation of the universe… The Kalam Cosmological Argument.

For as long as man has been keeping records, they have been wrestling with the idea of the universe being finite or self-existent. They pondered, if the world really were eternal, then such a world would have an eternal past, with every single event being preceded by another, on and on, into infinity (*ad infinitum*, to infinity). Among the ancients, there were two dominant views on whether matter and energy are infinite. The *Enuma Elish* and the *Greek Mythologies* saw the gods born out of an eternally existing state of chaos (matter and energy), with the Earth as a byproduct of quarrels with these gods—arising from the chaos as well, or ordered by them. This position encompassed the majority of the ancient world and included a pantheon of gods, each representing different mechanisms in nature and human affairs, such as the wind, air, and war. The other view of the universe, mainly held by the Hebrews, and Christians held that the entire universe (the Heavens and Earth) was created by God a finite time ago.

"In the beginning, God created the heavens and the earth" (Genesis 1:1)

Before I continue, I must take care of something. Like most people in our pluralistic culture may ask, “why can’t both views be equally true?” The claim about whether the universe is past eternal or incomplete is not a claim grounded in a person's taste or opinion. The nature of the truth value of the claim is grounded in the object it focuses on, the universe, not the person. It’s centered on a very real, separate object called the universe and is in no way based on an individual's preferences. This is like saying the claim that a truck’s color is a subjective matter. We can walk over to the truck in question and observe its properties to see if it exhibits a specific color, say, orange. Even if you want the truck to be hot pink super bad, it will not change color; it will remain orange.

In the same manner, we can observe the universe and try to determine whether it had an absolute beginning in the finite past or is actually an infinite regress of events, and thus eternal. Only one claim about the nature of the universe can be true: either it is self-existent and eternal, or it is past incomplete and has a cause—there can be no in-between. And that is what I will try to present to you in the majority of this book about the origin of the universe.

Historical Context Of The Argument

During the Enlightenment period (1685-1815), philosophy once again gained prominence in Western culture. It was during this timeframe that the two views of the nature of the universe came into contact at long last. Before this time, the two views were being pitted against one another, culminating in the famous conclusion of *Immanuel Kant* (1724-1804 AD) saying that, since both sides had convincing arguments, this somehow revealed the bankruptcy of reason itself, which would later lead to modern agnosticism. From this point forward, there seemed to be silence between the scientific men of the times and the theologians. But despite this long-held silence, the argument has returned to academic circles with a fire of revenge never seen before. At the climax of this quiet time, men would look to the stars, asking of their nature and duration, and the response they got back would shake some to their very core.

The Kalam Cosmological Argument has its roots primarily in Islamic Theology. *William Lane Craig*, probably at the head of this argument today, dubbed it the Kalam (Arabic for word or speech) argument,

"The Cambridge Companion to Atheism (2007) reports, 'A count of the articles in the philosophy journals shows that more articles have been published about . . . the Kalam argument than have been published about any other . . . contemporary formulation of an argument for God's existence. . . . theists and atheists alike cannot leave [the] Kalam argument alone.'" [1]

Whenever Islam conquered Egypt, muslim theologians would absorb the already established Christian thought that had dominated those areas in the centuries prior. They picked up the arguments developed by earlier Christian thinkers, mainly from places like Alexandria, the center for Christian learning. Christians used these arguments for the creation of the universe against their contemporary Greek philosophers. The muslim theologians would take these arguments and further build upon them in complex ways for the existence of God as the cause of the universe.[2] The phrase "*Kalam Allah*" (word of God) in Arabic is where the name originates from—and the argument itself was birthed in an Islamic school of thought called the *Mutakallimun*. These Muslim scholars used these arguments to counter those influenced by Aristotelian thought, which held that the universe was eternal.

The main figurehead, seen to the left, who pushed the argument the furthest was the 12th-century Islamic theologian *Al-Ghazali* (1058-1111). Ghazali observed that the other Persian thinkers of his time were being influenced by Greek philosophy, namely the idea that the universe was eternal. He saw that this influence led his fellow theologians to "limit" Allah's creative power, such as denying that God created the universe or that He could not perform certain actions within creation. Instead, they believed the universe necessarily follows as a matter of course by virtue of the fact that God exists. In other words, they claimed that the universe as a whole was a sort of "effect" from God that occurred because He exists. If the universe did come from God's existence, then of course it

would be eternal since God is eternal. They saw everything as a material emanation that originated within the very being of God.

Ghazali would go on to study the teachings of Greek philosophers like Aristotle & Plato, and compose a magnum opus called "*The Incoherence of the Philosophers*," where he heavily critiques the ideas of the Greeks. In it, he argues that the idea of an eternal and self-existent universe is logically absurd, and to affirm the existence of an actual infinite is ridiculous. He points out the fact that since nothing begins to exist without an external cause, there must be a creator/cause of the universe since it is a being that has a beginning. "Every being that begins has a cause for its beginning; now the world is a being that begins; therefore, it possesses a cause for its beginning."[3] He doesn't just make the mere claim that the universe has a beginning, but he also offers several deductive arguments for the impossibility of its eternality.

Jumping forward about a century, *Saint Bonaventure* (1217-1274) would also utilize the Kalam Cosmological Argument. He argued that whatever begins to exist must have a cause for its existence and, like Ghazali, believed this could be proven about the universe itself. He acknowledged that the many arguments for the impossibility of an actual infinite were extremely strong, so much so that he stated that the past can't be eternal. He said this because if the past were actually infinite, then the occurrence of today would be impossible, since the past includes an infinite set of events before today.

> "If the universe were eternal, consisting of an infinite regress of moments, one could never reach the present moment. For no matter how many moments one passes, one will never pass an infinite set of moments. But, if the universe were eternal, then there would be an infinite set of moments in the past, and one would not be able to reach the present moment." [4]

Although the Kalam argument has its roots primarily in Islam, it goes as far back as the 5th century AD. Recall that I mentioned that Muslims would adopt the arguments provided by the Christians they conquered. One of the arguments they adopted (what would become the

Kalam) can be traced back to Arabic Christians such as *John Philoponus* (490-570). Despite the age of this argument, it is still discussed over a millennium after its initial formulation. Hopefully, this demonstrates the intellectual integrity of this argument, as it has come back time and time again within academic circles throughout history. We shall now move on to the premises of the argument and offer a brief discussion of each.

Premises Of The Argument

The Kalam Cosmological Argument for the existence of God is very short and simple, making it easy to remember. It has two main premises, which, if shown to be true, necessarily lead to the conclusion. This chapter is only dedicated to providing a brief explanation of the argument; the inductive evidence will be provided in the following chapter. For now, the argument goes a little like this,

Premise (1): Whatever begins to exist has a cause for its beginning.

Premise (2): The universe is a being that began to exist.

Conclusion (3): Therefore, the universe has a cause for its beginning.

Premise (1) states that any entity that begins to exist will do so because an external causal agent caused it to come into being (X cannot cause X to begin to exist). *Premise (2)* claims that the universe is finite in age and is a being that began to exist. The evidence for this is provided in Chapter 3. *Premise (3)* is the conclusion that will necessarily follow if *(1)* and *(2)* turn out to be true. If the universe began, and nothing can cause itself to come into being, then the universe itself has a cause that is external (or transcendent) to it. The universe—on the most general scale—is composed of space, time, and mass-energy (matter). The cause must be transcendent because, if space, time, and matter all had a moment when they came into existence, then the cause of it can not be bound by those categories. We will now briefly review each premise. Chapter 9 also offers a further analysis, but for the present moment, a basic understanding of the argument will suffice.

(1) Whatever Begins To Exist Has A Cause For Its Beginning

The first premise of this argument states that anything that begins to exist has a cause that is external to the thing. This is also the law of causality. It is the foundational principle of all of science, and without it, performing science is impossible. Science is, therefore, a search for causes. Applying this to the universe, we can use science to search for causes that go back to a first cause. If I took some snow off the ground and compacted it into a snowball, the snow itself is not what caused it to become something new (*a snowball*); there was a causal agent that is separate (*me*) that acted upon a prior material state of affairs to produce an effect, or something that was not there before. If a mechanic goes to a junkyard, gathers parts from multiple cars, and jerry-rigs them into a new one, the new car did not bring itself into existence; the mechanic did. The engine itself was not designed by itself, but the engineer.

William Lane Craig summarizes this premise in his lecture on the Kalam Cosmological Argument:

> "If the universe began to exist, then it had a cause for its beginning... with the term 'universe' referring to all contiguous spacetime reality, even subatomic particles that are the result of quantum decay processes."[5]

This means that to hold to the belief that the universe did not have a cause for its beginning is to hold to the belief that the entire universe came into existence from absolutely nothing. You can posit an eternal universe—sure—but as we shall see, observational evidence heavily contradicts that claim, even if the universe has been expanding for an infinite time.[6] That something can come from absolutely nothing is absurd. Nothing comes from nothing. The fact that something cannot come from nothing is about as basic a metaphysical truth as "there are other minds other than mine," that there is an external world, or that when the coffee is hot, it really is hot and will burn my mouth. But the premise, as currently stated, could be interpreted as not including subatomic particles resulting from quantum decay processes within quantum fields. So *premise (1)* can also be restated: "If the universe began to exist, then the universe has a cause for its beginning. Stating it this way avoids any attempt to circumvent the inclusion of sub-atomic particles, and forces one of the opposing sides to shift their focus to all of natural existence.

Let's turn our focus to this specific claim: that particles that result from quantum decay processes in quantum fields represent the creation of something from nothing. But this heavily misrepresents particle physics, as virtual particles that actualize in a quantum vacuum state are not manifesting from literal nothingness. There is a sea of violent energy contained within the quantum field that randomly fluctuates to produce these particles. This energy, called quantum vacuum energy, is surely not “nothing”. Quantum decay processes do not produce particles from “nothing”; what is occurring is the conversion of one type of energy into another while the total amount of energy remains constant. In physics, the vacuum is not what the common person imagines it to be… nothing. This vacuum energy is a sea of fluctuating energy with a physical structure describable by mathematics and governed by physical laws. The vacuum is definitely this sea of fluctuating energy—and not absolutely nothing.[7]

“Care is needed when using the word ‘creation’ in a physical context. One familiar example is the creation of elementary particles in an accelerator. However, what occurs in this situation is the conversion of one type of matter into another, with the total amount of energy being preserved in the process.” [8]

A more fleshed-out explanation is that, in quantum field theory, particles are interpreted as specific configurations of the fields themselves. There is an underlying field that permeates all of space that corresponds to each fundamental particle in the material universe. Certain arrangements of these fields correspond to different particles actualizing within the universe; for example, one arrangement allows the production of the fundamental particles, and another prevents that production.

“Relativistic-quantum-field-theoretical vacuum states . . . are particular arrangements of elementary physical stuff... The fact that some arrangements of fields happen to correspond to the existence of particles and some don’t is not a whit more mysterious than the fact that some of the possible arrangements of my fingers happen to correspond to the existence of a fist and some don’t. And the fact that particles can pop in and out of existence, over time, as those fields rearrange themselves, is not a whit more mysterious than the fact that fists can pop in and out of existence, over time, as my fingers rearrange themselves. And none of these poppings . . . amount to anything even remotely in the neighborhood of a creation from nothing. Krauss is dead wrong and his religious and philosophical critics are absolutely right.” [9]

That is far from particles coming into existence from a state of absolutely nothing. Indeed, there are major philosophical issues with the belief that something can come from nothing, and quantum field theory does not help either. The quantum vacuum is not nothing. Nothing is a universal negative quantifier, i.e., literally meaning “no-thing”; therefore, it is completely illogical to attempt to define it as something. Nothing is the pure absence of being, the absence of anything, having no properties or qualities; therefore, it cannot be equated with quantum fluctuations or be said to have the ability to produce entire universes. To deny *premise (1)* in light of the evidence is to think the entire universe came into existence from nowhere, by nothing, and for no reason. If, indeed, everything did come from nothing, then why doesn't anything else come into existence from nothing? Another reason that refutes this is that, if everything came from nothing, there would be no reason why anything else is not doing the same. This fails to explain why 24 packs of DeerPark water bottles aren't falling from the sky or appearing in my closet every morning. If everything in the universe ultimately came from nothing, then there is no logical warrant for anything else's inability to do the same.

To deny the law of causality is to deny rationality. Why is "nothing" so selective in producing only universes? "What makes nothingness so discriminatory? There can't be anything about nothingness that favors universes, for nothingness doesn't have any properties. Nor can anything constrain nothingness, for there isn't anything to be constrained!"[1] To deny *premise (1)* is also to deny humanity's holistic experience, the principles of cause and effect, sufficient reason, and the evidence that confirms it, which may be found in chapters 3 & 4. Craig notes that attacking the first premise, to him, seems to reveal that a person isn't really sincere about seeking the truth about reality. That they often seem to be searching for a refutation of the argument, an attempt to get around the conclusion.

"In fact, I think it represents a greater leap of faith than to believe that God exists as a cause of the universe because, as I say, to reiterate, it is literally worse than magic to hypothesize such a thing. If this is the alternative to the belief in God, namely, to think that the universe just popped into being uncaused out of nothing, then I think atheists need to simply be forever silent in their denunciation of theists as being irrational because what could be more irrational than this – to think that the universe just popped into existence uncaused out of nothing?" [10]

There is no possible way for nothing to produce an entire universe. Nothing has any properties. Nothing is quite literally what rocks dream about.

(2) The Universe Is A Being That Began To Exist

The second premise is the most debated one. It is rather difficult to find someone who genuinely believes things come into existence from absolute nothing; you will find far more people holding to a beginningless universe as opposed to a finite one.[11] This position views the universe as self-existent, infinite in age and space, and all that is. But there are some problems with this belief that an actual infinite exists, and it is the universe. Again, this chapter will not discuss the evidence for a beginning; rather, I will review some issues with believing in an infinite universe, or anything that is truly infinite and bound by space, time, and matter simultaneously.

Did the universe have a beginning? If we discover evidence that it did not, then it does not require a cause; but if we find evidence for its beginning, then it does require a cause for its beginning. The premises alone form an airtight logical argument. If everything that begins to exist has a cause, and the universe had a beginning, then it had a cause for the beginning of its existence. *Premise (1)* is self-evident and grounded in the law of causality, and with deduction alone is valid by all measures. But we have no idea if *premise (2)* is valid with deduction; we need to step into a different mode of reasoning, namely induction. We can observe the universe to see what it reveals. For now, the various philosophical issues for an eternal past that Ghazali, Bonaventure, and many other philosophers lay out for why the universe cannot be infinite in age will do. These are the main philosophical issues with the existence of an actual infinite, which we will dive into in the next chapter, where we will examine the inductive evidence that supports this second premise.

Actual And Potential Infinites

If the universe never began to exist, then the past is an infinite duration of time. This means there would have to be an infinite number of events that occurred before today. How did all of that come about, then, if the past has an actual infinite number of events preceding not just today, but every individual event itself? It simply makes no sense, logically speaking. But before we can conclude the universe cannot be infinite, we must understand what an infinite is, and the two types there are.

Potential Infinites are where infinity (a number greater than any assignable quantity or countable number) serves as a maximum upper limit that can never be reached. A great example is choosing any length and dividing it in half. Say we divide one meter into 50 centimeters, then

into 25, and so on. You could hypothetically divide that distance an infinite number of times. Or, say, a man sits in a chair and begins at one and counts on and on. He will continue into infinity, but he can never reach infinity, because no matter how far he has progressed, there is always an infinite number of numbers left to count.

Actual Infinites are an actual number or quantity of infinite things. But an actual infinite number of things cannot exist in the material world. Let's say that I ran an event, and 5,000 people attended. I also have a chest full of an infinite quantity of candy, and upon entry, each attendee receives one piece of candy. How many pieces of candy are left in my chest? An infinite quantity. What if the candy government taxes 33% of my lollipops? How much is left then? Something weird happens here. Not only do I have an infinite quantity of candy left, but the ⅓ division that was taxed is also an infinite quantity because a division of an infinite quantity yields another infinite. The same goes for addition, multiplication, and subtraction of infinite values… the yield is always infinite.

Something weirder happens when we divide an infinite. We get more infinites. A division of an infinite still results in each division having an infinite value. Therefore, the existence of an infinite number of past events preceding today would never result in today ever occurring. Traversing the infinite is an impossible task; the past is not infinite.

Successive Addition Does Not Generate Actual Infinites

Besides the logical absurdities with the existence of an actual infinite, another logical issue arises. If the past were infinite (and the universe eternal), then the number of past events would be accumulating as time moves on. One event following another, for an infinite duration backward. Yesterday I went to work; two days ago I went to work; three days ago I visited my mom; four days ago I went to the store, on and on into infinity. But you cannot reach an infinite value by adding one by one; an infinite series of events cannot happen one after another. This is known as the impossibility of traversing an infinite. If the past were an infinite series of events, and no series of addition can traverse an infinite limit, then the past can not be infinite.

Some may still claim that we just don't know enough about infinites to conclude that they cannot exist, but this misunderstands mathematical frameworks such as set theory, which declare that infinites cannot actually exist *because we know so much* about them. We have a very systematic understanding of the nature of infinity—so we do not claim one cannot actually exist because of some gap in our knowledge—rather, it is because we know so much, not because we don't know enough. Appealing to this argument also commits a *gap fallacy*, a logical fallacy (errors in reasoning) where someone appeals to a gap in someone else's knowledge in an attempt to support their side of the argument. Claiming that we do not know enough about infinites is a gap argument, and saying that we will one day find something that is actually infinite is not offering any substantive support for your claim, therefore making it a null and invalid argument to begin with. One would have to offer a reason for this belief other than simply avoiding a finite universe (as nobody has seemed to have offered any other reason). Until somebody makes a legitimate positive case for the possibility of an actual infinite, traversing the infinite remains impossible.

(3) Therefore, The Universe Had A Cause For Its Beginning

If *premises (1)* & *(2)* can be demonstrated to be valid, then the conclusion that the universe had a cause necessarily follows. To remain unconvinced that the universe is finite is okay, but something must be kept in mind from here on out. The claim that the universe is eternal is an objective truth claim, not a subjective one. This cannot boil down to "your truth is yours and my truth is mine," as the value of the claim is not grounded in "my truth." It is grounded in the object of the universe, which can be observed apart from our feelings and preferences. This is where empirical evidence such as the Cosmic Background Radiation, distant starlight redshift, mathematical singularity theorems, philosophical issues, and lines of reasoning come into play. In the following chapter, we will review the many scientific discoveries made over the last 100 or so years that led to the most observationally confirmed cosmological model, the Big Bang Theory. It postulates a universe that is expanding and, at some point in the past, had a beginning ex nihilo (from nothing).

But beware, for you indeed have the choice to follow the evidence where it leads, but refusing to do so is simply exerting your *right to be wrong*.

Since the claim that the universe is eternal is an objective truth claim, the intellectual's task would be to conform to wherever the evidence leads. To deny where it points and sweep it aside as religious jargon is, by definition, closed-minded. We should keep an open mind to examine each possible explanation as objectively as possible, but not so open that our minds fall out and we accept irrational ideas. That is why we will examine each postulated explanation and determine, via inference to the best explanation, which one truly represents the simplest, most likely, and logical explanation.

A Christian And The Big Bang?

Some readers may stumble upon the mention of the Big Bang and scratch their heads. Don't Christians deny the Big Bang? We do not. In fact, as we shall see, the discovery of the Big Bang actually supports a theistic worldview, and many Christians saw it as just that. Around the mid-2000s, a group of authors gained prominence in Western culture. These New Atheists (such as *Richard Dawkins*, *Sam Harris*, and *Christopher Hitchens*) would go on to viciously attack religion as an idea—but nowadays their movement is dying out in the intellectual realm. Their rhetoric would, I believe, eventually lead to this layman's view that the Big Bang actually supports an eternal and self-existent universe, or that it somehow was a model of how everything came from nothing.

Just from my personal experience, a lot of people are stunned by the fact that I, a Christian theist, believe in the Big Bang. But this is no big matter, as there are many Christians who also believe this cosmological model is accurate. The Big Bang postulates that the universe is expanding, and as you go back in time, the universe would get smaller and smaller until you reach a point of no space, no time, and no matter. This single point is called the singularity, a point where the universe has a spatial curvature that approaches infinity, with a total volume of zero. This means that before the Big Bang event, there was no space, no time, and no matter. Now, from a naturalistic lens, everything must have come from nothing, as the evidence points towards that. But if there exists a transcendent God, He would fit the mask of the cause perfectly. But I digress. The bottom line is this: belief in the Big Bang is not anti-Christian and does not go against a theistic worldview. As you will see throughout this book, all of the evidence actually makes an atheistic worldview the one that requires more faith.

Does God Require A Cause?

A very common, and almost immediate comeback to evidence for a transcendent cause of the universe is to assert that whatever caused the universe requires a cause that transcends itself as well as the universe (In other words, God requires a creator). Did the first cause have a cause that was caused by another cause preceded by more causes with an even longer chain of causes before that? At first glance, this seems like a reasonable and devastating blow to the theist, but it has some flaws in the understanding of God's nature as well as the first premise of the argument.

Premise (1) does not state that all things that exist require a cause; rather, all things that *begin to exist* require a cause. But something eternal would not need a cause, because it never came into being (since beginning implies that the entity has temporal relations). God, by definition, is not an entity subject to time. With concern to the finitude of the universe, He transcends space, time, and matter entirely to be adequate to cause it. For if God existed within the universe, then He would be part of what began, but the theist does not claim such, and the evidence does not support the claim that the universe caused itself, or that a material event caused it. For the universe's cause to require a cause itself, time would have to be an entity that did not come into existence with the universe. But the evidence, both empirical and mathematical, points to the contrary. Things that exist within time are subject to it, and "beginning" implies a temporal relation to something, yet time itself began at the Big Bang. If the cause was atemporal (not subject to time), then a beginning does not apply to it at all. To ask if God had a beginning is like asking what is north of the North Pole?, which color shirt can take out this screw?, what flavor of screws do you want for this project?, or why a wooden log can't replace my car tire—the objection does not even apply. It is fundamentally a category mistake.

This is in no form special pleading. This is the exact thing that atheists have claimed about the universe: that it is eternal and uncaused and therefore has no cause for its existence. Atheists have been saying the same thing about matter and energy since the debate over this started. If something is eternal, then it did not have a beginning, and matter and energy have been proven not to be eternal, so they had a cause. The "who caused God?" objection can only hold if God is being defined as a being that began. God is not a material state or an extended body in space; He is a transcendent entity. Yet, theists do not claim that God began, nor does the cosmological evidence suggest that the cause of the universe did. This objection is a simple misunderstanding of terms & definitions, the argument, and the Big Bang theory entirely.

We have now become a little more familiar with the leading philosophical argument for God's creation of the universe. Two other arguments could be introduced here, but they will be covered later on. With a small introduction out of the way, we can now delve into what the heavens actually say to us when we ask if it is eternal. The following chapter will include a brief overview of the scientific developments that were made during the majority of the 20th century. The next chapter covers the fine-tuning parameters of the beginning of the universe, along with reviews of alternative models that attempt to circumvent a beginning and their refutations and, oddly, theistic implications. The goal will be to determine if the evidence supports a finite universe as opposed to an eternal one. But the Kalam is not the only argument put forward in this volume. A point of view from the fine-tuning of many features of the universe that leads to an intelligent and personal cause (*The Teleological Argument*) is also laid out. What can be said with certainty at the moment is that the Kalam Cosmological Argument for the beginning of the universe alongside the Teleological Argument for the design of the universe does not warrant any conclusion whatsoever that includes “God cannot exist.” These are the two arguments that will be put forward in this book. With what has been presented in this chapter, it is very obvious that the universe cannot logically be conceived as being infinite in age and space. For if it were, today would have never happened, and you would deny reason.

Chapter 2 Notes

[1] (Craig, William Lane. "*The Kalam Cosmological Argument*." Lecture delivered at the University of Birmingham, 2015)

[2] (Craig, William Lane. "*The Scientific Kalam Cosmological Argument*." Lecture delivered at the Georgia Institute of Technology, 2014. Transcript published by Reasonable Faith, 2026, pg 1)

[3] (Al-Gha-zalı-, *Kitab al-Iqtisad fi'l-I'tiqad*, cited in S. de Beaurecueil, *Gazzali et S. Thomas d'Aquin: Essai sur la preuve de l'existence de Dieu proposée dans l'Iqtisad et sa comparaison avec les 'voies' thomistes*, Bulletin de l'Institut Français d'Archéologie Orientale 46 [1947], pg 203—do not ask me how to pronounce that)

[4] (Fernandes, Phil. "*Faith Examined*." In *Faith Examined: New Arguments for Persistent Questions, Essays in Honor of Dr. Frank Turek*, edited by Clark R. Bates. Eugene, OR: Wipf & Stock Publishers, 2023, pg 34)

[5] (Craig, William Lane. "*The Kalam Cosmological Argument.*" Lecture delivered at the University of Birmingham, 2015)

[6] (See Chapter 3, section on the BGV Theorem)

[7] (Craig, William Lane. *"The Scientific Kalam Cosmological Argument."* Lecture delivered at the Georgia Institute of Technology, 2014. Transcript published by Reasonable Faith, 2026, pg 3)

[8] (Isham, Christopher J. "*Creation of the Universe as a Quantum Process*." In *Physics, Philosophy, and Theology: A Common Quest for Understanding*, edited by Robert John Russell, William R. Stoeger, and George V. Coyne, 375–408. Vatican City: Vatican Observatory Publications, 1988, pg 378)

[9] (Albert, David. *"On the Origin of Everything." Review of A Universe from Nothing: Why There Is Something Rather Than Nothing*, by

Lawrence M. Krauss. The New York Times Sunday Book Review, March 23, 2012)

[10] (Craig, William Lane. "*The Scientific Kalam Cosmological Argument.*" Lecture delivered at the Georgia Institute of Technology, 2014. Transcript published by Reasonable Faith, 2026, pgs 4-5)

[11] (Guth, Alan H. "Inflationary Universe: *A Possible Solution to the Horizon and Flatness Problems*." Physical Review D 23, no. 2, 1981: pgs 347–356)

Chapter 3
Did The Universe Have A Beginning?

Is The Second Premise Of The Kalam Cosmological Argument Valid? An Inductive Investigation Into The Finitude Of The Universe From Astrophysical Cosmology.

A young Jason was sitting in his Earth and Space Sciences class. It was his last year of middle school, and he was soon to enter the long-sought ninth grade. Eager as always to learn about the planet, atomic structure, the stars, and most striking, the beginning of the universe. Before learning about the periodic table, electrons and neutrons, chemical and physical changes, the layers of Earth's crust and core, and plate tectonics, all the students in the classroom were introduced to the Big Bang Theory.

I attended public school in a small rural town in PA. I've always had a nagging obsession with science classes, and specifically anything to do with cosmology. Before that day in eighth grade, and besides playing video games and hanging out with friends at the local park, I spent a lot of my free time binging YouTube videos or watching documentaries on Curiosity Stream about cosmology and astronomy (instead of doing homework). Just the entire idea that the universe, everything that exists here, and in & beyond the skies, all began within the confines of an infinitesimally small point, the size of an atom, and that before this, there was absolutely nothing (or at least we don't know yet) astonished my small, pea-sized, pre-pubescent mind. Moreover, the fact that we are even able to make sense of and apply mathematics on a universal scale blew my mind. I could never completely wrap my head around the idea of everything coming from nothing (since nothing comes from nothing). When the theory was taught to me in school, the confusion didn't get any better, especially with the dumbed-down Quantum Cosmology claiming quantum fields were absolutely nothing. But being under the lens that this authority is right, I shrugged my shoulders, and practically gave up on that intellectual endeavor, and swallowed the secular pill.

I would eventually run into some dumbed-down summaries of Chaotic Inflationary Theory. Though I was unable to understand most of what it postulates at the time, I personally subscribed to this explanation of the Big Bang but remained mostly agnostic about the concern. Fast forward a few years, through high school and into my time at a trade school close to home, I would encounter several philosophical arguments for the impossibility of the infinitude of the universe's past, as well as many scholars and apologists who offered inductive support for them. I felt like I finally began to find a path to the truth of this matter, so I continued learning about the historical developments and scientific discoveries that led up to the Big Bang in my own time, and what these great minds have to offer will be presented in this chapter (as well as in this entire book).

But before we get to discussing the evidence and alternative theories and their explanatory power, I think knowing the context around these discoveries makes it easier to remember and explain when someone asks you to defend what you believe. By examining the discoveries that led up to the war over cosmology, we can determine whether the universe really did have a beginning. And if it did, we should be able to look at the effect of that cause (the universe) and decide which hypothesis offers an adequate explanation by comparing their explanatory power. We may also examine the nature of the effect and reason back to a set of properties we may attribute to the cause; hopefully, from that, we can determine whether a God really did cause the universe to come into existence, based on these properties and which explanatory entity best fits the mold.

Distant Starlight Red-Shift

For many, many centuries now, scientists and philosophers have pondered the idea that the universe could be temporal or infinite. Before this time, many men saw the heavens as the literal heavenly places. Ancient pagan nations would see individual stars or constellations as the gods themselves, and that their material had existed eternally because of this. When ancient men began diving into the depths of thought about the universe, they would first attempt to answer the question from first principles, those of a theological or logical nature. Aristotle saw the universe as an infinite sequence of events. This was due to his view of time as a sequence of connected events, so that even if the universe began, it would have been preceded by the conclusion of a prior event. People such as these saw postulating a beginning to the universe as logically absurd.

The other dominant view, mostly formulated by Christian and Jewish philosophers during the Middle Ages (although the idea itself can go back to ancient Jews with Genesis 1:1, and to the earliest Christians)[1], would see the universe as a created, caused entity with a beginning (creation ex nihilo). People like *Augustine, Aquinas, Maimonides*, and many others affirmed this view of the universe.[2] Those of the *ex nihilo* position argued from the aforementioned Kalam Cosmological Argument by demonstrating the pure absurdities of affirming the existence of an actually infinite past that were put forth in chapter 2. Indeed, if a man tried climbing out of an infinitely deep pit, no matter how much distance he covers, there will always be an infinite amount of “pit” left to climb. Therefore, he would never escape… and actual infinites cannot exist. Give it a few centuries until technological advances would catch up with the question, and men would begin to double-check their previous statements about the temporality of the entirety of nature.

Scientists then began to wonder whether the universe contained an actually infinite amount of matter and space. Some held to a finite universe, but with infinite space, such as *Issacc Newton*. But some recognized that an infinitely large universe would exhibit a uniform distribution of stars that would light the entire sky, concluding that if space extended infinitely, every line of sight would be filled with light. This paradox was named the "Olbers' Paradox," after *Heinrich Wilhelm Olbers*. Of the various answers proposed to this, such as a substance called the “ether” absorbing all of the light before it reaches Earth, not one answered the paradox with any level of substantive certainty. It wasn’t until they began making further discoveries that they would be blown away.

Entering the 20th century, many of these men affirmed an infinite duration of the age of the universe for various reasons—Isaac Newton’s framework of universal mechanics, featuring infinite space, implied infinite time as well. Uniformitarian dates for the age of the Earth, extrapolated to the universe, and other deep-time theories would also help solidify this view of a very old, if not eternal, universe. This position was simple and had few issues because there was no need to posit an origin when none existed. But it wasn't long before an astronomer at the Mount Wilson Observatory claimed that the entire universe consisted of our Milky Way galaxy and nothing beyond. In 1918, *Harlow Shapley* estimated the size of the Milky Way at around 300,000 light-years across, though later scientists would abandon this estimate in favor of more accurate measurements.[3]

This eventually would give birth to a debate between Shapley and *Heber Curtis* that took place at the Smithsonian Institution in 1920, where they discussed whether these nebulae were either inside or outside the Milky Way. As expected, Shapley argued that these clouds existed inside the Milky Way. It wasn't until several years later that *Edwin Hubble* settled the debate, but his work relied on the prior work of another astronomer.[4]

Illuminating The Calculations

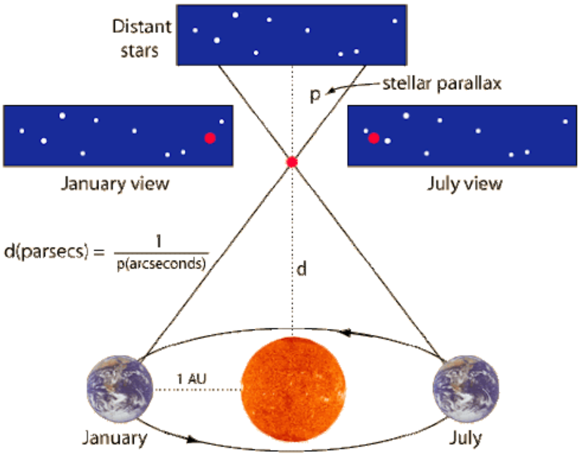
Harvard College Observatory would hire women to scan photographic plates to record stars and observations. This is where the next figure, *Henrietta Leavitt* (1869-1921), began working, examining plates. Photographic plates were used because they could be exposed to the sky for extended periods, catching objects the human eye could not normally see. As they were exposed to the night sky for longer periods of time, they would gather more light than the human eye can from just a mere glance. This way allowed astronomers to see more detail than they could have before. These plates enabled astronomers to make even more accurate observations of the night sky. Leavitt was deaf, but had a knack for analyzing the smudges left on the plates to find and catalog stars. While analyzing plates, she made a discovery. Leavitt discovered a specific star called a Cepheid Variable Star, a type of pulsating star. She found that the brightness of these Cepheids in a nebula called the Small Magellanic Cloud oscillates with a period that correlates with their magnitude. In other words, the brighter the star, the longer the pulsation period; and the longer the pulsation, the greater the apparent brightness.[5]

Apparent brightness is measured by using a photometer, which measures the number of photons that arrive in an observed area per second. Absolute Brightness is measured using standard distance measurements. Absolute brightness varies only with pulsation, whereas apparent brightness varies with pulsation and distance. Stephen Meyer offers an analogy to aid us in understanding why this matters to an astronomer:

> "...imagine looking at a light coming from a lamppost through the fog while walking through a park at night. If you see a light in the park that looks extremely bright to you, you might attribute that apparent brightness to the light being extremely close at hand. Or you might attribute the brightness of the light to an extremely high-output lightbulb located on the other side of the park." [6]

Unless you know the distance to the light source, you have no way to calculate the actual brightness at the source from what you're seeing from a distance. Astronomers would face a similar challenge while using apparent brightness to calculate the absolute brightness and distance of a specific star. They can measure the apparent brightness of a Cepheid; they are also aware that the intensity of light dissipates by the inverse of the square of the distance ($1/d^2$); however, they can only calculate absolute brightness if they know the distance to the star they are observing, and the distance to the Magellanic Cloud was unknown. So Laevitt was unable to find the absolute brightness from their apparent brightness. What she was able to do was plot the relationships of how both the apparent brightness and absolute magnitude varied in correspondence with the period of a Cepheid's pulsation. Therefore, to calculate the distance of the Cloud, someone, somewhere would have to know of a Cepheid with a known distance to calculate.

In 1913, the Danish astronomer *Ejnar Hertzsprung* used a method called Statistical Parallax to determine the distances to 13 relatively close Cepheids.[7] Normal Stellar Parallax measures the position of a star in the sky at 6-month intervals, when the Earth is on one of two sides of the Sun, to determine a distance via the angles of their positions at those two periods (see figure above). "The method uses trigonometric formulas to determine the distance via the differences in angular displacements at the two six-month periods. But Statistical Parallax assumes that stars move in random directions, so the distribution of radial velocities, V_r, (velocity moving directly toward or away from Earth) and the distribution of tangential velocities, V_t, (velocity perpendicular to the radial velocity) are roughly the same. The radial velocities can be calculated using the Doppler shifts in the stars' emitted light. The tangential velocities cannot be measured, but the angle, θ, that a star moves across the night sky over some time interval, t, can be." [8]

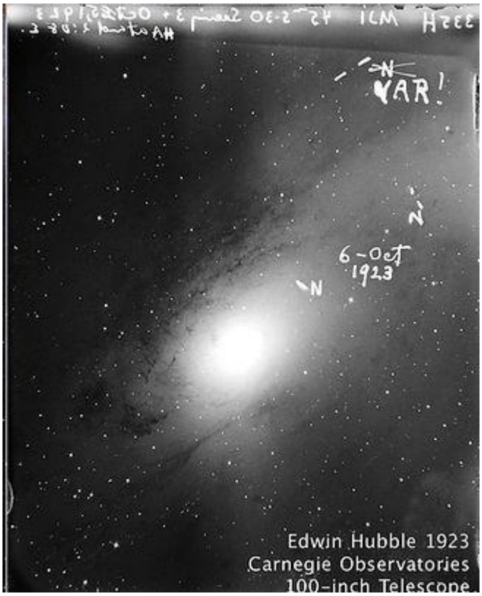


Hertzsprung first found a Cepheid within the Magellanic Cloud with the same periods of pulsation as the ones he found near the Sun.

Using Laevitt's graph, which plotted the relationship between apparent brightness and pulsation, he found a Cepheid in the Cloud with the same pulsation period as the average of those he determined near the Sun. Since all Cepheids with the same pulsation share the same absolute brightness, he was able to find the absolute brightness of whatever Cepheid he was observing. He determined their distances to be about 30,000 light-years, but since nobody yet knew the extent of the Milky Way, there was no way to know whether the cloud was internal or external to it.[9]

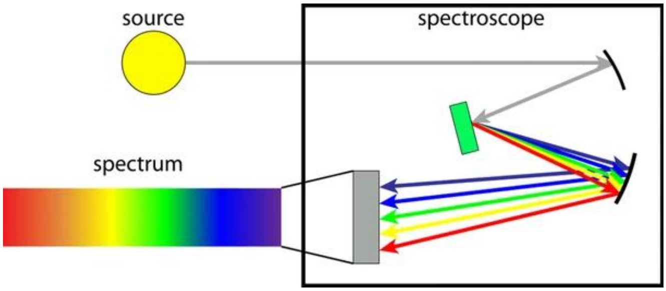
The Red-Shifted Pill

Now we return to *Edwin Hubble*, who began working at the Hooker Telescope in California in the 1920s. In 1925, he was examining a 40-minute exposure of the M31 Nebula, which would soon be identified as the Andromeda Galaxy. Hubble noticed some novae within the nebula, which would turn out to be a Cepheid star and two novae. A nova is a binary star system (usually one white dwarf from a dead star and a normal living star), where the white dwarf "steals" material from the normal one via its gravitational pull. As the white dwarf steals more hydrogen from, say, a red giant, it will eventually reach an extremely high temperature (around 20 million Kelvin), triggering a nuclear fusion event. This "explosion" appears to us as a sudden increase in brightness that slowly dissipates over time.

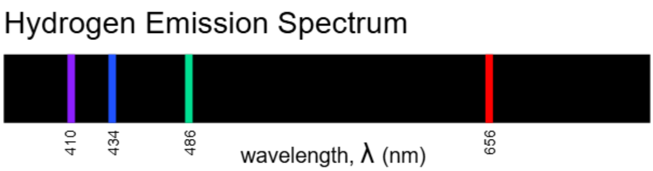


As you can see to the left, Edwin Hubble was observing these two novae and a Cepheid (crossed off and marked VAR on the plate). Then, using Leavitt and Hertzsprung's methods, he recorded that the Cepheid in Andromeda brightened and dimmed over 31.415 days and calculated its absolute and apparent magnitudes, which enabled him to determine its distance. He concluded that the Andromeda Nebula was 900,000 light-years from Earth, though modern measurements establish it at 2,500,00 light-years away.[10] Hubble claimed that Andromeda was not a nebula, but actually another galaxy, and that the universe was much bigger than what Shapley had proposed in 1920.

In 1912, an astronomer named *Vesto Slipher* used a 24-inch telescope and spectroscopic methods to study light from astronomical bodies. When an atom absorbs energy, the electrons become excited and jump to higher energy levels. They then naturally decay back to more stable states, emitting a photon in the process to release the energy they have gained. The energy of the photon is proportional to the frequency and inversely proportional to its wavelength. The equation for the energy of a photon is $E = hf$, where f is the frequency of the light and h is Planck's constant, a fundamental physical constant used to relate frequency to energy. The study of the light emitted and absorbed by chemical elements, their wavelengths, frequencies, and colors is called *Spectroscopy*. When an element absorbs energy, it emits photons with specific frequencies and wavelengths due to its unique energy levels.



When light enters a small slit in a spectroscope (a tool used to examine the characteristic wavelengths of light from sources), it encounters a diffraction grating or prism that splits the light into its constituent colors, which a focusing mirror may then direct. The light is split into a color spectrum because different colors with different wavelengths refract and bend differently, allowing a straight, sequential spectrum to form. If a light source is only emitting wavelengths that correspond to, say, red, green, and violet, a pattern of vertical lines will appear on the spectrum in the eyepiece. These vertical lines are called spectral lines, and certain elements have their own unique sequence of

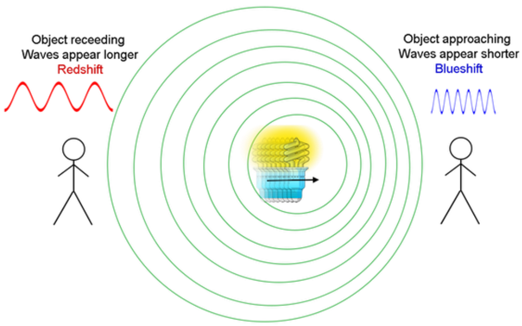


spectral lines, called a spectral pattern. These patterns may look something like this:

When light is directed at a prism, its wavelengths are dispersed, creating what we see as a rainbow (R.O.Y.G.B.I.V.), which represents only a small fraction of the full electromagnetic spectrum, the full range of possible wavelengths of light. The full spectrum includes radio waves, microwaves, infrared light, visible light (what we see), ultraviolet light, X-rays, and gamma rays.

Which leads me to an off-topic tip. When astronomers discover an exoplanet they claim may harbor life, they are not actually looking through a telescope and seeing a blown-up image of the planet. When an exoplanet (a planet that orbits a star outside our solar system) is detected, it is inferred from changes in a star's behavior and brightness. It is then that they use spectroscopic readings to determine the planet's atmospheric composition. Nowhere does anyone actually have a view of a planet, and the pictures in YouTube videos and news articles are just artists' imaginations, not what is actually there. It's more analogous to seeing the lamppost in the fog flicker, then inferring that a moth may be smacking into the bulb.

Anyhow, Slipher would use this method to analyze the spectra of various nebulae. In 1912, he began measuring the light from several spiral nebulae and recorded specific spectral patterns for each one. Yet, Slipher noticed something was a tad bit off about these patterns. While the patterns were still consistent with those viewed on Earth, the ones he was seeing seemed shifted toward the red end of the spectrum.[11] In simpler words, the patterns he was observing were shifted towards the red side of the spectrum compared to those that are viewed on Earth (think back to using spectroscopes in school). This meant that the light from these nebulae had larger wavelengths.



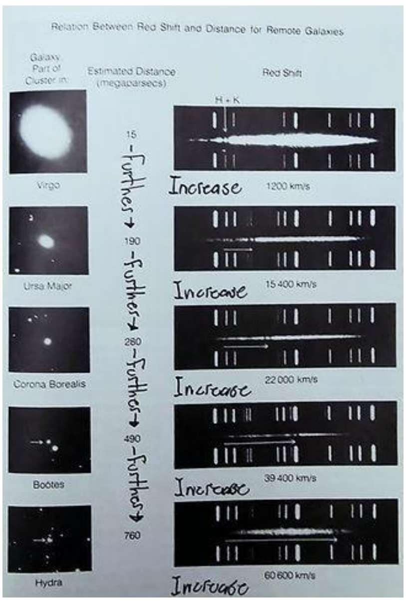
This is known as the Doppler Effect (displayed above), where wavelengths are shortened if they originate from a source moving towards an observer and stretched if they come from one moving away. Thus, if we observe a galaxy with redshifted light, we conclude it is moving away from us. Slipher saw that stars that we know are in the Milky Way may have a blue or red shift, but that "more indistinct" nebulae exhibited a greater red shift, implying they were moving away from us. By 1914, Slipher would have records for 13 of the brightest galaxies in the sky, publishing them in the Royal Astronomical Society. His record was dominated mostly by redshifted galaxies rather than the equal mix of red and blue shifts he had expected, leading to a startling revelation.

Hubble’s Constant

As Edwin Hubble examined Slipher’s redshift records and other work by *Milton Humason*, he found that more distant galaxies had greater redshift. Beginning in the early 1920s, he performed more observations at the Mt. Wilson Observatory. By 1925, Hubble had records of 45 Doppler-shifted galaxies, mostly redshifted. In 1936, he noted that redshifted galaxies dominated his records.

"The numerical values of the new velocities were found to be surprisingly large and of an entirely different order from those of any other known type of astronomical body."[12]

In 1928, an American physicist named *H. P. Robertson* noticed that the more distant a galaxy, the greater the red shift, with the red shift directly proportional to distance. This suggested that the further away a galaxy was, the faster they were receding from us. His discovery of the relationship between recessional velocity and galactic distance has been named "Hubble's Constant".



This discovery further implied that the universe was experiencing some sort of outward expansion. If a galaxy were five times as far as another, it would be receding five times faster. Hubble found that the rate of recession of a galaxy was directly correlated to the distance it is from us. Taking this into consideration, galaxies would have been closer together at any time in the past. As you go further back, all the matter in the universe would have to converge at a single point where the universe began necessarily. Hubble's Constant (H) lies somewhere between 77 ± 14 Km/s per megaparsec. One megaparsec is about 1.92 x 10^{19} miles (or 1,920,000,000,000,000,000,000 miles). This means that a galaxy 1 Mpc away will recede on average about 77 km/s. One that is twice as far will move 154 Km/s, and one 10 Mpc away will recede at 770 Km/s.

A Banging Start: The Big Bang Model

During this period and some time afterward, there were significant advancements in observational astronomy that led to the conclusion that we live in an expanding, finite universe. There were also leaps made within the realm of astrophysics and mathematical theorems. This progress eventually led to the first mathematical models of the universe discussed in the following sections, namely, the Big Bang Theory, proposed by *Georges Lemaître* in 1927, and the Steady-State Model, proposed by *Sir Fred Hoyle*, *Thomas Gold, and Hermann Bondi* in 1948. We begin this part with the brainchild of the German-born Theoretical Physicist, *Albert Einstein*.

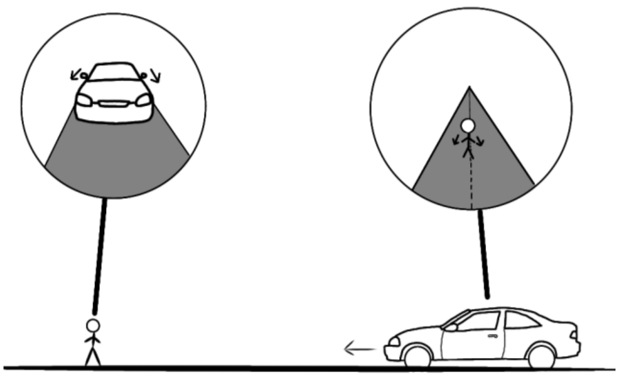
Special & General Relativity

Einstein is one who, at first, rejected the idea of a temporal universe and viewed the idea of its expansion to be foolish and unrealistic. In 1905, he cooked up his Theory of Special Relativity,[13] which states that distance and time are relative in the sense that two observers moving at different speeds perceive time and space differently. The effects described in this theory would only be noticeable at near light speeds. The perception of time, depending on the observer's speed relative to an object, is known as time dilation. Time dilation has been confirmed in experiments using atomic clocks, where one is on the ground, and the other is in a plane flying.[14] Einstein's Special Theory shows that measurements of space and time are ultimately linked since a measurement of space also depends on how fast you move over a period of time, and your experience of time depends on how fast you travel through space.

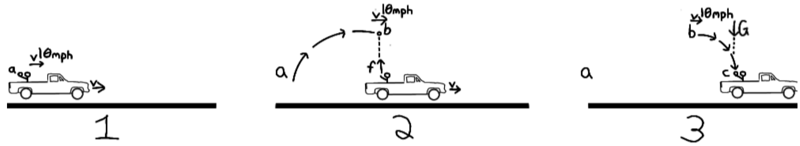
Throughout the creation of SR, Einstein realized that it implies that space and time are linked, birthing a new physical entity, spacetime. Spacetime combines the three spatial dimensions (x, y, and z) with the time variable (t) in a four-dimensional continuum (x, y, z, ct) where C represents the speed of light. With spacetime being the fundamental component of his theory of General Relativity (1915), which describes gravitation in relation to mass and spacetime, he envisioned gravity as a geometric property of spacetime, one like a fabric that objects possessing mass warp with their presence. A massive body will warp the multidimensional fabric of spacetime around it, creating a depression in it. The more mass, the more the fabric will warp; and with more mass, the deeper the warp, and the stronger the gravitational force. A smaller body will travel through the curved spacetime, essentially "falling" into the gravitation of the larger body. In essence, "Space tells matter where and how to move, and matter tells space where and how to curve."

Special Relativity

Special Relativity was Einstein's attempt at a theory of universal mechanics that combines the concepts of inertia (Newtonian Relativity) with the physics of electromagnetic waves. The name of the theory comes from the fact that it only focuses on situations where objects are at constant velocities without acceleration, a special situation. I will provide a rundown of Special and General Relativity in this section. It may be technical, but I will simplify it as much as possible.



The figure above depicts a thought experiment. Keep in mind the concept of detecting motion. In the figure, you are standing on the road with a car approaching you. From your point of view, you and the road are at rest, and the car is moving. But from the car's point of view, it is at rest, and the road is moving. Einstein is attempting to determine how one could actually detect who is truly moving and who is truly at rest, because both frames of reference perceive themselves as at rest.



Let’s say you are now in a moving vehicle, the bed of a truck moving 10 miles per hour. You grab a baseball from your bag and want to toss it up into the air. You may expect the ball to simply fall behind the truck, since it is at rest relative to you. If the ball is at rest, perhaps we could use it to detect who is truly moving. You throw the ball *(1-2)*, but from your point of view, the ball just goes up and down like it would if you were at rest on the ground. But from an outside point of view, the ball you threw, since it was in constant motion, remained in motion (10 mph). This is Newton’s first law of motion. In *(1)*, the truck, you, and the ball are all inertial, constantly moving at 10 mph, and the ball begins at point a. In *(2)*, you apply a force (*f*) that launches the ball up to point b, but since it is inertial, it remains moving 10 mph until, in *(3)*, gravity *(G)* acts upon it and pulls it back down into your hand at point *c*.

Suppose you now have a gun and the truck is moving around 850 miles per hour (the speed of a bullet). You aim the direction of travel and pull the trigger. You may expect the truck to be traveling the same speed as the bullet, alongside it. But when you shoot your gun, the bullet travels in your direction at 850 miles per hour from your moving frame of reference. Because you were moving at 850 miles per hour, the bullet left your gun moving at that speed, plus the velocity it gained from the gunpowder in the bullet casing. This demonstrates that Einstein couldn’t use particles or everyday objects to detect who is truly moving. Because they possess inertia, they can not be used… but maybe waves would work. Perhaps another thought experiment would help.

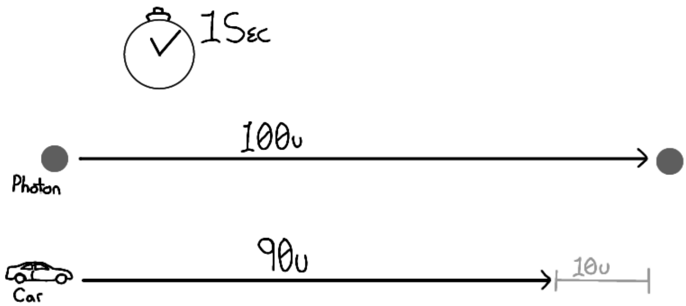
Say you have a string pulled tight and you whip the end you are holding. You observe a wave created along its length that travels from your hand to the other end of the string. Now, say you are on a boat at rest and drop a rock in the water. You see waves disperse from the center where the rock was dropped. Now, say you are moving at the same speed as those waves and drop the rock. Your boat would be moving at the same speed as the waves made by the rock, and from your point of view, the wave will seem at rest, looking completely still alongside the boat. So waves do not have inertia. But wait! If you were to travel at the speed of sound through air, there would be air resistance in the opposite direction at the same speed you are traveling, thus making the waves appear at rest from your point of view that is actually moving.

All waves require a medium to traverse within, and sound's medium is air. So using waves to solve Einstein's problem is practically an escalator effect, where you walk down an escalator at the same speed the steps are moving up. So, taking this into account, both frames of reference are correct within their respective frames. Therefore, motion is relative. This is Newtonian relativity; it states that constant motion cannot be truly detected, called an inertial frame of reference.

So now what? Can Einstein not detect motion? From a Newtonian standpoint, yes, he can not detect motion, but he does something special. He combined this version of relativity with the physics of electromagnetic waves, also known as light. For a long time, scientists believed light was a wave similar to sound. And since a wave needs a medium, and air is sound's medium, light had a postulated "ether" as its medium of travel. Through Newton's theory of light as a particle, the ether had no place. If light were a particle, then it wouldn't need a medium to travel, kind of like a bullet. But if it is a wave, it requires a medium. The major shift came with *Clerk Maxwell* in the 1860s, who unified electricity and magnetism with his equations. But Maxwell was still relying on the ether concept in wave mechanics. In 1887, *Albert Michelson and Edward Morley* would fail to detect the postulated ether winds in their paper "On the Relative Motion of the Earth and the Luminiferous Ether".

Finally, Einstein decided to assume that the speed of light was constant and did not require a medium for travel, thus avoiding the issue he had encountered with sound waves. Imagine you are in a spaceship moving at the speed of light (about 186,282 miles per second, and represented with the letter c), and you flip on the headlights. If the speed of light is constant, then you would see the light frozen, and if the ship is moving slower than the speed of light, you would observe the light slowly advance in your frame of reference. Light can be used to detect motion, and it seems to violate Newtonian relativity.

Michelson and Morey shone light in the planet's direction of travel, but its speed was still *c*. Einstein thought: if light does travel at *c*, and constant motion is still undetectable, then light's speed must be the same for all frames of reference. This was the only way he could make sense of constant motion being undetectable, while maintaining light's speed and ability to travel within a vacuum (no medium), but it violates Newtonian physics. More thought experiments will further display Einstein's thought process. Say you are in a car traveling at 90% the speed of light with a wave of light next to you traveling in the same

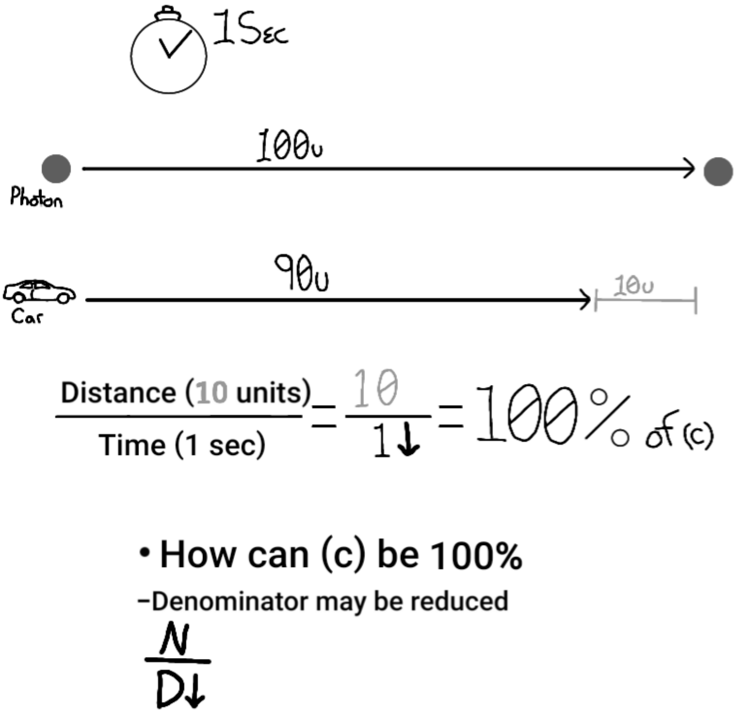


$$\frac{\text{Distance (10 units)}}{\text{Time (1 sec)}} = \frac{10}{1} = 10\% \text{ of (c)}$$

• How can (c) be constant?

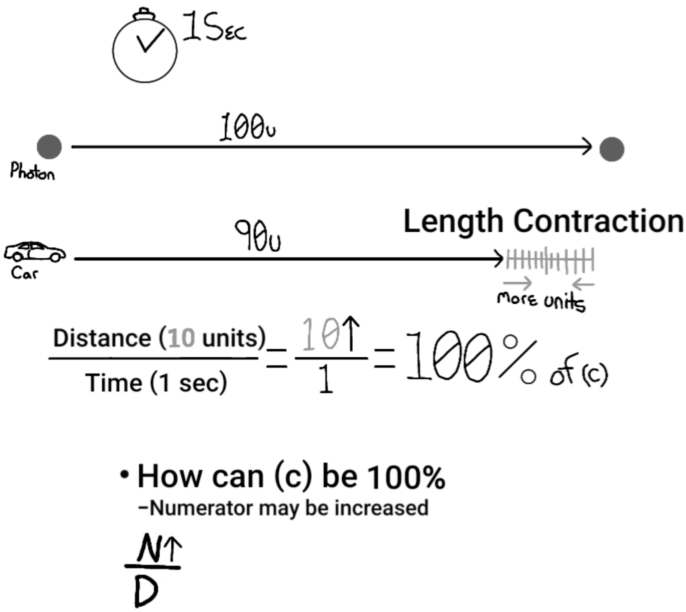
direction. For simplicity's sake, let's say one second passes, and the light travels 100 units of space, and the car 90 units of space.

You travel for one second and then make a measurement of the light traveling at 100% c, coming out to 100 units of space. When you measure the speed of light, you would observe it to be 10% of the speed of light. Since Einstein is assuming that light's speed is constant no matter the frame of reference, how can you measure the light wave



traveling at 100% *c*? Einstein says that in order to make the light's speed constant, two things can happen.

The denominator in our equation can be reduced, which means the time you spend in the car would slow down. For you in the car, one second has not passed; your clock has slowed down. This is time dilation, which, as previously mentioned, has been experimentally proven with atomic clocks.[14]



The numerator in our equation could also be increased. This means that the distance you would measure in the car would appear to contract, meaning there are more units in the difference between the photon's 100 units and the car's 90 units. This is length contraction, which has not been directly proven, unlike time dilation with atomic clocks, but inferred based on its accuracy in experiments. But the sheer accuracy of predictions that account for length contraction, such as high-energy particle accelerator experiments and cosmic ray muons reaching Earth's surface, is explained by either effect. So, while we cannot directly observe something moving that fast contracting, our observations in experiments directly line up with the mathematics that account for it. So, the speed of light will be constant for you in the car, and someone on the outside observing you and the light.

Inertia, or constant motion, cannot be detected. We saw that particles could not be used because they have inertia, and waves wouldn't work because of the medium's resistance. But since light does not require a medium like sound, its speed is constant no matter the frame of reference, which results in the qualities of space and time changing based on motion. This gave rise to a new physical quality: spacetime. Ultimately, space and time are linked and affected by an observer's motion through spacetime. This is Special Relativity, where the only absolute thing is the speed of light. Spacetime combines the three spatial dimensions (X, Y, and Z) with the time variable (T) in a four-dimensional continuum (x, y, z, and ct), where c represents the speed of light, or speed of causation. Spacetime would become the foundation of his next breakthrough, General Relativity.

All Things Fall

Before Einstein's theory of Special Relativity, there were ancient men like *Aristotle (384-322 BC)* who noticed that all things tend to fall towards the ground, and he thought the Earth was the center of the universe (he was working with the model of the Earth as the center of the universe). The next major mind was *Copernicus* (1473-1543 AD), who created what would become the physics of motion. He distinguished between circular motion, the orbits and rotation of the planets, and rectilinear motion, such as the path that objects falling to the ground take. [15] Then, *Johannes Kepler* (1571-1630) discovered that planetary orbits are actually ellipses and not perfect circles, as well as distinguishing between two types of motion to describe the motion of comets and shooting stars. Then, in London while the Black Death was rolling through, and as Cambridge closed its doors to prevent the spread of the plague, a young *Isaac Newton* was stuck in his dorm with a lot of new time on his hands. Because all of his classes were halted, Isaac wasn't limited by the start times of mandatory lectures and deadlines; he was essentially free to do whatever he wanted to. This period would come to be called the most influential of his life. During this time, he laid the foundations for calculus, split white light into its fundamental colors, and formulated his theory of universal gravitation. He built on the scattered work of men before him, combining what he learned and expanding upon it in his magnum opus, *The Mathematica Principia*.

His theory states that all of the planets are under the influence of a mysterious force that keeps them locked in their orbits, which seems to have its origin with the sun. He proposed that this force acts at a distance, as prior models posited a sea of ether that kept the planets in orbit; he faced a lot of criticism. He would discover that this force's strength weakens by the square of the distances of those planets from the sun. He also stated that the gravitational force is directly proportional to the amount of matter an object contains. This gave us Newton's equation of universal gravitation, $F = G\frac{M_1M_2}{r^2}$, a mathematical description of the behavior of matter in space.

General Relativity

Then came Albert Einstein in 1905 with On the Electrodynamics of Moving Bodies, formulating Special Relativity. Within this theory, we also got the famous $E=mc^2$, which states that mass (m) is just another form energy can take, a sort of concentration of energy. E = Energy, m = the mass of the object, and c = the speed of light (299,792,458 m/s). The speed of light (c) is squared, which equals 9 x 10^{16}, implying that even a small amount of mass produces a massive amount of energy. That form of the equation only applies to matter at rest, and the full equation for matter in motion is $E^2=(mc^2)^2+(pc)^2$, where E = Energy, m = mass of the object, c = the speed of light, and p = the momentum of the object.

Newtonian physics and Special Relativity were incompatible, though. This is because under Special Relativity, no information can travel faster than the speed of light (c). It represents the fastest speed at which information can travel. For example, if you had a 4x4 plank of wood that was a light-year long and pushed one end of it, the board would not travel faster than the speed of light, and the other end would move instantly. Each atom of the plank would have to exchange a photon/wave of light to transfer information that the plank's atoms are in motion in the form of the electromagnetic force. The plank would move at near the speed of light, but not at or faster than. Information cannot travel faster than c. But in Newtonian physics, gravity is instantaneous, so that if the sun were to disappear, all of the planets would immediately no longer feel the sun's gravitational effects. This problem led to one of Einstein's greatest thought experiments.

When you are in a car and slam the gas pedal, you feel a drag of force in the opposite direction of your travel. You get thrown to the back of your seat until your body catches up to the same speed as the car's acceleration brings it to. Or when you go around a sharp turn, and your little brother goes flying across the back seat. He experiences a force in the opposite direction of the acceleration of the turn. Every time you accelerate in a direction, you feel an opposite force in the other direction. But when you're falling, gravity is accelerating you 9.8m/s down; would you feel a jolt in the opposite direction? You would feel weightless for a second or two until air resistance kicks in. Einstein, as the story goes, was looking out a window at a construction site and imagined one of the workers falling, realizing the period of weightlessness the worker would feel.

Why is there no opposite force? Because in the car, there was an object (*the car*) that was applying force to your hips and back, while your head was whipped back until it accelerated. The seat accelerated, while your head remained at rest (*inertial*), and will tend to be at rest until the car's force reaches it. There is a lag or drag in the car's force. But let us ignore air resistance for a moment, and imagine you are falling in a vacuum alongside your phone. Both you and the phone would fall at the same rate, as gravity accelerates all objects at 9.8 m/s². Because all points of your body are being accelerated at the same rate, there is no drag. No part of your body was at rest, as all of you is feeling the force of gravity. In the prior examples, only your hips and back moved first because they were in contact with the car, and then your head followed.

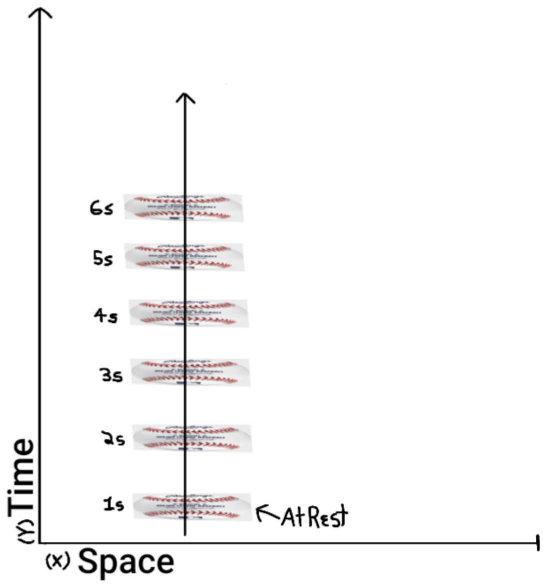
Why is the force of gravity accelerating all things at the same rate? Why wouldn't you fall faster than your phone in a vacuum? Mathematically, this can be explained by the fact that the net force accelerating you equals your mass times your acceleration. Written out, this looks like $\frac{G \cdot M_{Earth} \cdot M_{Person}}{R^2{}_{Earth}} = M_{Person} \cdot a$. The mass of you ($M_{Person}$) cancels out on both sides of the equation, thus you would feel weightless. But the M_{Person} on the left side of the equation is your gravitational charge, and your inertial mass is on the right. They are two independent quantities that just happen to be the same. Why is this? Every other force operates differently; electrical energy depends on the charge, magnetic energy depends on the spin, but gravity's charge seems to be your inertial mass.

Einstein would then propose that there is no force of gravity, but that gravity is the effect of something else we shall shortly see. He would postulate that the ground is actually moving up at 9.8m/s, giving you the sense of weight, like the lag you feel in an accelerating car. There is no way to tell which model is true, gravity as a force that accelerates things down, or an effect of the ground accelerating up by observation alone, as both models explain the effects of gravity. This would lead Einstein to state that it is impossible to distinguish between being in an accelerated frame of reference and being in a gravitational field (the Equivalence Principle). Hence, G-force is the term for the force you feel when accelerating, as well as when influenced by gravity, as it is a measurement of acceleration.

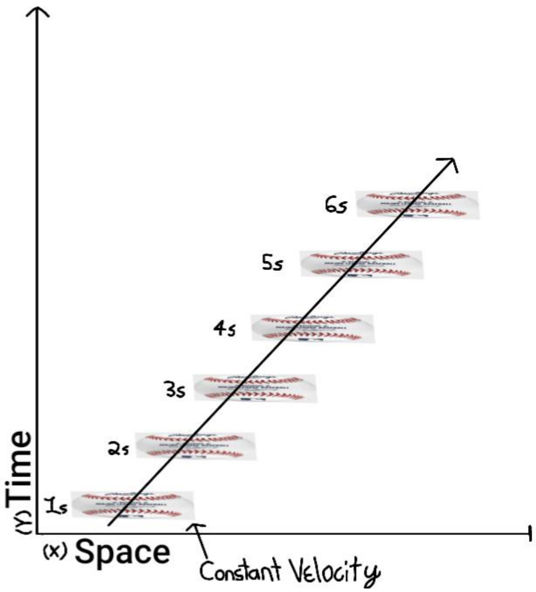
He built on prior thinkers like Copernicus and Galileo, who described different types of motion; specifically, Galileo, who saw motion and rest as relative to the observer and discussed this in his "*Dialogue Concerning the Two Chief World Systems"* (1632). In it, he argues that if a ship were moving at a constant speed, it would be impossible to tell from below the deck if the ship is at rest or in motion by, say, tossing a ball up or to your friend. But Einstein is attempting to generalize this to everything in a newer theory of universal gravitation by viewing gravity from two points of view: either as a field or in an accelerated frame of reference. But unfortunately, we know the Earth is round, but is it expanding at 9.8m/s?

When things fall, they stretch very slightly because gravity is stronger at points closer to Earth. It is not noticeable with everyday objects; a larger object, like an asteroid, would be. A good example of this is the moon's gravitational field causing the Earth to stretch, which creates high and low tides. Newtonian gravitation accounts for this by virtue of gravity's effects feeling stronger the closer one gets to the surface of Earth. If the Earth were expanding, creating the illusion of a force pulling on objects, we wouldn't expect objects to stretch under gravity, yet we observe exactly that. Objects "falling" towards a rising surface wouldn't stretch, because gravity is not a force according to Einstein—so no force is pulling objects to stretch. This means that his equivalence principle is only applicable in local regions where the strength of gravity may be assumed to be uniform, such as near the surface of the Earth. But how can a falling object stretch without any force acting on it? You see, Einstein wasn't satisfied with the Newtonian view of gravity as a force that mysteriously acts at a distance. And with the scenario of the sun disappearing, and gravity's effects also vanishing instantly with it, along with Special Relativity's discovery of the universal speed limit of light, he needed a new view of gravity to explain certain phenomena. His essential question now is this: how can gravity still affect massive objects without it being a force like electromagnetism? A spacetime diagram would help us visualize this much better.

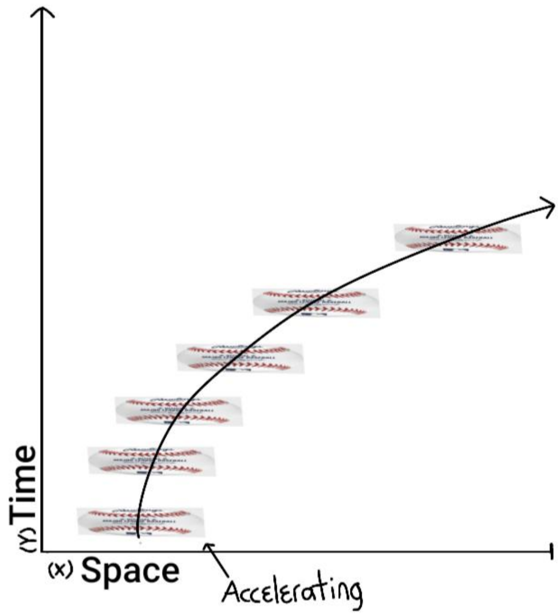
A spacetime diagram is a visual aid that mathematicians and physicists use to form a mental image of phenomena within an observable frame. It is drawn with the vertical Y-axis representing time, pointing up to indicate the forward direction. The horizontal X-axis represents space. A good example is the depiction of the universe's history in the form of a vertical cone. As time flows forward (up the Y-axis), space expands (on the X-axis), producing a cone with a wider end that tapers down into a point.



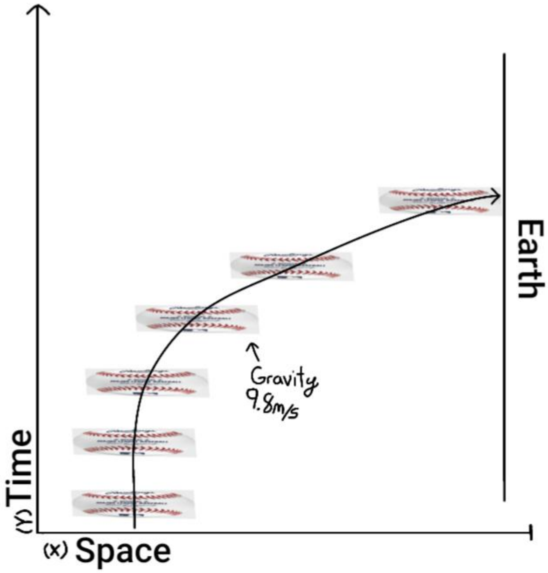
Say a baseball is at rest in space, but still traveling forward through time. Since the X-axis represents its position in space, it does not move left or right. But because the ball is moving through time, at every point in the future, it will travel up the Y-axis at each measured time increment *(1s-6s)* in a straight line. Its path of travel through space and time on the graph is called its world line. When an object is at rest, its world line on a spacetime diagram is straight and vertical. Does it make sense?



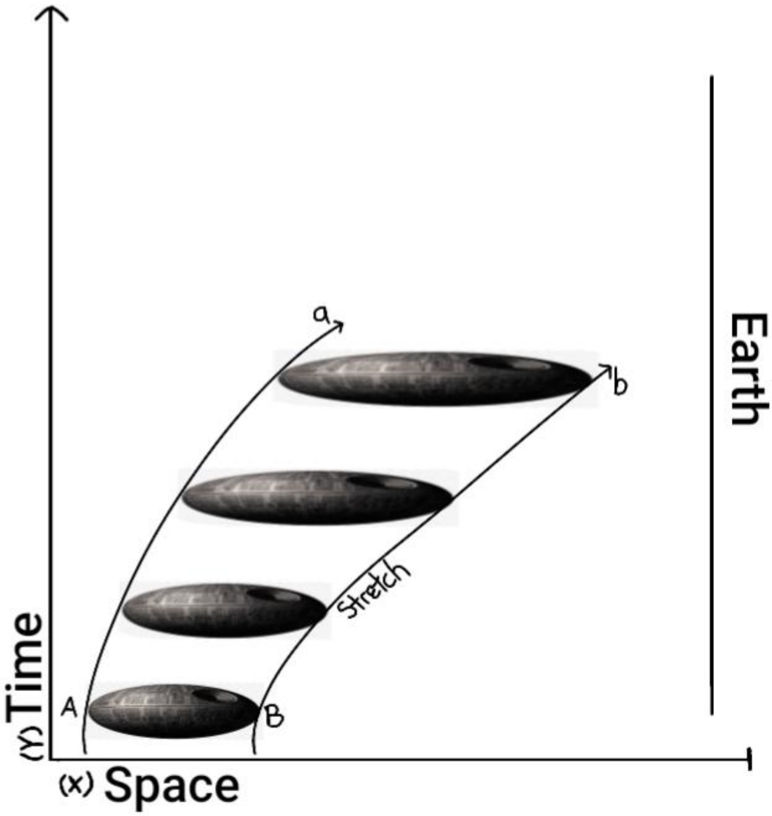
What if the baseball were in constant motion through space? The ball, moving through space, would move along the X-axis as it travels. It will also travel up the Y-axis at each time increment, and since it is moving in space, its world line is diagonal and upward. Objects in constant motion have diagonal world lines.



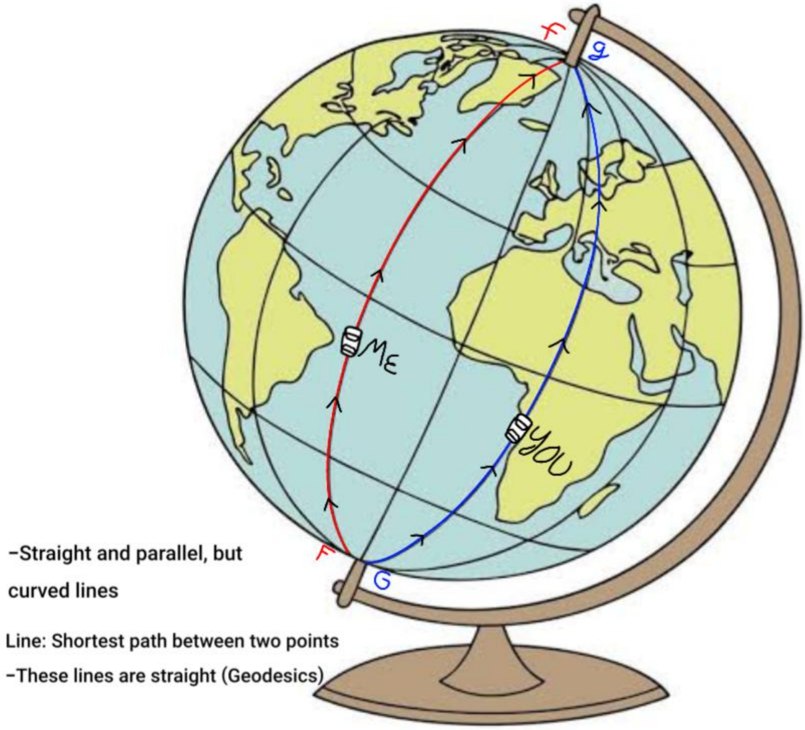
But if the ball is accelerating, at each measured time increment, it will be moving faster than before. It travels along the Y-axis as it moves through time, but since it is faster at every point than the one before, its world line is curved rather than straight. Instead of a straight but diagonal line, you get a curved path.



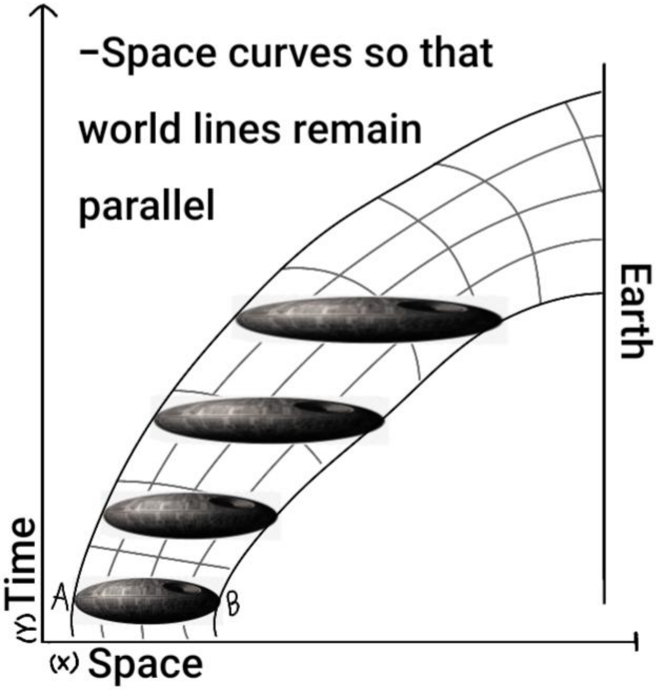
Now let’s add the Earth to the graph, represented by a second line titled accordingly. Let us assume the ground is at rest. Since Earth’s gravity is affecting the baseball, it will accelerate at 9.8m/s towards it. Its world line is curved toward the Earth.



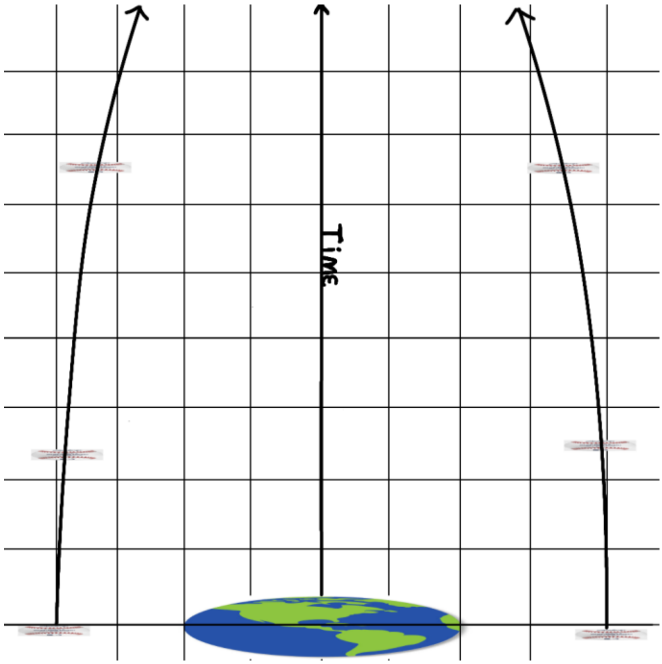
Let’s add a larger object, like the Death Star from Star Wars. Let’s say the Death Star is stuck under Earth’s gravitational influence and it accelerates towards it. This is where stretching becomes very important. Because the Death Star is a large celestial body, the effects of gravity stretching the Star would be much more noticeable than with the baseball. In Newtonian physics, the parts of the Death Star that are closer to Earth (path Bb) feel a stronger force, thus making its world line curve more towards the Earth. This pulls the closer end more than the farther end (path Aa), resulting in stretching. Einstein assumes that the ground is accelerating upward and that objects that appear to fall are actually at rest. According to this view, how would the Death Star’s two ends diverge and gain distance? Since it is at rest, its two ends should have straight, parallel world lines, but as we can clearly see, they seem to diverge. How can parallel world lines get further apart and remain parallel?



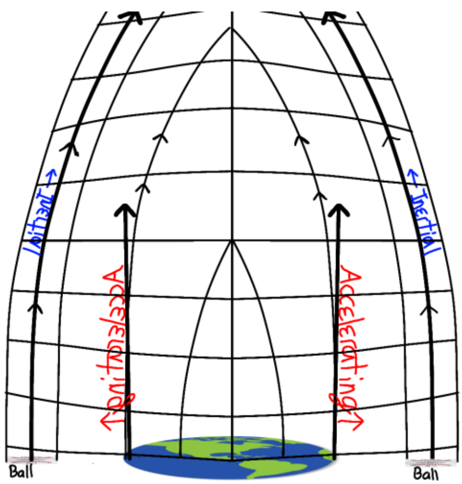
This is the Earth, or a smaller version of it, a globe. Say you and I get into our cars and begin at the equator, driving north on lines Ff and Gg. We would begin our trip side by side, but as we continue North, we will converge and meet at the North Pole, while still driving straight. But how can we get closer when we are parallel? Because we are on a curved surface. Lines on a curved surface diverge or converge while remaining straight. “But the lines on the globe are not straight lines; they are obviously curved,” you may say. But what is a straight line? Is it not the shortest path between two points? On a globe, the lines of longitude represent the shortest paths from North to South. So parallel, straight lines can curve and diverge or converge on a curved surface, and these are called geodesics (to avoid confusion with “straight” line terminology).



On a flat surface, lines must remain equidistant or not converge or diverge. But on curved surfaces, they can converge and diverge as much as the surface allows. In the figure above, every part of the Death Star is assumed to be inertial (at rest) according to Einstein. So the two ends *(A and B)* should have straight and parallel worldlines. But we know that the Death Star would stretch as it falls, so Einstein made a world-shattering assumption. He assumed that it must be the underlying spacetime itself that is curving, allowing parallel world lines to converge or diverge. This is how Einstein discovered the curvature of spacetime.

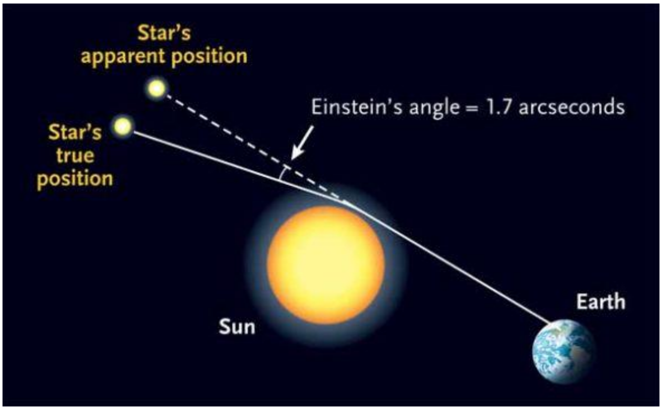


We still have an issue here, though, as Einstein also assumes the ground is rising at 9.8 m/s^2 in his view of gravity. In the figure above, the Earth is between two baseballs. Under Newtonian physics, the Earth's (at rest) gravity pulls and accelerates the baseball's world lines towards it (seen by their paths curving towards the center of the Earth) relative to space.



But if the balls are at rest, as Einstein assumes, then their world lines should be straight, and the Earth should expand to meet them where they are. Since Einstein isn't viewing gravity as a force but as the curvature of spacetime, the mass of the Earth curves spacetime around it, causing the world lines of the baseballs to curve along it towards the Earth. So the balls remain inertial, while still "falling". The two sides of the Earth should also be falling towards the center, but the matter beneath it prevents them from doing so, as it is constantly accelerated away from the center. Since the atoms in the matter below the ground are exerting electromagnetic force against it, they are essentially accelerating away from the center to maintain the Earth's form, making people feel a weight (a force is not really pulling them, but following their natural world lines that are disturbed by the Earth's matter). Harken back to the globe figure, where you and I are driving North. If we wanted not to follow the curved surface of the Earth, we would need to be accelerating away from the natural geodesic of the line of longitude we are on. This is exactly what the ground is doing relative to the rest of Earth's matter. The electromagnetic repulsion from the Earth's atoms is causing the two sides of it to accelerate away from their natural world lines in our diagram above. Now the spacetime diagrams are one-dimensional, but spacetime permeates all of three-dimensional space, something that cannot really be drawn or fully visualized.

This is a somewhat watered-down explanation for ease of understanding, but perhaps it helps clarify the idea that mass curves spacetime. Essentially, space tells matter how to move, and matter tells space how to curve. A massive body will warp the multidimensional fabric of spacetime around it, creating a depression in spacetime. The more mass, the more the fabric of spacetime will warp, as well as the deeper the warp, and the stronger the gravitational force. A smaller body will travel through the curved spacetime, essentially "falling" into the gravitation of the larger body. And it wouldn't be long before Einstein's theory would have the opportunity to be tested. Not only did his Theory of General Relativity properly account for a mysterious shift in Mercury's orbit, but it was also put on full display in an experiment in 1919. *Sir Arthur Eddington* used a total solar eclipse on May 9, 1919, to test the predictions of General Relativity, which holds that, since gravity curves space, it should also alter the path of light near massive celestial bodies.



If General Relativity is accurate, then he should observe the light passing near the sun bend around it during this eclipse. Einstein's model predicts that stars whose light trajectory is near the Sun's surface should appear in different positions from a reference on Earth because their light bends around the Sun and changes its trajectory. Knowing the positions of the stars he observed and seeing their apparent positions deviate from expectations offered hard evidence that spacetime near the sun was bending around it. This also meant that the laws of General Relativity are true throughout the universe; after all, it is a theory of universal gravitation.

Einstein realized that all mass in the universe, if no counteracting force were present, would produce a gravitational effect throughout and, over time, cause all the matter in the universe to congeal in a single area. As each massive body exerts a gravitational force on the others, the matter in the universe would eventually blob together at a single point. Isaac Newton posited an infinite amount of matter that was equally distributed throughout an infinite space to allow for this balance. But Einstein's case was vastly different because his theory posited that all matter bent space itself, so that if the universe consisted of an infinite amount of matter, massive bodies would still cause the space to curve in on itself, eventually meeting the same blob-point end. He realized that if gravity were the only force acting, then all the matter would congeal and spacetime would contract on itself, creating a "big crunch," but nothing of the like has happened.

In response to this issue, he posited an outward-pushing force of expansion to account for the observed space between galaxies (massive bodies). This physical constant was called the Cosmological Constant.

> "As a result Einstein's universe was balanced on a razor's edge, and the least perturbation—even the transport of matter from one part of the universe to another— would cause the universe either to implode or to expand."[16]

The Static Universe

In his 1917 paper titled Cosmological Considerations in the General Theory of Relativity, he introduced the cosmological constant to explain the constant active repulsive force that countered the effects of gravity from massive bodies. In it, he argued that his equations allowed for a static universe under certain assumptions. (1) The curvature of the universe was positive (meaning like the surface of a sphere), and (2) his equations include the additional cosmological constant with a specific value to perfectly balance the gravitational force, not allowing the universe to expand or contract. He assigned a value so precise that the effects of gravity and repulsion were perfectly balanced (we will see shortly how this value is precise). His choice for the value had no empirical justification; it followed from his assumption of an eternal universe. Setting the constant to a specific value allowed him to keep the universe static and eternal.

Then, in 1922, the Russian physicist *Aleksandr Friedmann* solved Einstein's field equations,[17] but on terms that enabled the radius of the universe to change with time. The field equations allow physicists to describe differences in the spatial configuration of the universe that would arise from different possible distributions of mass-energy at the start of the universe. His assumption followed from Einstein's theory of gravity, mainly that massive bodies cause space to contract and change over time. Although he never attempted to explain whether or not the universe was expanding, contracting, or static (only that the status of the universe was different depending on the value of the cosmological constant), he showed that practically all values except the one Einstein chose implied a dynamic universe (dynamic here means that it changes with time, or expands/contracts).

Friedmann's model ultimately predicted universal expansion. And if his model was correct, the universe could no longer be viewed as a static and eternal entity. Rather, the universe would have a history, a history with a beginning. This further implied that Einstein's choice of the cosmological constant made his universe fine-tuned. But even with Einstein's value, his model implied a very unstable universe that was susceptible to the slightest disturbance or variation. But in an eternally existing universe, these disturbances are bound to occur, and it has had an infinite time in the past to do so. Yet the universe is still here, implying that it had a beginning.

Combining Evidence With Theory

Five years later (1927), Belgian priest and physicist *Georges Lemaitre* produced the same equations as Friedmann, but he combined them with observational evidence from Vesto Slipher and Edwin Hubble.[18] He used Slipher's Doppler shift observations of distant galaxies and correlated them with Hubble's measurements of other galaxies. With this, he implied that galaxies were receding from us, and that the further away a galaxy was, the faster its recessional velocity was. Lemaitre formulated this relationship before Hubble, although Hubble later did so with more data than Lemaitre. This recessional relationship suggested a spherical expansion in all directions.

Through this, he would show that the values of the cosmological constant, the distribution of mass-energy, and the curvature of the universe had to be precisely set to allow for a static universe. Even the tiniest alteration to any of those three values causes the universe to eternally expand or violently crush.

"Working in conjunction with Mr. G. C. McVittie, I began some months ago to examine whether Einstein's spherical universe is stable. Before our investigation was complete we learnt of a paper by Abbé G. Lemaître which gives a remarkably complete solution of the various questions connected with the Einstein and de Sitter cosmogonies. Although not expressly stated, it is at once apparent from his formulae that the Einstein world is unstable —an important fact which, I think, has not hitherto been appreciated in cosmogonical discussions."[19]

Lemaitre not only used mathematics to suggest that space changes over time, but he also cited observational evidence showing that space is expanding! His model implied that not just galaxies were moving away from us in space, but that space itself was expanding, and that it must have started at a single point that he called the "*Primeval Atom*".

"At some point in the past... the distance between neighboring galaxies must have been zero."[20]

In 1929, Edwin Hubble would show that the light from distant galaxies is shifted towards the red end of the electromagnetic spectrum. This expansion was predicted in the Friedmann-Lemaitre model (as it would come to be called). According to the Friedmann-Lemaitre model, as time progresses, the distances between galaxies increase. The galaxies themselves are at rest with reference to space, but recede from one another as space itself expands, just as two dots drawn on an inflating balloon. If we were to rewind the clock of the universe, all of the expanding space would congeal on one single point. This state (the beginning) represents a singularity, where spacetime curvature, along with pressure, temperature, and density, approaches infinity. This starting point, or singularity, marks a sort of edge or "boundary" to spacetime itself—a point from which no further back extrapolations can take place.

> "If we extrapolate this prediction to its extreme, we reach a point when all distances in the universe have shrunk to zero. An initial cosmological singularity therefore forms a past temporal extremity to the universe. We cannot continue physical reasoning, or even the concept of spacetime, through such an extremity. For this reason, most cosmologists think of the initial singularity as the beginning of the universe. On this view, the Big Bang represents the creation event; the creation not only of all the matter and energy in the universe, but also of spacetime itself" [21]

This solution to Einstein's field equations would later be developed into the *Friedmann-Lemaitre-Robertson-Walker Metric* (*FLRW Metric*), which implies a dynamic expanding or contracting universal cosmology.[22]

Einstein's Bone To Pick

Einstein expressed disagreement with Friedmann's and Lemaitre's solutions to his field equations, initially claiming that they did not actually satisfy them. He saw Lameître's hypothesis as "inspired by the Christian dogma of creation, and totally unjustified from the physical point of view." But he would be gradually convinced, and in 1927 he encountered the redshift evidence from Lemaître on a cab ride to the fifth Solvay Conference. In 1930, Sir Arthur Eddington also informed him of the observational data, introducing him to Hubble's 1929 paper establishing Hubble's Constant during a visit to the University of Cambridge. Eddington also showed him how the value of the cosmological constant and the curvature of the universe needed to be extremely fine-tuned for the universe to be static.

In 1931, Einstein visited Hubble's Mt. Wilson 2.5-m telescope, where he saw first-hand the evidence of the expanding universe. After this visit, he publicly announced his recognition of a cosmological beginning. He later admitted that his choice of a static universe was "*the biggest blunder of my life*."

The Steady-State Model

During the rest of the 20th century, cosmologists would shift their aim at creating alternative models to the Big Bang. Most of which were made for the sole purpose of avoiding an absolute beginning, stemming from philosophical assumptions from a naturalistic worldview. If someone sees the universe as nothing but the natural world (naturalism), then the assumption of a beginningless universe surely follows. An infinitely old universe would completely annihilate the logical warrant for understanding its origins, as something infinitely old is self-existent. They needed an eternal universe because the Big Bang Theory implied that the universe was finite and caused by something external to space, time, and mass-energy. Naturalism had nothing to posit but space, time, and mass-energy.

In 1948, *Fred Hoyle, Thomas Gold, and Hermann Bondi* created the Steady-State model to explain the expansion of the universe without implying an absolute beginning.[23] They had to account for the expansion of the universe per the empirical evidence and confirmation from Eddington. Since the evidence for expansion was so overwhelming, they posited that the universe would endlessly expand and double in size; since doubling an infinite just generates another infinite, the overall dimensions of the universe would not change but would remain.[24] Indeed, if the universe contained a field that generates new mass-energy into this expanding universe, then there would be no need for a beginning; the universe expands, and an unknown field creates new matter, and the process just goes on forever. But where does this new mass-energy originate? What mechanism, if any, can be put forth to produce this new matter? Hoyle would go on to postulate a creation field (C-field) that is responsible for generating new mass-energy. He also introduced an arbitrary fundamental principle that the universe must always remain at a constant matter density. This assumption had no physical justification or evidence; it was necessary from the assumptions made by the model as a whole.

In reality, the postulation of a C-field was no more ad hoc (unrealistic and improvised) than Einstein's cosmological constant. Mathematically, the C-field is practically a variation of the cosmological constant, "though one that acted locally and episodically rather than uniformly and more constantly."[25] When it's all said and done, Hoyle's field never really gained much traction in the wider field of physics, and the model would eventually die out (as we shall shortly see). Anyhow, the C-field was seen as a vast ocean of negative energy that has co-existed with the eternal, self-existent universe.

Here Lies The Steady-State Model: The Cosmic Background Radiation

Despite the Steady-State model not gaining attention in the long run, it was favored by many physicists and cosmologists for the remainder of the 50s and into the early 60s. At the halfway mark of that decade, in 1965, Arno Penzias and Robert Wilson made another universe-shaking discovery that would seal the coffin of the Steady-State for good. The Big Bang theory predicted a low-energy background radiation throughout the entire universe. This was due to the extremely dense mass-energy shortly after the beginning of the universe, which would have been extremely hot, radiating electromagnetic energy throughout the universe at that stage, essentially leaving behind a flash from the Big Bang that would still be dissipating. This period of the universe's history is called the Recombination. Before this period, the universe was in a state of extreme heat and plasma that consisted of free electrons (not bound to an atomic nucleus). Because the electrons were not bound in atoms, photons were constantly scattering and bouncing off of them. When the universe cooled to around 300,000 Kelvin, electrons were able to bind to protons in hydrogen atoms, allowing the photons to freely travel through space and make a sort of cosmic "flashbang" that would dissipate as the universe expanded. Before this period, light could not travel very far without bumping into an electron, but since there were fewer free electrons, it could travel throughout space. As the universe expanded, this light moved with it and, by our time, formed a low-energy radiation background to the universe.

In 1948, *Robert Herman and Ralph Alpher* predicted this radiation: as the universe expanded and cooled to the point where electrons could attain stable orbits around protons and neutrons, light could travel freely without being redirected by electrons in the Plasma State. This would have bathed the early universe in light traveling in every direction. The continuing expansion of space would have stretched this light's wavelength to the far end of the electromagnetic spectrum, namely the microwave region at 1mm. They also calculated that the temperature of the blackbody of the mass-energy from the plasma state, based on the Big Bang model, is only a few kelvin above absolute zero today, at 2.5-5 kelvin.[26] They did this by dividing the temperature of the universe at that time when light could first travel, 3000, by the expansion rate of the universe at 550 times. This gave them a temperature for the cosmic background radiation today at about 5 kelvin.[27]

In 1964, *Penzias and Wilson* were unable to eliminate some radio static from their antenna at Bell Telephone Laboratories in New Jersey. They had this constant hum that was in every part of the night sky. They had no way to identify and avoid the low-frequency hum. A physicist proposed that they were not experiencing an antenna fault, but detecting residual background radiation from the universe's beginning. They discovered the Big Bang model's predicted Cosmic Background radiation![28] They won the Nobel Prize in 1978 for their discovery. There were later confirmations of the radiation from the *Cosmic Background*

Explorer Satellite, launched in 1989, and the *Planck Space Observatory*, launched in 2009. For many scientists, this evidence confirmed the belief in a temporal universe. Cold case homicide detective and apologist *J. Warner Wallace* gives us a helpful analogy for understanding the Cosmic Background Radiation by comparing it to a flash-bang:

> "We employed a "flash-bang" grenade in nearly all these SWAT entries. The grenades are designed, of course, to 'flash' and 'bang'; they make a lot of noise, light, and heat. We typically threw a grenade in the room where the suspect was barricaded (usually through a window). When the grenade hit the ground, it exploded violently, lighting the room, deafening the suspect, and filling the space with debris and heat. In that instant, as the suspect was distracted, our team came in from the opposite corner. Flashbangs are excellent distraction devices because they leave a lingering impact in the space where they are deployed."[29]

If the universe did begin from an initial state of tremendous heat, density, spacetime curvature, and expansion, then we should expect to find evidence of the temperature blackbody that Herman and Alpher predicted. Proponents of the Steady-State model would soon admit that their theory didn't predict the detection of this background energy, but this was not the only issue. The Steady-State Model predicted that galaxies should be observed in various ages, from young to old, but no such young galaxies have ever been observed. By the 1970s, the theory was dead in the water and buried with a gravestone that reads, "Here Lies The Steady-State Model."

The Oscillating-Universe Model

After the discovery of the Cosmic Microwave Background Radiation led to the demise of the Steady-State model, cosmologists began searching for another way around the cosmic beginning. They would go on to lay out the Oscillating-Universe model that proposed a universe that would expand, decelerate expansion, and begin to shrink under gravitational effects, and then, once it reaches the Planck scale (1.6×10^{-35} meters), and by an unknown and unobserved mechanism, restart expansion, and the cycle continues for eternity, despite the philosophical issues with a genuinely infinite past. And this model didn't appear in a vacuum. People like Richard Tolman proposed early versions of the Oscillating Universe in the 1930s, working with Friedmann's solutions that implied an expanding or contracting universe, which later cosmologists would revisit and refine in the 70s.

The Death Of The Oscillating-Universe Model

Proponents of this theory were ultimately unable to devise a mechanism that would restart the expansion after gravitational collapse. From the 1980s to today, there have been cyclical “bounce” theories that make the same ontological mistake as the Steady and Oscillating models, positing physical mechanisms for which there is no empirical or epistemic justification. These models also violate the null energy condition, which is an assumption that Einstein’s equations allow for matter and energy to behave in reasonable ways. It essentially asks whether, if a photon of light were to travel across the universe, there would ever be a point along its path where it experiences negative energy. Since it would pass stars, galaxies, gas clouds, and through the Microwave Background Radiation, the null energy condition says no, and gravity essentially focuses light (like the sun bending the light of stars around it). In other words, matter curves spacetime.

Because they violate the null energy condition, each “bounce” would result in more and more instabilities with each cycle.[30] It also ran into difficulties with the 2nd Law of Thermodynamics. Alan Guth showed that with each oscillation cycle, the entropy of matter and energy would increase.[31] This results in less usable energy available to perform work with each cycle, and causes longer and longer periods of oscillation from the inhomogeneities in mass-energy distributions, affecting the efficiency of the gravitational force to cause contraction as expansion decelerates. This means each previous oscillation would be progressively shorter, and it cannot decrease ad infinitum. You're still left with the implications of a beginning.

To make matters worse, as the universe expands and contracts more and more for an infinite time, all the energy in the universe would reach thermodynamic equilibrium and become completely randomized, leaving only heat energy and none to perform work, a state known as the "Heat Death" of the universe. Modern measurements have found that the universe's mass density is actually less than the density needed to overcome expansion and cause it to stop, laying another bullet in our buddy Osci. The expansion may also be the result of what physicists call today dark energy, which seems to permeate all space and exert outward pressure on it. We now have three competing models in view; The Big Bang, postulating that the universe began, with space, time, and energy emerging with it, and that it has been expanding ever since; The Steady-State, postulating that the universe is eternally expanding with an arbitrary C-field creating new matter to balance gravity with expansion perfectly; and The Oscillating-Universe, positing an unknown mechanism by which the universe restarts expansion after it collapses on its own spacetime curvature.

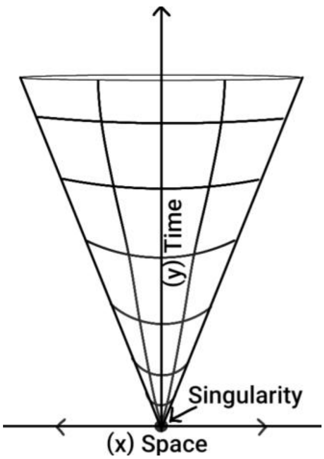
One Of The Last Hurdles

For the most part, though, the Big Bang seemed to have won the battle for evidence, emerging as the favored theory for the origin of the universe. But it had one last major issue. For galaxies and other massive bodies to form later in the universe's history, the mass-energy after the beginning had to exhibit fine fluctuations in its density. This means that as some areas have slightly more mass-energy, they would gather under its gravitational effects to form galaxies as the universe expanded in the forward direction of time. This follows from the fact that as we observe the night sky today, we see massive amounts of space between galaxies. These fluctuations would affect the background radiation, as different densities of mass-energy would produce different wavelengths from different regions of the universe.

That is why the Big Bang theory implies tiny variations in the density of the Cosmic Microwave Background Radiation. In 1989, when NASA launched the Cosmic Background Radiation Explorer Satellite, they measured the background radiation, suspended above the noisy atmosphere humanity dominated, and discovered the predicted variations in its density that previous ground scans were unable to detect. This evidence cleared one of the last issues with the Big Bang model, solidifying it as the favored theory of a temporal universe. There would still be breakthroughs in mathematical theorems that would offer more support for a cosmic beginning.

The Singularity Theorems

In the 1960s, while a young Stephen Hawking was conducting his PhD research, he came across the earlier work of physicist *Roger Penrose*. Penrose was developing the physics of black holes, regions of space where the mass is so densely packed by gravity that not even light can escape its pull. The mass of a black hole is so large and dense that it curves spacetime around it into a close region of space, and the gravitational effects are such that not even the path of light can escape it. Depictions of black holes show a dark spherical center. That black



sphere is not the actual enclosed space of the black hole (the singularity), but a region around it called the event horizon. This is the point where the gravitational effects of spacetime are so strong that not even light can escape; hence, the region appears dark, as no light can leave it. For us to see the black hole itself, light would have to be able to bounce off its surface, or it would have to release light in all directions like a star. Still, since no light can escape its event horizon, all we can see is a black area of space around it due to the absence of light reflection or emission beyond that point (imagine going down a hill that gets steeper and steeper until it's practically at a 90-degree angle, at which point you have nothing to hold onto and you fall).

Hawking began examining Penrose’s work, relating the idea to the universe's past state. At every single point in the past, the mass of the universe would become denser and denser due to its expansion in the forward direction of time. Extrapolating this further back, the curvature of space would approach an infinitely small spatial volume that corresponds to a volume of zero. This zero-volume region is called a singularity, where the laws of physics break down, and where the universe would have begun its initial expansion. In his PhD thesis, Hawking included an entire chapter on the implications of General Relativity and the expanding universe, and provided mathematical proof of the singularity at the beginning of the universe. He showed that any time or light-like path between any two points in the expanding universe would necessarily terminate at some finite point in the past, a past incomplete universe.[32] During the late 60s and 70s, Hawking, Penrose, and George Ellis published some papers that made implications for the beginning of the universe from General Relativity. Their solutions to Einstein's field equations implied a singularity at the beginning of the universe, where the matter density and curvature would approach an infinite value

Friedmann's previous solutions for a dynamic universe also implied a singularity at the beginning of the universe, but he did so by assuming the mass-energy distribution was completely homogeneous; in other words, the distribution of mass-energy was the same in all directions, and looked the same in all directions. But for galaxies to form, the initial distribution needed slight variations in its overall density. Then came the big three. Hawking, Penrose, and Ellis solved Einstein's field equations without assuming perfect homogeneity of mass-energy distribution. In doing so, they showed that given General Relativity, the universe began in a spacetime singularity (The Hawking-Penrose-Ellis Model). As the universe expands, space flattens, and the curvature approaches zero. Still, in the reverse direction of time, the curvature increases, and as the distances between any two points also decrease, the curvature approaches an infinite value. The distance between the two points approaches zero. Hence, the infinite curvature corresponds to zero spatial volume. Also, if the curvature of space approaches infinity and the volume approaches zero, time would approach zero as well.

How Much Can You Put Into Where And When?

In 1978, the cosmologist and physicist *Paul Davies* described the singularity like this:

> “If we extrapolate this prediction to its extreme, we reach a point when all distances in the universe have shrunk to zero. An initial cosmological singularity therefore forms a past temporal extremity to the universe. We cannot continue physical reasoning, or even the concept of spacetime, through such an extremity. For this reason most cosmologists think of the initial singularity as the beginning of the universe. On this view the big bang represents the creation event; the creation not only of all the matter and energy in the universe, but also of space-time itself."[34]

An infinitely tight space corresponding to zero spatial volume. This forms a barrier, implying that no further back extrapolation in time can occur, suggesting that time was an emergent property of space and mass-energy. The singularity theorems do not allow one to posit prior mass-energy or gravitational fields as an eternal entity since neither space nor time existed beforehand. It implies that energy and matter first arose at the beginning, along with space and time, although the actual point of creation is not described by current physics. The initial expansion from the singularity cannot be visualized from the outside; you surely can do so, but in reality, there was no space outside of the space of the universe for observers to look upon the universe from. Moreover, the origin of the Big Bang theory postulates an absolute origin from nothing. Not only matter and energy, but space and time themselves come into being at the state of the initial singularity. If the universe truly came from nothing, then we have a creation ex nihilo scenario in view.

"The universe began from a state of infinite density about one Hubble time ago. Space and time were created in that event and so was all the matter in the universe. It is not meaningful to ask what happened before the big bang; it is somewhat like asking what is north of the North Pole. Similarly, it is not sensible to ask where the big bang took place. The point-universe was not an object isolated in space; it was the entire universe, and so the only answer can be that the big bang happened everywhere"[35]

Indeed, to posit spacetime or energy before the Big Bang violates the very foundational premise of the theory, namely that the universe (spacetime and mass-energy) began. Sir Arthur Eddington would also put in his two cents about the past incompleteness of the universe:

"The beginning seems to present insuperable difficulties unless we agree to look on it as frankly supernatural."[36]

This raises philosophical issues concerning a beginningless, eternal universe. It also heavily supports the second premise of the Kalam Cosmological Argument: The universe is a being that began to exist. But there is some more history to cover, as well as other cosmological models being proposed that will be covered in detail in later Chapters (5-6). For now, we know that it would be at least nonsense to deny that the Big Bang posits a past incomplete universe.

Inflationary Cosmology

During the 1980s, *Alan Guth, Andrei Linde, and Paul Steinhardt* developed a theory they called Inflationary Cosmology. Initially proposed to explain the homogeneity of mass-energy in the universe, it posits that soon after the Big Bang, the universe underwent a rapid, short expansion due to negative gravitational energy from a proposed inflaton field. It asserted that space rapidly expanded within fractions of a second after the Big Bang for a brief period of time, before slowing down to the current rate it is at today. [37] The only physical candidate that was able to account for the sudden expansion of the early universe was some sort of energy similar to Einstein's cosmological constant. They would describe this exotic, expanding energy as a field that pervades all of empty space, with the key assumption that its density must remain constant throughout space. This means that, as in the Steady-State model, as space expands, more energy needs to be produced to keep the field constant, and its source is not entirely determined. To get around this, the theory often proposes that the space of the inflation field is infinite, so that any arbitrarily chosen part of it observed will have a constant density no matter how much it expands (if that makes sense, and an actual infinite actively growing to a potentially infinite size).

Due to quantum field theory, many thought this inflation field would be subject to random fluctuations in its local energy density that would produce causally separated universes called bubble universes. This is exactly like having two dots drawn on a balloon being blown up. As the balloon's surface expands, the distance between the dots grows larger and larger. Similarly, as the inflation field expands (blowing up the balloon), fluctuations in its energy cause a random local region to dip into a negative vacuum state. This random, localized region's inflation essentially halts. Still, the field's decay in the local region releases energy that drives the region to expand into a bubble universe (like you drawing dots on a balloon). From this point on, that bubble universe's expansion rate follows the rate of the inflation field as it expands (like the surface of the balloon being stretched larger, making the dots slightly grow as they stretch, as well as the distance between them growing). Because the bubble universes are gaining distance as the field expands, they are causally isolated and thus unobservable from within another bubble universe. The difference between the inflation field's energy density and the bubble's density is converted into mass-energy for that bubble universe. But since the field itself is eternally expanding, the bubble universes will continue to expand slightly and produce other regions in the field for other universes to inhabit as the fluctuations cause other regions to decay. This form of the theory is called Eternal Chaotic Inflation, or the Inflationary Multiverse.

Eternal Chaotic Inflationary Violations

Proponents imagined the inflaton field being effective eternally into the past as well as into the future, creating an infinite array of bubble universes. Since the space outside the universes continues to expand faster than the bubble universes, they practically never make contact with each other and are thus undetectable from within one of them. Inflationary cosmological models all affirm quantum fluctuations as the prime mechanism to produce universes, but these models also include violations of various energy conditions required for singularity theorems to hold. Some quantum fluctuations would result in negative mass-energy densities in universes, violating the Strong Energy Condition of General Relativity.

The Weak Energy Condition states that for a singularity to hold, the energy of the universe must be nonnegative (zero or positive). *The Strong Energy Condition* states that for a singularity to hold, the density of the universe must be greater than the negative value of the pressure caused by the motion of the energy in the universe. In other words, the density pressure of all of the energy in the universe must be nonnegative. If that still is a bit technical, the amount of mass-energy in the universe must be enough to guarantee that gravity has an attractive effect on bodies within it (spacetime curves). It is practically an assumption that depicts gravity (within the model) as behaving as we observe it to behave on Earth.[38] Why was inflation created, though? And why did so many cosmologists and laymen favor it?

Why Inflation?

The inflationary theory was first created to explain the homogeneity of the universe. This means that the universe has roughly the same matter distribution in all locations, mainly from the uniform temperature of the cosmic background radiation, which exhibits fluctuations so faint as to 1 part in 100,000.[39] This was only an issue for the Big Bang model unless very finely tuned initial conditions were posited. Some people are rather misinformed that inflationary theory is required for the Big Bang model to explain the homogeneity. Still, it can be explained by the Big Bang by postulating that the universe had nearly perfect uniformity in temperature and mass-energy distribution in the plasma state. But inflationary cosmologists do not attempt to explain homogeneity on initial conditions, as that would warrant intelligent design of the universe (whatever caused it designed it for what we see today). Instead, it postulates an early, rapid rate of expansion that smoothes out the distribution via an exponentially fast rate and a sudden stop at just the right time. Because of this, any remnants of the beginning of the universe would have been pushed far beyond the edge of the observable universe. How convenient.

This expansion explained the observed flatness of the universe. Flatness here means that space would have close to no curvature, so that two parallel lines would never converge or diverge, but remain next to each other, unless influenced by gravity. Our universe is relatively flat because its expansion has barely overcome the gravitational attraction produced by the mass-energy density. Today, physicists believe our universe has a mass density slightly lower than the critical mass required for gravity to overcome expansion and halt it. Nonetheless, gravity would still cause the universe to be slightly curved, just so that any small section of it would seem relatively flat (like a small section of land on the Earth). Inflation also seemed to explain the absence of monopoles, particles that would act as magnets but with only one pole instead of two. How so? By claiming inflation pushed the evidence far beyond an observable distance. How convenient.

The BGV Theorem And The Death Of Eternal Inflationary Cosmology

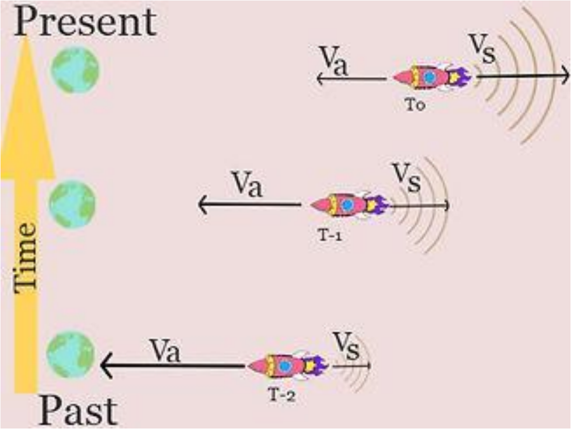
By the time the 90s rolled in, Inflationary Cosmology nearly dominated the field. It was the best model for the origin of the universe without a beginning, and nobody could fully refute its eternality. But then came a group that created just that: a theory that led to another proof of the temporal universe. The best part is that it holds even if the inflationary theory is correct. The popularity of inflationary cosmology motivated physicists *Arvind Borde and Alexander Vilenkin* to examine what inflation implied about the universe. If the universe really could be "past eternal". *Alan Guth* later joined them, and soon came to a sobering conclusion that still leaves some modern-day scientists and many Reddit atheists in denial.

> "Our argument shows that null and time-like geodesics are, in general, past-incomplete in inflationary models, whether or not energy conditions hold, provided only that the averaged expansion condition holds along these past-directed geodesics."[40]

Instead of attempting to do so based on General Relativity, they did so on the grounds of Special Relativity. In 2003, *Borde, Guth, and Vilenkin* created a theory for the beginning of the universe that did not rely on any energy conditions or singularities.

"A remarkable thing about this theorem is its sweeping generality. We made no assumptions about the material content of the universe. We did not even assume that gravity is described by Einstein's equations. So, if Einstein's gravity requires some modification, our conclusion will still hold. The only assumption that we made was that the expansion rate of the universe never gets below some nonzero value, no matter how small."[41]

In 1994, Borde and Vilenkin would first attempt to investigate whether inflationary cosmology was able to avoid an initial singularity in the universe. They concluded that, even if chaotic eternal inflation continued to produce new bubble universes, the field and the universe would have sprung from a temporal singularity in the past. Their *1994* paper argued that inflationary models met the weak energy conditions, as their theorem did not require the strong energy condition to be met. But in *1997*, they published another paper arguing that inflationary models do not, upon further analysis, actually meet the weak energy condition. Then, in *2003*, they would base their analysis of inflationary models on Special Relativity and show that even during inflation, the universe still required a beginning.[42, 43] The BGV (*Borde, Guth, Vilenkin*) Theorem states that "any universe that is on average expanding is past incomplete." Before I explain the theory, let me sum it up in simple terms for the layman. Simply, the theory states that if any universe is expanding, as time is extrapolated backward, all matter and energy within the expansion will eventually reach a velocity limit, the speed of light, marking the beginning of the expansion because it would be impossible to extrapolate back any further.



As time advances, the apparent velocity of the ship *(V_a)* decreases due to the velocity of the expanding space around the ship *(V_s)* increasing. As time decreases *(T)*, the recessional velocity of the space around the ship *(V_s)* decreases; consequently, the apparent velocity of the ship *(V_a)* increases. If we were to continue to extrapolate backward infinitely, the apparent velocity of the ship *(V_a)* would eventually reach the speed of light, marking the start of the expansion and the beginning of the universe.

Given that the universe is expanding, and any two points will gain distance between them because of it, if a spaceship is moving towards Earth, it would appear to be moving slower relative to Earth than if the universe were not expanding due to the space around it also expanding along with the space between them (its apparent velocity). If the spaceship were inertial and moved at a constant velocity, it would appear to be moving slower and slower as time progresses *(T[-2] - T[0])*; its apparent velocity will decrease due to the space around the ship expanding at a faster and faster rate (because the expansion is accelerating). Just like two dots on a balloon appearing to move faster and faster away from each other as the surface of the balloon grows. If we continue to extrapolate backward in time, the velocity of the space expanding around the ship will decrease *(V_s)*, resulting in the apparent velocity from Earth to increase *(V_a)* because the space around the ship and between it and Earth would be contracting.

The recessional velocity of space would have been greater in the past than in the present. This means that as time is extrapolated back, the apparent velocity of any object increases; as this continues, the velocity would eventually reach the speed of light, the universal speed limit for anything with mass. At this point, no back extrapolations can continue, implying that the universe must have had a beginning to its expansion even if it was inflationary and "eternal". To sum it up in other words: in an expanding universe, the further one follows the path of an object back in time, the greater its apparent velocity would have been relative to an observer. But according to Special Relativity, an object in any frame of reference cannot exceed the speed of light. So if we extrapolate back in time, objects relative to an observer would have reached this limit at some point in the past, after which no further extrapolations can be made. This would necessarily represent the beginning of the path of any matter or energy and mark the beginning of expansion.

Attempts To Get Around The BGV

Some current models have been based on attempts to create theorems that propose possible exceptions to the BGV conditions that the universe has been in a state of average expansion. These models, which avoid the BGV theorem, introduce unrealistic physical entities and bloated ontologies. They see the universe as expanding infinitely in both directions of time from a state of extreme compaction. The universe was in a state of infinite size and time, but then went through an infinitely large contraction until it reached an extremely compact state. From this singularity state, the universe then expanded to its current size.

These models would run into several major issues that warranted extremely unlikely fine-tuning from the infinite past that would have led to the low-entropy (organized) state our universe exhibits at the singularity (fine-tuning is covered in Chapter 4). As William Lane Craig and James Sinclair said, "Sure, it would seem that a model that posits a prior contracting phase certainly evades BGV—the time coordinate τ will vary monotonically from −∞ to +∞ as spacetime contracts for all τ less than 0. But how does that entail that models of this sort are in fact viable options… In a personal communication with James Sinclair, George Ellis identifies two problems that plague these models: 'The problems are related: first, initial conditions have to be set in an extremely special way at the start of the collapse phase so that it is a Robertson-Walker universe collapsing; and these conditions have to be set in an acausal way (in the infinite past). It is possible, but a great deal of inexplicable fine-tuning is taking place: how does the matter in widely separated causally disconnected places at the start of the universe know how to correlate its motions (and densities), so that they will come together correctly in a spatially homogeneous way in the future?? Secondly, if one gets that right, the collapse phase is unstable, with perturbations increasing rapidly, so only a very fine-tuned collapse phase remains close to Robertson-Walker even if it started so, and will be able to turn around as a whole (in general, many black holes will form locally and collapse to a singularity). So, yes, it is possible, but who focused the collapse so well that it turns around nicely?'" [44]

There are four exceptions to the BGV theorem: The first are models that posit infinite contraction like De Sitter Cosmology; The second are models that propose an unstable initial state that was followed by a period of inflationary expansion; The third postulates a period of contraction followed by extreme expansion driven by dark energy, with the universe breaking into other bubble universes; and the fourth imagine a mirror-image inflationary expansion that expands into both directions of time away from the initial singularity. Although these four exceptions get around the BGV theorem, they are simply too speculative and unrealistic to be taken seriously:

> " Jim shows that these highly speculative models are all either in contradiction to observational cosmology or else wind up implying the very beginning of the universe they sought to avert."[45]

Borde, Guth, and Vilenkin (after whom the BGV Theorem is named) showed that all cosmological models featuring an expanding universe, whether multiverse, inflation, steady-state, or oscillating, are subject to the BGV theorem.

> "With the proof now in place, cosmologists can no longer hide behind the possibility of a past-eternal universe. There is no escape; they have to face the problem of a cosmic beginning."[46]

Nowadays, cosmologists look towards quantum cosmological models to explain the eternal universe, but that is a topic for the coming chapters. We shall discuss in more detail Inflationary Cosmology, String Theory, and finally Quantum theories for the origin of the universe, and whether they can claim an eternal universe.

The Small Size Limitation

I must mention one last very important fact before we continue to other areas. All singularity models presuppose General Relativity as the most accurate theory for describing gravity. But General Relativity poses one issue: these models can only go backward so far, to when the universe had a spacetime curvature of 10^{-12} to 10^{-33} cm in diameter. At this unimaginably small size (the Planck Scale), General Relativity breaks down, and another theory, Quantum Physics, has to be used. At this small size, quantum phenomena dominate, and cosmologists have to develop models analogous to phenomena found in quantum physics to explain the state of the universe before this period, before the singularity.

Despite this issue, many take the unimaginably small size to mean there was a beginning. But there are still those who would attempt to get around the beginning by proposing Quantum Cosmology, which many, unfortunately, believe avoids a cosmic beginning, and another issue: the fine-tuning of the universe. Practically all models that attempt to get around a cosmic beginning just push the fine-tuning issue back further, as well as further complicating it, which hasn't really wholeheartedly avoided an initial cause, as the Kalam Cosmological Argument states. Yet there are still some points to discuss before covering the Teleological Argument.

Philosophical Evidence: Infinite Regress

As mentioned briefly in the previous chapter, there are some philosophical issues with an eternally existent universe (one that is infinite in its past). From here, I refer you to the discussion of potential and actual infinites from the previous chapter on the Kalam Cosmological argument. Potential infinities are one thing: an ideal limit of a continuous set. Like a man counting from one and continuing to do so for an infinite time. He will continually approach the ideal limit of infinity, but he will never actually reach it. Now we come to actual infinites, that being infinites that actually exist. An example of an actual infinite set is the set of whole numbers. There is an actually infinite number of numbers in the set, but actual infinites existing in the material, natural world are an entirely different thing. Actual infinities result in absurdities.

If I have a chest full of an infinite number of lollipops, and I have to give away one lollipop to every person on Earth, how many would I have left? An infinite number of lollipops are still in my chest. Moreover, if the candy government taxes 33% of my lollipops, how many do I have left after 1/3 is removed? Still, an infinite number remains. Here's a better example: in the set of whole numbers, which has an infinite number of numbers in it, how many odd numbers are contained in it? An infinite number of odd numbers are within the whole number set. How many prime numbers are there? An infinite number of prime numbers. J. Warner Wallace offers a useful explanation: you are about to begin a race, and before the race begins, you are told to move your starting line back a foot. Before the race starts again, you are told to move your line back a foot. If this continues forever, will you ever reach the finish line? Without a beginning, you will never have an opportunity to finish. If the universe had never begun, today would never happen.

Thermodynamic Evidence Of A Beginning

Not only does an infinitely old universe result in logical absurdities, but the idea also violates thermodynamics. Namely, the second law of thermodynamics. The quantity of energy in a closed, isolated system remains constant, while the amount of usable energy available to perform work decreases over time. The amount of entropy in a system will increase over time, meaning disorder will increase. This means that if the universe were infinitely old, then the amount of usable energy would have run out an infinitely long time ago, which is an absurd thought, and has obviously not happened. Better yet, unless fed from an outside source, the energy in the universe would even out, be randomized, and reach equilibrium in temperature, energy, and disorder.

Imagine you stumble across a cabin while hiking with your friends. You guys walk up the porch steps (what remains of them) and approach the door. The door is just on its hinges, and as your buddy knocks it over, you all see an old, broken-down kitchen with a table. On the table is a cup of hot tea, and on the floor is a wind-up easter chick, still bouncing and ticking about. You would almost immediately deduce that the tea was just made and the toy had been wound up by someone else before you knocked on the door. The fact that the universe still contains usable energy and is not a large sludge of heat suggests that the universe had a beginning. Moreover, models like the Steady-state Model violate the first law of thermodynamics, which states that mass-energy is not created or annihilated, but transferred in its form and usability. If the universe still contains usable energy, and it's supposedly infinitely old, then it must have had a starting point where it was wound up.

What Next?

As we have seen, major developments in astronomy, cosmology, and mathematics all offered hard evidence that the universe was, in fact, not eternal, nor infinite in time or space. With the spacetime curvature of a singularity approaching an infinite value corresponding to zero spatial volume, the universe essentially did begin at this point, with matter and energy arising alongside space and time. Where can we put something if there's no space to put it? Indeed, if singularity theorems do not enable one to posit a material state before the singularity, then the cause of such cannot be within it. It seems, at least to me, that this cause must have been transcendent to space, time, and mass-energy. It must be a spaceless, timeless, self-existent, all-powerful, intelligent cause to be at least adequate to explain the universe in the first place! How can a material state exist before any material state? If the universe remained at this material state for an infinite age, why did it not cause a universe at any point before, when it did, if it existed in a material state that is causally adequate for the universe to come into existence for an infinite amount of time beforehand? Jeese! All of this infinite babble is making my brain cramp!

Moreover, the cause must also be personal, for reasons to be stated in a later chapter, but for now, I can say that to go from a state of non-creation to creation requires a choice to be made. And if there was a personal mind before the universe, it very well could have chosen to create this universe that we see today. Might I also say that this does not really get us to the Christian God; rather, that comes with a thorough investigation of the historical reliability of the crucifixion and resurrection of Jesus Christ. At least for now, we can confidently say that some personal cause with the attributes of the Biblical God is causally adequate to explain the universe we observe today. We can now say with high confidence that the second premise of the Kalam Cosmological Argument is true. That being that the universe began. By looking at the discoveries of modern science, we see how the universe would have indeed begun at a single point with no volume, a singularity.

Continuing, we will now look at an area of physics called the “fine-tuning parameters”, which are specific values found in natural laws that exhibit extreme fine-tuning, with many of them only able to change their current values by a small fraction before life in the universe as we know it is impossible. In doing so, we can then begin to lay out the nature of the cause that left the effect of the cosmological singularity.

Chapter 3 Notes

[1] (For Christians, it will suffice to say that they began with this view. Literarily, this can be traced back to Theophilus of Antioch [180 AD], who, in his work *To Autolycus*, argues for the finitude of the universe and offers calculations for its age based on what is provided in Scripture from a literal interpretive approach.)

[2] (Meyer, Stephen C. *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe*, New York: HarperOne, 2021, pgs 69-70)

[3] (Shapley, Harlow. *"Studies Based on the Colors and Magnitudes in Stellar Clusters. VII. The Distances, Distribution in Space, and Dimensions of 69 Globular Clusters."* Contributions from the Mount Wilson Solar Observatory, no. 152, 1918)

[4] (*Transcript: The Scale of the Universe*, Bulletin of the National Research Council, 1921)

[5] (Leavitt, Henrietta S. *"Periods of 25 Variable Stars in the Small Magellanic*

Cloud." Harvard College Observatory Circular, no. 173, 1912: 1–3. Cambridge, MA: Harvard College Observatory)

[6] (Meyer, Stephen C. *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe*, New York: HarperOne, 2021, pgs 76-77)

[7] (Herzsprung Ejnar *"Zur Strahlung der Sterne. VIII."* Astronomische Nachrichten 196, 1913: 201–209)

[8] (Meyer, *Return of the God Hypothesis: Extended Research Notes*, HarperOne, 2021, n. 4d)

[9] (Meyer, Stephen C. *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe*, New York: HarperOne, 2021, chapter 4, n.35)

[10] (Hubble, Edwin P. *"Cepheids in Spiral Nebulae."* The Observatory 48, 1925: 139–142)

[11] (Slipher, Vesto Melvin. *"The Radial Velocity of the Andromeda Nebula."* Lowell Observatory Bulletin 2, no. 8, 1913: 56–57. Flagstaff, AZ: Lowell Observatory)

[12] (Hartmann, William K., and Chris Impey. *Astronomy: The Cosmic Journey. 4th ed.* Belmont, CA: Wadsworth Publishing Company, 1989, pg 554)

[13] (Einstein, Albert. *"On the Electrodynamics of Moving Bodies*." In *The Principle of Relativity: A Collection of Original Memoirs on the Special and General Theory of Relativity*, translated by W. Perrett and G. B. Jeffery. London: Methuen, 1923)

[14] (Hafele, J. C., and Richard E. Keating. *"Around-the-World Atomic Clocks: Predicted Relativistic Time Gains."* Science 177, no. 4044, 1972: 166–168)

[15] (Copernicus, Nicolaus. *"Excerpt from On the Revolutions of the Heavenly Spheres."* In Documents of Western Civilization, Volume II: Since 1500, edited by Candace Gregory, 254–257. Dubuque, IA: Kendall Hunt Publishing Company, 2021)

[16] (Craig, William Lane. *"The Scientific Kalam Cosmological Argument."* Reasonable Faith, 2015, pg 7)

[17] (Friedmann, Alexander. *"Über die Krümmung des Raumes."* Zeitschrift für Physik 10 1922: 377–386)

[18] (Lemaitre, *A homogeneous universe of constant mass and increasing radius accounting for the radial velocity of extragalactic nebulae*, Annales de la Société Scientifique de Bruxelles 1927, vol 10, pgs 377-386)

[19] (Nussbaumer, *Einstein's Conversion from His Static to an Expanding Universe*, pg 5, quoted in Meyer, *Return of the God Hypothesis Extended Research Notes*, HarperOne 2021, note 5a)

[20] (Hawking, Stephen W. *A Brief History of Time: From the Big Bang to Black Holes.* New York: Bantam Books, 1988, pg 49)

[21] (P. C. W. Davies, *"Spacetime Singularities in Cosmology," in The Study of Time III, ed.* J. T. Fraser, Berlin: Springer Verlag, 1978, pp. 78-9, quoted in Craig, *The Scientific Kalam Cosmological Argument*, pg 8)

[22] (The FLRW Metric was fully solidified with the works of Howard P. Robertson [1935] and Arthur Geoffrey Walker [1937])

[23] (Bondi and Gold, *The Steady-State Theory of the Expanding Universe*, Hoyle, *A New Model for the Expanding Universe,* Monthly Notices of the Royal Astronomical Society, 1948, vol 108, pgs 252-270)

[24] (Meyer, Stephen C. *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe.* New York: HarperOne, 2021, pg 98)

[25] (Stephen C. Meyer, *Return of the God Hypothesis: Extended Research Notes*, New York: HarperOne, 2021, note 5b)

[26] (Alpher, Ralph A., and Robert C. Herman. *"Evolution of the Universe."* Nature 162, 1948: 774–775)

[27] (Meyer, Stephen C. *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe.* New York: HarperOne, 2021, pgs 100-101)

[28] (Penzias, Arno A., and Robert W. Wilson*. "A Measurement of Excess Antenna Temperature at 4080 Mc/s."* The Astrophysical Journal 142, 1965: 419–421)

[29] (Wallace, J. Warner. *God's Crime Scene: A Cold-Case Detective Examines the Evidence for a Divinely Created Universe.* Colorado Springs, CO: David C. Cook, 2015, pg 36)

[30] (Battefeld, Diana, and Patrick Peter. *"A Critical Review of Classical Bouncing Cosmologies."* Physics Reports 571 [2015]: pgs 1–66; cited in Meyer, Stephen C. *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe.* New York: HarperOne, 2021, pg 467-468, n.53)

[31] (Though the demonstration of such was originally done by Richard C. Tolman as early as the 1930s; Tolman, *On the Problem of the Entropy of the Universe as a Whole,* Physical Review [1930])

[32] (Hawking, *Properties of Expanding Universes,* American Physical Society, 1965, pg 105).

[33] (Their papers include: *Penrose [1965]; Hawking [1966]; Hawking & Penrose [1970]; Hawking & Ellis [1973]*)

[34] (Davies, Paul C. W. *"Spacetime Singularities in Cosmology."* Nature 273, 1978: pgs 336–339)

[35] (Gott, J. Richard III, James E. Gunn, David N. Schramm, and Beatrice M. Tinsley. *"Will the Universe Expand Forever?"* Scientific American 234, no. 5 [1976], pg 65)

[36] (Eddington, Arthur S. *The Expanding Universe.* New York: Macmillan, 1933, pg 124)

[37] (Guth, Alan H. *"Inflationary Universe: A Possible Solution to the Horizon and Flatness Problems."* Physical Review D 23, no. 2 [1981]: pgs 347–356)

[38] (Meyer, Stephen C. *Return of the God Hypothesis: Extended Research Notes.* New York: HarperOne, 2021)

[39] (https://lambda.gsfc.nasa.gov/product/cobe/dmr_image.html)

[40] (Borde, Guth, and Vilenkin *[2003]*, pg 3)

[41] (Vilenkin, Alexander*. Many Worlds in One: The Search for Other Universes.* New York: Hill and Wang, 2006, pg 175)

[42] (Borde, Arvind, Alan H. Guth, and Alexander Vilenkin. *"Inflationary Spacetimes Are Incomplete in Past Directions."* Physical Review Letters 90, no. 15 [2003]: 151301)

[43] (Meyer, Stephen C. *Return of the God Hypothesis: Extended Research Notes.* New York: HarperOne, 2021, note 6b)

[44] (Craig, William Lane, and James D. Sinclair. *"The Kalam Cosmological Argument."* In *The Blackwell Companion to Natural Theology*, edited by William Lane Craig and J. P. Moreland, 101–201. Chichester, UK: Wiley-Blackwell, 2009, pg 143)

[45] (Craig, William Lane. *"The Scientific Kalam Cosmological Argument."* Lecture delivered at the Georgia Institute of Technology, March 3, 2014, transcript 2026,, pgs 15-16)

[46] (Vilenkin, Alexander. *Many Worlds in One: The Search for Other Universes.* New York: Hill and Wang, 2006, pg 176, Quoted in Meyer, Stephen C. *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe.* New York: HarperOne, 2021, pg 128)

Chapter 4
Is Our Universe Fine-Tuned For The Existence Of Life?

Is The Universe Fine-Tuned? What Does Fine-Tuning Mean? Did It Happen By Chance? Or Did The Cause Of The Universe Have A Goal For Life To Thrive?

In the preceding chapters, I established the scientific, philosophical, and mathematical discoveries and proofs that confirmed the notion that the universe had a beginning. If we are tackling the question of whether a personal God was the cause of that beginning, we must look at a set of discoveries in physics called the fine-tuning parameters of the universe. Cosmologists, physicists, and mathematicians alike have all discovered that various laws in physics exhibit fine-tuned values within their very logical structure. Not only are the laws themselves fine-tuned, but their relationships to one another all lie within extremely specific and improbable values, ones we should not expect to find if the universe came into being by natural laws and random chance.

If there were no logical mind that caused the universe, then we should never expect to find even a sliver of order within it. Yet our universe does, in fact, exhibit extreme magnitudes of order within its energy distribution and laws and constants of physics. Some of the features have probabilities so low that a mind must have designed them for life to exist and thrive on Earth. So, without further ado, let us now dive into the history of these discoveries and their implications for an intelligence that transcends space, time, and mass-energy.

The Fine-Tuning Required For Life's Most Essential Element

Since the 1950s, physicists have come face to face with the brute fact that life in the universe depends on a very improbable set of forces and mass-energy distribution at the very beginning of the universe. Fred Hoyle would research theories attempting to describe nuclear reactions inside stars. He was on a mission to find a way for hydrogen to fuse into the rest of the elements on the periodic table.[1] He was a stark atheist when he began his work:

> "Religion is but a desperate attempt to find an escape from the truly dreadful situation in which we find ourselves."[2]

He was the one who coined the term "The Big Bang" for the theory of cosmic expansion, implying an absolute beginning. He chose Big Bang to poke fun at the idea of a cosmic beginning, which begs for a cause, as it represents a cosmic "creation" event, motivating him to create the Steady-State model mentioned in the previous chapter. He would also play a huge role in the discovery that the properties of the universe fall within improbable ranges necessary for the development and thriving of life on Earth. The specific magnitudes and strengths of various forces, along with the initial distribution of mass-energy at the beginning, seem to be balanced on a razor's edge for Earth to exist, for chemistry to work the way it does, and for life to thrive. Each fundamental law or force has just the right strength, and all the energy was perfectly distributed in just the right arrangement to allow stable galaxies and stars to form, heavy elements to be created, and ultimately for Earth to be the outcome with life.

Carbon is the most crucial and fundamental element for the existence of life. Its atomic structure makes it form bonds with other elements the best out of the rest. Carbon dioxide is also a gas, making it easy to expel as waste, and it plays a key role as the central atom in the four main biomolecules from which all life is created. It can also form long, stable, chain-like molecules that store information (DNA & RNA) and drive the development, regulation, and adaptation of biological forms. Hoyle knew that the universe contained an abundance of carbon.[3] The theory at the time was that protons and neutrons collided inside stars to produce heavier elements. Still, most models predicted the expected amounts of lighter elements, not those of heavier elements.[4]

Fusing elements inside stars meant they had to pass atomic structures with five protons and neutrons in the nuclei, but these structures are very unstable. They would not last long enough for another collision to happen and continue the process. This block was named the "5-nucleon crevasse." 5-nucleon atoms have half-lives of $1/10^{-24}$th of a second; thus, most theorists were stumped at finding a way for elements to pass through this barrier. George Gamow and Ralph Alpher envisioned three helium atoms (each with 2 protons and 2 neutrons) colliding to form carbon-12 (6 protons and 6 neutrons), the most common form of carbon. Still, they rejected their model because such a collision is implausible inside stars. Hoyle cooked up a method that solved the issue, though it was a bit trivial at first. Hoyle imagined a helium nucleus colliding with beryllium-8 to form carbon-12: (2 protons and 2 neutrons) + (4 protons and 4 neutrons) = (6 protons and 6 neutrons). He chose beryllium because (1) it had the right amount of nucleons, and (2) despite it also being unstable, it has a half-life just long enough to continue making collisions to produce carbon. (Around 8.2×10^{-17} of a second, or 0.000000000000000082 seconds)

Then he ran into another barrier; the total energy of this carbon exceeded the total energy of the common carbon-12. This means there must have been a form of carbon with this energy level for his theory to be correct. He calculated the total energy of the helium and beryllium to be more than the ground energy state of carbon-12. Later on, he would visit the Kellogg Laboratory at Caltech and have a physicist's experiment to see if this form of carbon existed. Though resistant and skeptical at first, Willy Fowler would discover a form of carbon with the exact energy Hoyle predicted.[5] He would then publish these findings in a paper titled “On Nuclear Reactions Occurring in Very Hot Stars. I. The Synthesis of Elements from Carbon to Nickel” in 1954 to document this discovery. But this had some implications now that it was confirmed; It meant that this form of carbon had to have this exact energy level, or heavier elements would not develop, and neither would life.

> “The resonance levels of different elements are a consequence of many factors and can be calculated using equations of quantum chromodynamics, a subdiscipline of quantum mechanics. Thus, the resonance levels of carbon would have been different if different factors had been in play. And if those resonance levels had been different, then beryllium-8 and helium-4 could not have combined to form carbon-12.”[5]

This means that there are specific physical parameters that, if absent, would prevent the heavier elements from being manufactured in stars and prevent Earth and life from developing later. Fred Hoyle's recognition of this motivated him to conduct further research into the conditions required to produce his form of carbon. He proposed that collapsing stars can produce carbon from lighter elements under particular conditions. But creating this theory just raised more questions and dug the fine-tuning hole another foot or two deeper.

The Fine-Tuning Parameters

Hoyle's model of how carbon can be produced in collapsing stars lifted the veil on the fine-tuned physical laws and forces responsible for the energy levels of helium, carbon, and beryllium. Four fundamental forces act in nature; they include:

The Electromagnetic Force: This force attracts particles with opposite charges and repels those with the same charge.

The Weak Nuclear Force: This force causes nuclear radiation, which is the decay of particles, releasing energy often in the form of photons or electrons.

The Strong Nuclear Force: The attractive force that binds quarks (smaller sub-atomic particles) to make protons and neutrons, as well as binding them in the nucleus of an atom.

Gravitational Force: The force that acts upon macro-scale objects in the universe to form the larger universe with planets, stars, and galaxies. This force does not operate like the other three, as its effects are the result of the fabric of spacetime curving around massive bodies.

These four forces are all fine-tuned within their mathematical structure and relate to one another with regard to objects and phenomena in the universe. The strengths of the electromagnetic and strong nuclear forces must be balanced. Inside the nucleus of an atom, protons are about ten-trillionths of a centimeter apart. The electromagnetic repulsion acting upon them alone would cause them to fly in opposite directions near the speed of light. The force of repulsion at this distance between like-charged protons is about 24,000,000 dynes of force, which only comes out to about 250 newtons, but is a massive amount of force to be imposed on particles as small as these. If we observe the nucleus of an atom, we would notice that they do not repel, but is held together tightly. There is something neutralizing the effects of the electromagnetic force, overcoming it. So it must be extremely strong to overcome the force and disperse rapidly with distance, as this new force is not detectable at distances farther than what we see.

This new force is the strong nuclear force; it balances the electrostatic repulsion within an atom's nucleus. If the strength or magnitude of the strong nuclear force were changed slightly, the protons would not be able to form stable atomic nuclei; moreover, the mass of the types of quarks that fit together to produce protons and neutrons would not be just the right mass and energy to bind the nucleus. Recent calculations reveal that the SNF and electromagnetic force are fine-tuned to within about 0.5% of their current values.[6] This means that the differences between their values cannot change within half a percent of their current value, or atomic nuclei could not form.

The Fine-Tuning Of The Quark

The charges of up-quarks and down-quarks are heavily fine-tuned to allow stable atomic nuclei to form. There are six types of quarks: Up, Top, Charm, Down, Strange, and Bottom. But the up and down quarks are what make up protons and neutrons, which make up the atomic nucleus. For ease of understanding, I will use the charge of an electron as a comparison to the charge of the quarks. This way makes it easier to see how well these charge values combine to form protons and neutrons. The Up quark has a charge of +⅔ of an electron, and the Down quark has -⅓ of an electron. Now, when up and down quarks combine to form a Neutron, one up and two Down quarks combine. This means the charge combination can be written as:

Up(+⅔) + Down(-⅓) + Down(-⅓)

This can be simplified to:

⅔ - ⅔ = 0

And this is why a neutron has a 0 charge; its charge value is 0 compared to that of an electron. Now, let's say we want to make a proton, which is made of one down quark and two up quarks. The combination can be written as:

Up(-⅓) + Down(+⅔) + Down(+⅔)

Which may be simplified to:

(-⅓) + ⁴⁄₃ = 1

This is why the proton is said to have a positive charge; it has a charge of +1 electron.

If these charge values were to change, protons and neutrons could not form, and by and large, neither would atoms. Not only are the charges fine-tuned, but so are their masses. The range of these possible mass values extends from zero to the Planck Mass, which is about 0.002 milligrams.

The mass of the up quark must have a mass between zero and 10^{-9} of the Planck mass, which corresponds to a fine-tuning of 1 part in 10^{21}. The mass of the down quark is 3.9×10^{-22} of the Planck Mass, making its fine-tuning 1 part in 10^{22}. Thus, for Hoyle's form of carbon to be produced, multiple layers of fine-tuning must be met; layers that are individually implausible given their possible values. 10^{22} is a very large number, one that the human mind cannot even imagine. When scientific notation is used, the exponent represents how many zeros follow or precede the number it's applied to. For example, 10^6 is the number 1 followed by six zeros, or 6,000,000. So 10^{22} is 10,000,000,000,000,000,000,000. If a number written in scientific notation has a negative exponent, the zeros precede the number; for example, 3×10^{-3} is 0.0003. Hopefully, this illuminates the sheer size and implausibility of these numbers.

The Fine-Tuning Of Gravity

For carbon to form within stars, beryllium and helium need to gain enough kinetic energy (a measure of particle motion). For this to happen, the strength of the gravitational force must be its precise value. The momentum (kinetic energy) gained enables helium and beryllium to overcome the sheer electromagnetic repulsion they experience, which varies with the star's interior temperature. The star's ability to produce immense temperatures is heavily dependent on the specific strength of its gravitational effects, which relies on the strength of gravity overall. If the gravitational force effects were weaker (if mass affected spacetime differently), stars would not burn hot enough to produce the kinetic energy required to produce carbon-12. If it were stronger, stars would be able to produce only heavy elements and burn up too fast, resulting in a different ratio of heavy to light elements in the universe.

Mass must curve spacetime the amount it currently does, or any large-scale objects wouldn't exist. If gravity were too strong (spacetime curves more on average), then over time the mass-energy in the universe would gather to form galaxies far too dense for life to exist on Earth, or worse, only black holes would be able to form. If gravity were weaker (spacetime curves less on average), then galaxies wouldn't be dense enough, and the gravitational effects wouldn't balance expansion, potentially preventing large-scale bodies from forming entirely! Physicists have discovered that the value of the gravitational constant (G) is fine-tuned to 1 part in 10^{35} in relation to the possible values it could have had. The value of G is 10^{40} times weaker than the strong nuclear force, and assuming that the strong force represents a maximum for the possible strengths of G, it could have had a value anywhere between 0 and 10^{40} times its current value. This means if the value were to change in either direction, 1 part in 10^{35} - 10^{40}, its current value, say goodbye to the ordered large-scale universe.

Fine-Tuned Laws And Constants

It is, nowadays, rather undisputed whether the laws of physics are fine-tuned for the allowance of life on Earth. Both the laws of physics and chemistry are exquisitely fine-tuned, but what does that mean? The constants in the laws themselves are what are fine-tuned. In A Fortunate Universe, authors Lewis and Barnes list the leading physicists like John Barrow, Bernard Carr, Paul Davies, Stephen Hawking, George Ellis, Alan Guth, and more who all affirm the appearance of fine-tuning. Stephen Meyers says that the list was generally split between theists and non-theists, with theists mainly disagreeing with non-theists' multiverse models.

Variable Quantity: A quantity that can change its value depending on the situation's context.

The laws of physics are used to relate a variable quantity to another. For example, a variable (Force) begins to increase in a car as I press the gas pedal; other variables (like the car's velocity and acceleration) will also increase or change proportionally by some factor. In this case, applying more force to the car caused its acceleration to increase proportionally to the applied force. These relationships can be proportional (as one increases, the other increases) or inversely proportional (as one increases, the other decreases). Within these equations that describe forces and fields, resides a constant, or a physical quantity that is unchanging and discoverable through measurement and experimentation, and always remains the same in every context. For example, if the gravitational constant (G, describing the curvature of spacetime) were increased, your mass on Earth would remain the same. Still, the strength of gravitation would increase (as spacetime would curve more), and you may struggle to walk, and any large increase would make it difficult to stay alive.

These constants have values that are very unlikely given the vast range of possible values they could have:

> "The really amazing thing is not that life on earth is balanced on a knife-edge, but that the entire universe is balanced on a knife-edge, and would be chaos if any of the natural 'constants' were off even slightly."[7]

> "The remarkable fact is that the values of these numbers seem to have been very finely adjusted to make possible the development of life."[8]

Not only are the constants fine-tuned, but their ratios to each other exhibit extreme fine-tuning. The electromagnetic force constant *(K)* is fine-tuned to 1 part in 10120, with some sources offering slightly different numbers and others completely different, but still fine-tuned nonetheless. The ratio between the weak nuclear force and the strong nuclear force constants cannot exceed 1 part in 10,000. If it were to deviate from its current value by that much, stars fueled by hydrogen fusion would never have the possibility to form. The ratio between the electromagnetic force constant *(K)* and the gravitational force constant *(G)* is fine-tuned to 1 part in 10^{40}.

If G were stronger or K weaker by $1/10^{40}$th, gravitation would be too strong in comparison, overpowering the electromagnetic force, causing stars to burn too fast from rapid particle collisions, and not producing heavier elements necessary for Earth. If it were too weak, stars or any large-scale objects would not form, and the universe would be a giant soup of charged particles, as the sheer electromagnetic repulsive forces would overpower the gravity felt between each particle. The constants of the laws of physics and chemistry experience unimaginable fine-tuning in and of themselves entirely, as well as between each other. To give you an idea, 10^{17} surpasses seconds in 14 billion years, and 10^{90} surpasses the calculated observable particles in the universe. Some of this fine-tuning exceeds the time in 14 billion years, and with multiple layers of this fine-tuning, the total number of observable alpha particles in the universe.

More Fine-Tuning

The fine-tuning of the constants is but one aspect of the fine-tuning parameters of the universe. There are at least two other general aspects of fine-tuning in relation to the universe and its features: The initial conditions of mass-energy at the beginning (entropy), and the fine-tuning of some other contingent features.

1). The Fine-Tuned Initial Entropy

If you recall from the previous chapter, Einstein's field equations allow physicists to determine different spatial configurations of the universe that are derived from the possible distributions of mass-energy that can take form. This initial distribution of mass-energy needed to exhibit small fluctuations apart from being completely homogeneous. You may also notice that I will sometimes refer to matter at this stage as mass-energy. Einstein's equations gave us the famous equation $E=MC^{2,}$ which describes how energy and matter are different forms of the same substance. At the beginning of the universe, the energy within it was so dense and compact that practically no matter had formed yet; it was all a dense ball of hot energy with mass, hence "mass-energy."

The initial distribution of mass-energy at the beginning of the universe strongly influences how the larger-scale universe will evolve. This initial distribution accounts for the formation of stars, galaxies, clusters, and other structures. Physicists discovered that if this initial distribution of mass-energy were different, even by the smallest amount, the universe would result in either the clumping of all matter, leading to a universe of only black holes, or a distribution of matter far too sparse for gravity to accumulate large-scale structures. Both of these alternatives prevent the formation of atoms, elements, stars, planetary systems, galaxies, and clusters.

Entropy: A measure of the amount of disorder within a system being observed.

Remember how I talked about General Relativity in the previous chapter too? Einstein's General Theory postulated that any object with mass bends the fabric of spacetime around it, changing the world lines of objects influenced by the warp in space and causing them to fall into the curvature we call gravity. Since all objects with mass bend spacetime and exert gravitational effects, the initial distribution of energy (that would cool into matter as the universe expands) at the beginning of the universe would determine the structure in the future, as all mass would exert gravity, driving physical change over time. This initial distribution is fine-tuned to 1 part in 10^{55} of its current value, meaning if it were to change by $1/10^{55}$th, the above-mentioned circumstances would result. Physicists refer to this distribution of mass-energy as the universe's initial entropy.

A universe with a high initial entropy would result in black holes, and one with a low initial entropy would result in ordered large-scale structures, like galaxies. Since our universe has ordered structures, it has a low initial entropy (highly specific and ordered) of the distribution of mass-energy. To evaluate the required entropy, we first need to determine how many alternative configurations align with a specific circumstance; in this case, a life-permitting universe. So if we were to calculate the total entropy of the universe, we would need to know how many alternative configurations yield a life-permitting universe. This, in turn, will allow us to assess whether this entropy exhibits unexplained fine-tuning or is irrelevant to our big question.

A black hole represents the highest possible entropy a system can have, as the extreme gravitational force ensures that the matter and energy within its event horizon exhibit many chaotic configurations without significantly affecting the black hole's structure in toto. A galaxy, on the other hand, represents a low-entropy system, as there are few ways to arrange the matter within to result in the ordered spiral structure. So when we examine our universe and find very few black holes in comparison to stars and galaxies, we can confidently say it exhibits a low-entropy state in its present form. This implies that the universe had lower entropy in the past, as entropy increases in a system as time progresses. Our universe must have had an even lower entropy at the beginning.

Finding Entropy

Baryon: Composite sub-atomic particles made of three quarks, Protons and Neutrons.

The mathematical giant Roger Penrose tackled the task of determining how many different initial mass-energy configurations would yield a life-permitting universe. He started by assuming that no possible universe could have more entropy than that of a black hole. This meant he needed to find the total entropy of the universe if it were a single black hole. To do this, he used the Bekenstein-Hawking equation, based on General Relativity and Quantum Mechanics, which would calculate a reasonable maximum entropy for the universe.[9] Using the Bekenstein-Hawking equation, he calculated the value for every possible entropy per baryon to be about 10^{43}/baryon. He then multiplied this (the number of configurations per proton and neutron) by the number of total baryons in the observable universe (around 10^{80}), which came out to a total entropy value of 10^{123}. This entropy value represented the maximum for any universe, that of a black hole universe.

Penrose then calculated the total entropy of the present universe. To do this, he assumed that every galaxy had a black hole at its center with an average mass of one million solar masses, which yielded an entropy of 10^{21}/galaxy. He then multiplied this number by the total baryons, yielding a total entropy for our universe of 10^{101}. The universe at the beginning of its existence would exhibit an entropy no greater than this value. He concluded that our universe has an entropy value that is highly improbable given the possible configurations of mass-energy it could have had. This is because 10^{101} is a small fraction of 10^{123}; subtracting 10^{101} from 10^{123} leaves 10^{123} unchanged. His calculated ratio implied that for every arrangement of initial mass-energy that would produce a low-entropy universe like ours, there were 1010^{123} other possible ways of arranging it that wouldn't produce a low-entropy universe like ours that allows for life to exist. Paul Davies sums it up very well:

> "The present arrangement of matter indicates a very special choice of initial conditions... The arrow of time derives ultimately from the fact that the universe began in an exceedingly low-entropy (smooth) gravitational state, with almost all the gravitational activity concentrated in a single, orderly, dilatory mode, and only slight irregularities superimposed on this. This initial state was, therefore, from the gravitational point of view, exceedingly special and remarkable, yet an essential element in explaining the universe we perceive. Do we just leave it at that, and accept that the universe was born in an exceedingly unusual state? Or is there a deeper explanation?"[10]

We can confidently conclude that our universe has an extremely improbable initial entropy that results in a life-permitting universe as opposed to the common possible values it could have had. But why did it have this entropy? No law of physics can explain exactly why it was what it was, as it very well could have been different. In any case, the degree to which the universe is finely tuned beyond what is necessary for life, as well as its being fine-tuned in such a way that scientific discovery can be made about the universe, suggests that the universe was designed for such discoveries and the thriving of life!

2.) Universe Expansion

A life-permitting universe does not solely rely on its initial mass-energy distribution; it also relies on many other features that could have been otherwise, and if they were, would not result in intelligent life thriving on Earth. The expansion rate of the universe is highly determinative of whether the universe would be life-friendly. Stephen Hawking calculated the expansion rate of the universe to be fine-tuned, and later writers like Davies would use the value of 1 part in 10^{17} to represent how fine-tuned it is. This implies that if the expansion rate were lower by $1/10^{17}$th of its current value, gravity would have overcome expansion, causing the universe to collapse under its own spacetime curvature.

But the rate of expansion is dependent on other factors that are individually fine-tuned. The density of mass-energy would have been about 10^{24} kg per cubic meter, and if it were to change by a single kilogram per meter, galaxies would never have formed. This means the expansion rate is fine-tuned to 1 part in 10^{17}, but also has underlying fine-tuning of 1 part in 10^{24} in its mass-energy density per meter^3. But there is more, the cosmological constant (Λ), which represents the mass-energy density in the equations for the expansion rate, exhibits fine-tuning to 1 part in 10^{90}.[11] They got this number by dividing 10^{120} (the max range of values the cosmological constant can take based on quantum field theory) by 10^{30} (the max range of values it may take to permit life), which equates to extreme fine tuning of 1 part in 10^{90}.[12] This means that the expansion rate of the universe also exhibits many layers of fine tuning, increasing the issue ten fold.

3.) The Size, Shape, And Position Of The Milky Way Galaxy

Many characteristics of our home galaxy, the Milky Way, are also determinative of whether our universe is life-permitting. This is narrowing our fine-tuning focus to the local level, within our galaxy and solar system. If our galaxy were not a spiral galaxy, but an elliptical or irregular one, its center would emit harmful radiation, preventing the survival of life. If it were smaller in size, like a dwarf galaxy, it would contain a large amount of heavy metals, meaning there are not the right elements for life to thrive, as well as planet-making material. The tails of the spiral structure are important too, as that is where star formation and supernovae occur the most, transporting the correct elements to where our solar system would form. If the spirals were larger and more active, the radiation would be too much, as supernovae would occur rather often.

Moreover, if our galaxy were not isolated from other galaxies, we wouldn’t have such a stable gravitational field, as they would influence it. This would further prevent life from thriving. The Milky Way is also large enough so that solar collisions are rarer, giving life enough time to develop (under secular models of the origin of life). The very structure of our home galaxy determines whether we can be here to talk about it or not.

4.) Our Solar System

Our solar system, with the planets orbiting the Sun, is also in the perfect location within the Milky Way to support life. It sits about 26,000 light years away from the galactic center (a light year is the distance light travels in one year) in a relatively quiet region, the Orion Arm of the spiral. If it were closer to the center, there would be a higher density of stars, resulting in more supernovae and gamma-ray bursts that are not compatible with life. If it were further out in the galaxy, there would be a low supply of carbon, oxygen, iron, and other heavy elements. This would also mean that the area's metallicity would be too low for rocky planets like Earth to form. If we were closer, the dense amount of stars would influence the orbits of planets, preventing our larger solar system structure from changing drastically.

5.) Our Planet's Location

The last piece of evidence for fine-tuning I will discuss in this chapter is what astronomers call the Goldilocks Zone. It is a location for a planet that ensures the conditions are perfect for the thriving of life. Earth is just far enough from our Sun not to be bombarded with excessive radiation and heat. Some will dismiss this, claiming that the planet can move several hundred thousand miles before the radiation becomes too much or too little. They say that since we are claiming this distance cannot change even the slightest, or else life does not exist, and it can move several thousand miles, that it can move very far without life being affected. If you are on this boat, let me open the window and let some air in. The Earth is 93 million miles from the sun. The Earth can move about 1 million of those miles until the heat and radiation become unsurvivable. Now that the quantity of miles seems large, but when compared to 93 million miles, can you really say that the distance between Earth and the sun is not fine-tuned? I mean the Earth can't move more than 1% of its current distance without life going bye-bye.

Not only is Earth's location important, but what it is made of also determines whether life can thrive. The Earth contains liquid water, a crucial condition for life to thrive, and chemical reactions necessary for life to occur. This relies on the Earth's distance from the Sun, as well as the shape of its orbit. This also depends on physical factors such as the strength of gravity. Earth's location also prevents too much radiation from entering the atmosphere, which would raise temperatures and cause all the water to boil. Our star is also at the perfect stage in its life cycle to support life. If it were larger, its habitable zone would move further away from where it is now; if it were too small, it would move closer. If it were older, in its red giant stage, our orbital distance would actually be inside the Sun. Our atmosphere is also thick enough to trap greenhouse gases, but not thick enough to do so rapidly, which would result in uninhabitable temperatures. If our atmosphere were thinner, we wouldn't be able to trap enough greenhouse gases to keep the temperature right. Our planet is not too much or too little, but just right.

To our current knowledge, there have been no exoplanets found that exist in a Goldilocks zone with all the correct features for life to thrive. As far as we can observe, we are the only ones. We know the universe is fine-tuned for life, as well as our planet, solar system, galaxy, and our place within it. This effect, humans living on Earth, could have been very different if the cause of the universe had the initial distribution of mass-energy and the laws of physics been slightly different, implying it made a choice, an intelligent choice.

Can Chance Explain Fine-Tuning?

What can explain cosmological fine-tuning other than a transcendent cause of the beginning? Can it just have happened by random chance? Are all of the values for the constants and the initial distribution just coming to their current values by chance? The claim to chance is far beyond an adequate explanation at this point, as there are simply not enough particles in the observable universe or seconds in secular models to account for the fine-tuning features. The sheer number of ways these values could converge on the perfect one simply dispels reasonable doubt. It is just about the furthest thing from it.

Claiming that random chance explains fine-tuning discourages any further discovery and research. If it all just happened by chance, then there is no real rhyme or reason to think there is a physical mechanism describable by mathematics that caused it, since laws operate in regularity, and chance by definition is not regular. Going along with this explanation ignores the sheer improbabilities mentioned above and is grasping at straws at this point.

Is Fine-Tuning The Result Of Necessity?

Could the values of the constants and distribution just be the result of necessity? Maybe the only values and distribution they could have naturally taken were necessarily the ones they took? As our discussion about Roger Penrose calculating the total entropy of the universe already shows, this explanation is dismantled. This explanation assumes their values are not contingent (meaning they could have been different). But, as Penrose showed us, the distribution of mass-energy could have been different, implying they are contingent. If the constants of the laws of physics and initial distribution of mass-energy could have been different, and they certainly could have, then the universe is not fine-tuned by necessity. This explanation lacks empirical support: given that other universe models with different mass-energy configurations are logically possible, there is no reason to think it must have happened that way. This also ignores the mass-energy distribution fine-tuning, as the laws of physics can not explain why it is as it is, either.

Could The Laws Of Physics Be Responsible For Fine-Tuning?

The Physical constants are the variables that determine, for example, the strength of the electromagnetic force attracting oppositely charged particles or the strength of gravity acting on an object. But these constants cannot be explained by the laws of physics because they are foundational to those laws. No law has been discovered that can be responsible for the initial distribution of mass-energy at the beginning of the universe; the laws describe how forces and fields interact and govern the behavior of material states once specific material conditions are met. In other words, the laws presuppose the initial conditions; they do not explain them.

What About The Hostility Of Our Universe?

Some say that the universe cannot be fine-tuned for life because 99.99% of the rest of the universe seems unsuitable for it. This ignores the fact that the universe itself must have a total size, mass, and density that it currently has to achieve the single goal of a planet suitable for life. It also ignores the possibility that God may have had more than one reason for making the universe as it is. Like making the heavens diverse and beautiful, driven and governed by laws describable in a simplistic, comprehensible, linguistic, and mathematical fashion with symbols. This would enable His creation to observe the heavens and conclude that a God had made it solely for them (Psalm 33:6; Colossians 1:16;

Nehemiah 9:6; Isaiah 40:26). God also warned us not to worship the heavens, or mistake them for living beings (Deuteronomy 4:19), unlike some people nowadays who see the stars as having magical powers to determine their futures, or that the universe itself is somehow alive and a divine mind (whatever that means, because matter is not mind) that solely exists to serve their pleasures.

The hostility of other locations of the universe is actually not surprising to the Christian theist, who doesn't necessarily expect there to be anywhere else exactly like Earth, since God has His special attention on it. The atheist, on the other hand, believing in some form of chance or necessity origins, would expect at least some habitable zones for life to originate, yet the chances are stacked against them.

Naturalistic Interpretations: WAP And SAP

In 1974, Australian-born theoretical physicist Brandon Carter introduced a naturalistic interpretation of the fine-tuning evidence. He tried to offer an explanation that dwarfed the need to explain the fine-tuning. He stated,

> "What we can expect to observe must be restricted by the conditions necessary for our presence as observers" [13]

The Weak Anthropic Principle

This interpretation was called the Weak Anthropic Principle (WAP), and proponents argue that we shouldn't be surprised to observe a fine-tuned universe, because if the universe were not fine-tuned for life, we wouldn't be here to observe it. They argue that, because observers could exist in an observer-friendly universe, there is no need to explain the fine-tuning. This is faulty logic; it confuses observation with explanation. Imagine you were blindfolded and had a bunch of marksmen ready to execute you. Once the shots are fired, you take off your blindfold and observe that all the shots hit you; they missed.

The fact that the marksman missed does not explain why they missed. So the fact that we can observe the universe in an observer-friendly way only explains that we can observe a universe consistent with the thriving of life. It does not in any way explain why we live in such a universe with the incomprehensibly improbable conditions necessary for life to thrive.

The Strong Anthropic Principle

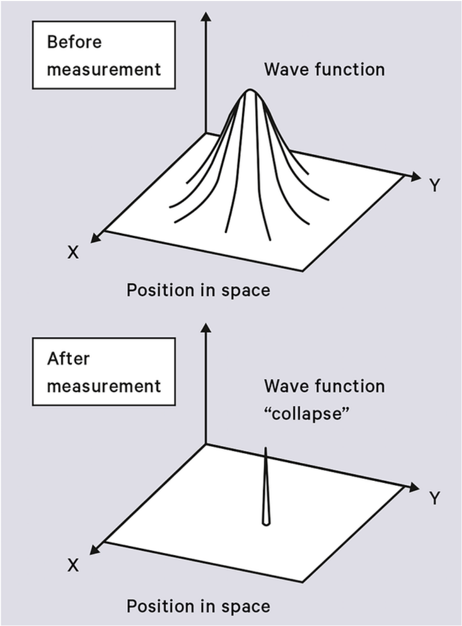
This interpretation, also proposed by Carter, holds that “the Universe must have those properties which allow life to develop within it at some stage in its history”.14 Proponents of this interpretation have never explained what causes the fine-tuning parameters to exist. They posit that any universe must, at some point, give rise to life to observe it. But this is simply arbitrarily assuming that, and ignoring the plethora of evidence against it.

SAP 2.0

There is another version of the Strong Anthropic Principle that claims:

> “The need for observers to confer reality upon the universe means that the universe had to be fine-tuned to produce human observers to observe it”[15]

This version was created analogous to the collapse of the wave function in Quantum Physics. In Quantum physics, there exists something called the wave function, which can be derived from a previous equation, whose solutions represent different positions that a particle may manifest within a wave of energy. For example, I have a wave of light approaching a photographic plate. Whenever I do my calculations, I find that a photon of light can be detected at many different locations along that wave. Until I make a measurement, I will not know what possible location the particle is in. Only once I make an observation will I know which possibility the particle is located at. Electrons and photons exist in multiple possible positions along a wave of energy. When an observer measures the wave of energy, a particle is detected.



An interpretation of Quantum Physics, called the Copenhagen Interpretation, holds that observation causes particles to manifest along the wave; thus, it claims that the universe itself may depend on an observer to exist. So the universe is fine-tuned for life because life observes it. But this has a major issue. Our concept of time and cause implies that an event that produces an effect precedes the effect in chronological sequence. Thus, the observers in this case, who cause fine-tuning, make their observations well after the effect they caused happens. Even in Quantum Physics, the collapse of the wave function occurs after observation. Thus, this interpretation was so bad that Scientific American writer Martin Gardner called it the CRAP, "the Completely Ridiculous Anthropic Principle".[16]

More importantly, the weak anthropic principle does not explain why or how the universe is fine-tuned for life, nor does it negate the question of why it is fine-tuned for life. The strong principle is not analogous to the collapse of the wave function either and is, at best, merely based on the concept.

The Teleological Argument

Was the universe fine-tuned from the get-go? Absolutely. The sheer impossible chances of these features finding the values they do, the initial distribution of the mass-energy, the expansion rate of the universe, the strength of the four forces, the features of the Milky Way, the location of our Planet, and many more contingent features all point straight in the direction that the universe was fine-tuned for the thriving of life. This argument, from the design of the universe (and biological systems), is called the Teleological Argument, which will be further discussed in chapter 9.

If the universe were fine-tuned, with extremely interdependent laws and features, and it also had a termination point of space and time in the past, then what are we to think of the cause? We can confidently list the characteristics of the nature of the first cause from what we have examined thus far. The cause of the universe must be spaceless, as before the effect, space was nonexistent; timeless, as time arose with space; immaterial, being transcendent to matter because none existed beforehand; all-powerful, to causally adequate to produce the vast amount of total energy in the cosmos (all that supposedly is); all-knowing to be able to create everything we know to exist; omnipresent, because if it is immaterial, then it is not confined to a physical, extended body or space; personal, to be able to choose to create from a state of non-creation; intelligent, to know to create the initial conditions so finely tuned to produce a life-permitting universe, and to obviously have a goal of observers in mind; to some degree loving (even all-loving, being, as of now, the cause of the love we experience), as it put so much into just creating a single planet with human beings equipped with minds able to make sense of it; and it must exhibit or consist of a mind, because only minds make decisions, and only minds comprehend things as complex as physical laws and the universe.

All of these characteristics align with the nature of God as revealed in the Bible. But so far in our investigation, we cannot really say which God it could be with confidence. We also haven't gone over alternative models or a deep dive into the total implications. In the following chapters (5-6), inflationary, string, and quantum cosmologies will be discussed in detail. In chapter 7, we will resume on the implications of these discoveries, our method of reasoning, and a comparison of multiple worldviews to determine what caused the universe. God, or Nature?

Chapter 4 Notes

[1] (Hoyle, Fred. *"The Synthesis of the Elements from Hydrogen."* Monthly Notices of the Royal Astronomical Society 106 [1946]: 343–383)

[2] (Hoyle, Fred. *"Our Truly Dreadful Situation."* Harper's Magazine, November 1948, 87–96)

[3] (Burbidge, E. Margaret, Geoffrey R. Burbidge, William A. Fowler, and Fred Hoyle. *"Synthesis of the Elements in Stars."* Reviews of Modern Physics 29, no. 4, 1957: 547–650)

[4] (For example, *the Big Bang Nucleosynthesis models* created by George Gamow, Ralph Alpher, and Robert Herman in 1948)

[5] (Meyer, Stephen C. *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe*. New York: HarperOne, 2021, Pg 135)

[6] (Csótó, Attila, Heinz Oberhummer, and Helmut Schlattl. *"Fine-Tuning the Basic Forces of Nature Through the Triple-Alpha Process in Red Giant Stars."* Nuclear Physics A 688, 2001: 560–576)

[7] (BBC. *"The Anthropic Principle."* Horizon, season 23, episode 17, May 18, 1987. Quoted in Stephen C. Meyer, *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe,* New York: HarperOne, 2021)

[8] (Hawking, Stephen W. *A Brief History of Time: From the Big Bang to Black Holes*. New York: Bantam Books, 1988, pg 26)

[9] (He would lay this out in several works, most notably *The Road to Reality [2004], and Cycles of Time [2010]*, but the foundations to this are from *The Emperor's New Mind [1989], and Singularities and Time-Asymmetry [1979]*)

[10] (Davies, Paul. *The Arrow of Time: A Study of Cosmic, Biological, and Psychological Time*. New York: Simon & Schuster, 1976. Quoted in Stephen C. Meyer, *Return of the God Hypothesis: Extended Research Notes* [New York: HarperOne, 2021], note 8b)

[11] (Some of the big figures of this estimate are Steven Weinberg [1989], Leonard Susskind [1990s-2000s], Martin Rees [1999], and Penrose [1979])

[12.] Stephen C. Meyer, *Return of the God Hypothesis: Extended Research Notes* [New York: HarperOne, 2021], note 8d)

[13] (Carter, Brandon. *"Large Number Coincidences and the Anthropic Principle in Cosmology."* In *Confrontation of Cosmological Theories with Observational Data*, edited by Malcolm S. Longair, 291–298. Dordrecht: D. Reidel Publishing Company, 1974)

[14] (Barrow, John D., and Frank J. Tipler. *The Anthropic Cosmological Principle.* New York: Oxford University Press, 1986, pg 21)

[15] (Meyer, Stephen C. *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe*. New York: HarperOne, 2021, pg 155)

[16] (Gardner, Martin. *"WAP, SAP, FAP & PAP."* The New York Review of Books 33, no. 15 [1986]: 22–25)

Chapter 5
Does the Multiverse Explain Cosmological Fine-Tuning?

Do Inflationary And String Theory Multiverse Models Adequately Explain The Fine-Tuning Issue? Responding To Alternate Models And Refuting Their Proponents' Claims.

The fine-tuning evidence of many features of our universe raised a massive problem for materialists. Because of this issue of seeming "design," there would be attempts to explain the fine-tuning on natural grounds alone. We have seen that the universe does have an absolute beginning, introducing the Kalam Cosmological argument for its temporality, and the many philosophical issues with affirming an infinite past. The hard scientific and mathematical evidence for this further solidified the Big Bang as the leading cosmological model. The Big Bang theory posits that the universe has been expanding. If we were to extrapolate backward in time, the universe's volume would collapse to a point of infinite density and zero volume. We also looked at the BGV theorem that proved that any universe that is on average expanding will have a beginning to that expansion based on Special Relativity, so that even if General Relativity needs to be altered, the conditions still hold.

Then we examined the fact that the constants of the laws of physics and the initial entropy of the universe exhibit improbable values that had a very wide range of possible values. We discovered that our universe exhibits extremely low, ordered entropy in the present and must have been even more ordered at the beginning. The universe has a very specific initial arrangement of mass-energy, as well as containing physical laws that, in themselves, are fine-tuned, and the constants within them are exquisitely fine-tuned with improbable values. We looked at a few naturalistic interpretations, such as the Strong and Weak Anthropic Principles, and how they fail to explain the existence of rare fine-tuning without invoking a transcendent intelligence. Indeed, naturalism posits that the only thing that exists, from which everything comes, is solely matter and energy. Proponents of this worldview presuppose that nothing outside of the natural world can exist, and many hold forms of naturalism that try to expand its explanatory power by postulating an infinite array of other separated universes.

However, the multiverse models just shift the fine-tuning problem to another system rather than explaining it, since the fine-tuning is present from the very start, implying an external fine-tuner rather than an internal system or mechanism driven by nature. In short, a system cannot cause itself (X cannot cause X to begin to exist); an external causal agent must act to bring it about.

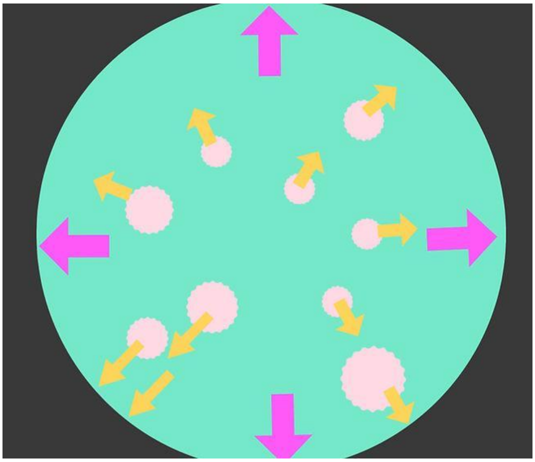
The Inflationary Multi-Verse

When the fine-tuning features of the universe were discovered, many naturalists were introduced to a massive problem: a cosmic beginning, one with implications of an eternal fine-tuner, some may even call it God. To get around the issue of an intelligent fine-tuner, cosmologists postulated an infinite number of causally isolated universes existing within a broader expansion of space, no matter how unlikely or irrational it may have been. Not only did these theories postulate an infinite array of other universes, but also an entire ensemble of physical mechanisms and causal agents that make this infinite collection of universes possible. In practice, our universe exists within a super-universe of smaller, isolated ones. By viewing the beginning this way, our universe did not absolutely begin, but was just another stage within a bigger universe. Proponents of these models see our universe as the winner of a cosmic lottery with an infinite number of players, which is rather convenient when attempting to account for cosmological fine-tuning.

Vacuum Energy: The energy of space, caused by the minimal energy level a quantum system can have due to fluctuations. This concept comes from the Heisenberg Uncertainty Principle, a fundamental condition of quantum mechanics and field theory.

Created by *Andrei Linde, Alan Guth, and Paul Steinhardt* to explain a few issues found in the universe. It was created to explain the universe's relative temperature homogeneity in the Cosmic Background Radiation, the universe's flatness, and the absence of predicted monopoles. Proponents posit that shortly after the beginning of the universe, space underwent a sudden, rapid expansion that smoothed out the mass-energy and then stopped, after a fraction of a second, to a more modest expansion rate. The most accepted version of this theory is the above-mentioned Eternal Chaotic Inflation model.

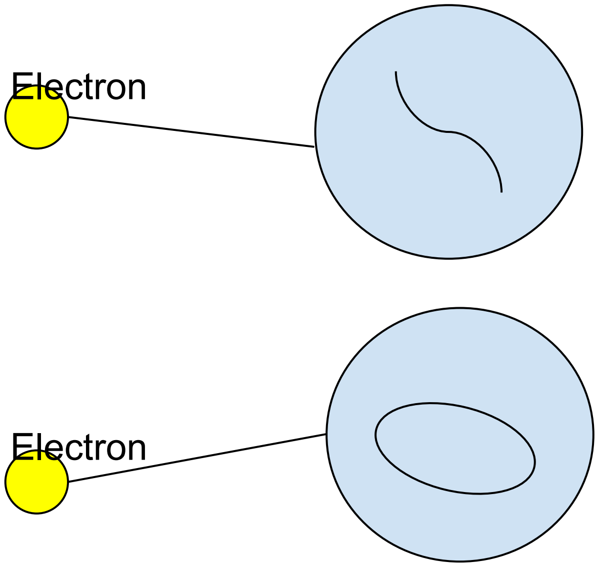
The different universes in these models are causally isolated from one another; in other words, one event in one universe will not affect the events in another. Thus, postulating a universe-generating mechanism lowers the rarity of a life-permitting universe being produced and shifts the fine-tuning issue to the result of random chance. Moreover, there would need to be a mechanism for this to happen; otherwise, from where else would these universes be coming from? With that stated, we come to the first general multi-verse model, the Eternal Chaotic Inflationary Model.



This model posits an outward-pushing (pink arrows above) expanding field with vacuum energy (light blue), creating a constantly growing space in which bubble universes may be born. This expanding field is called the Inflaton Field. As the inflaton field continues to expand, it decays in random locations due to quantum fluctuations in its vacuum energy, causing low-energy pockets to form, called bubble universes (light pink circles). The difference between these bubbles' density and the field's density is converted into matter, and the decay of the field’s energy is what provides the initial inflationary expansion of the bubble universe. The continuous expansion of the field causes bubble universes to slowly expand with it (yellow arrows), moving apart and practically never making causal contact. This model's mathematics explained away fine-tuning of initial conditions only, not even touching the laws of physics, since the generated universes exhibit the same laws the field is subject to. Inflationary proponents claim that, since there is an infinite array of other universes, every single event that has occurred and will occur in this universe is bound to happen in another universe an infinite number of times. This, in turn, makes the extremely implausible features more probable.

The String-Theory Multi-Verse

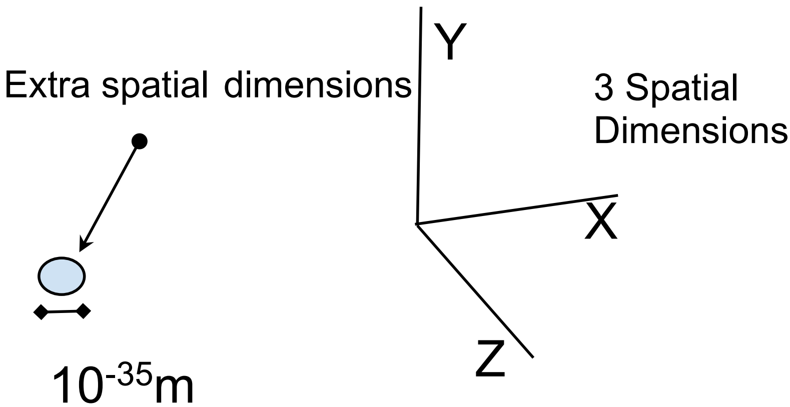
Since inflationary cosmology wasn't adequate to explain both the initial conditions and laws of physics, it didn't really leave the 1980s as a favored theory. Theorists began looking for another theory, one that could explain how the initial distribution of mass-energy and the values of the constants of the laws of physics came to be. A model that could account for the fine-tuning issue on the grounds of chance, without leaving crucial issues unexplained. This motivation led to the creation of the String Theory Multiverse. They would return to an older theory of particle physics to once again attempt to explain away the beginning of design.



This theory, created to describe the strong nuclear force, posits that the fundamental units of matter are not balls of charge (particles) or waves, but rather one-dimensional strings of pure energy. Each string exhibits a different vibration pattern that can manifest into either a closed or open string form. The open strings (top string in the figure above) drive gauge interactions, for example, a photon transmitting the electromagnetic force between two electrons. Open strings' vibration pattern along their length determines what type of particle is observed in the macro-scale universe (like us), while closed strings (bottom string in the above figure), because they form a loop, have clockwise and counterclockwise vibrations that both determine what type of particle is produced. All elementary sub-atomic particles are simply manifestations of those vibration patterns. String theory finds its roots in the 1960s and was created for no other purpose than describing the strong nuclear force. It would be filtered out in favor of another method, Quantum Chromodynamics, that better fits observations. Despite this, John Schwartz would revisit it in the 1970s in an attempt to unify General Relativity with Quantum Physics.[1]

Boson: Particles that transmit and carry their corresponding force, for example, the Gluon carries the strong nuclear force and the Photon carries the electromagnetic force.

Fermion: Particles that make up the material universe, such as nucleons and electrons.



The very first version of this theory described particles called bosons, thought to carry the strong nuclear force, and required a 26-dimensional spacetime, 22 of which were unobservable. More modern versions have reduced these 26 dimensions to a measly 7, including both fermions and bosons. Keep in mind that dimension here does not refer to a different world or universe, but a physical quantity describing space, matter, or time. But where do these 22 extra dimensions reside? They are compacted and curled up into many different configurations within a space smaller than 10^{35}m, or the Planck Scale.

The macro-scale universe has three observable spatial dimensions, but all of the extra dimensions in string theory are compacted into such a small scale that we cannot observe them. As the strings vibrate, they generate lines of flux that traverse through spacetime and hold the spatial dimensions in a specific shape, producing our larger-scale universe. Schwartz would notice that the equations of

String Theory allowed for near-infinite solutions corresponding to different lines of flux and physical phenomena. In other words, String Theory was compatible with a universe with different physical laws and spacetime configurations, and he would apply this with the prior multiverse models in mind. It also posits the existence of particles called Gravitons: massless, closed strings that transmit the gravitational force. Since this theory depicted gravity as an effect of virtual particles, and General Relativity depicted it as the curvature of spacetime, it was expected that the theory, if correct, would reduce all four fundamental forces to gravity alone through the graviton, and unify General Relativity with Quantum Physics, birthing a Grand Unification Theory (a theory of everything).

The specific vibrations of gravitons produce observable attractive effects (which we observe as the four forces through bosons), while other vibrational patterns generate material particles, or fermions.

String Theory Revised…

Supersymmetry

Quarks - Squarks

Up - Up Squark
Down - Down Squark
Charm - Charm Squark
Strange - Strange Squark
Top - Top Squark
Bottom - Bottom Squark

Leptons - Sleptons

Electrons - Selectrons
Muons - Smuons
Taus - Staus
Neutrinos - Sneutrinos

Gauge Bosons - Gauginos

Photon - Photinos
Gluon - Gluinos
W Bosons - Winos
Z Bosons - Zinos
Graviton - Gravitino

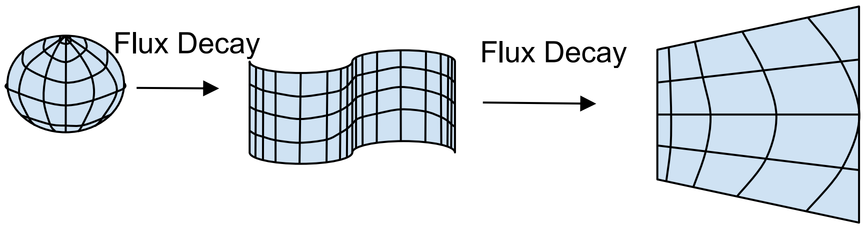
Early models of String Theory cosmology could depict only a universe containing bosons. The theory lacked a mechanism for fermions to exist, thereby preventing a material universe from being presented. To explain the existence of fermions, string theorists posited an arbitrary principle they called Supersymmetry.

Supersymmetry states that for every bosonic particle, there is a complementary fermionic particle, and for every fermionic particle, there is a complementary bosonic particle. Stephen Meyer notes that this principle alone shrunk the required spacetime dimensions from 26 to just 10. String theorists thus predicted the discovery and existence of gravitons and gravitinos, along with every other supersymmetrical particle. By introducing this into the theory, they hoped to create a single unified theory that reduced all forces in nature into one mathematical structure that accurately described everything. But… unfortunately, the equations of String Theory didn't produce any solutions strictly corresponding to the physics and spacetime of our universe. This is because the equations alone allow for a near-infinite number of solutions to describe the large-scale universe and are compatible with many different laws of physics. And this led to the multiverse being mixed in.

The String Theory Multi-Verse

The multiverse version of String Theory sees these solutions as incredibly tiny compactifications of spacetime in individual universes, called vacua, representing different vacuum universes that contain strings (vacuum here refers to the vacuum energy of space). Despite the large number of possible solutions to the equations, some theorists still attempted to exploit this. They claimed that each solution represented a different universe in the multiverse with different laws and constants. The different shapes of these vacua determine the physical laws that manifest at the macroscale within that universe, as well as the lines of flux they generate, thereby determining the constants of its physics. They would then apply this interpretation to the beginning of the universe.

They imagined each vacuum existing in an initially high-energy compactification of dimensions exhibiting a single gravitational field. In the figure above, the blue shade represents the gravitational field of the vacua (total spacetime curvature), and the intersecting lines represent the lines of flux that hold the spacetime in its specific shape. As time continues, the initial high-energy state begins to cause the lines of flux to decay, allowing new spatial compactifications of the extra dimensions and strings to emerge within the vacua corresponding to a different universe with different physical laws. These new shapes of vacua determine the laws of physics, and their size (determined by the strength of the lines of flux) determines the constants within the laws. As this decay continues, each different vacuum universe would change from one form to another, evolving into new forms and possibilities as each universe cascades down the landscape of possible vacua configurations represented by each solution to the equations of String Theory. Keep in mind that the figure above is not a perfect depiction of what this even looks like, as the interpretation originates from equations. Despite this,



do the postulations of a string landscape even solve the issue of fine-tuning to begin with? Meyer does not think so:

> "But this postulation is highly debatable, since there is no way of knowing how much of the string landscape will get explored by such a means."[2]

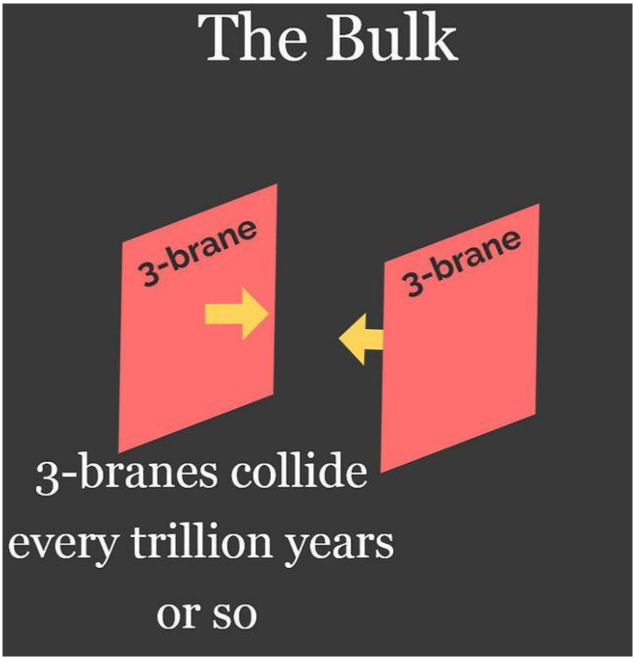
Indeed, if the solutions to the equations of String Theory are near infinite, then there is no reason whatsoever to expect that the entire landscape will be explored by a single cascading universe. If the cascade does not cover all of the possible solutions allowed by the equations, there is zero guarantee that the decay of flux would eventually result in a life-permitting universe to arise. Moreover, none of what String Theory posits has been observed, or is observable. Therefore, while this theory does explain the fine-tuning of our universe, it does so by sacrificing observable predictions for unrealistic unobservable explanatory entities, purely theoretical ones. Each solution to the equations represented a different universe with different physics. Thus, it wasn't long before the light of finding a solution that matched our universe began to dim. The number of solutions that have a positive value for their cosmological constant alone represents anywhere between 10^{500} and $10^{1,000}$ different solutions (meaning the universe will expand), all describing different physics. String theorists call this vast number of vacua solutions the String Landscape.[3]

If my explanation of String Theory was not satisfactory or confusing, just know that I know. It is very hard to explain these theories in a way that is easy to visualize. If you are interested in deeper discussions of the model, I would suggest reading Stephen Meyer's Return of the God Hypothesis, as it has been widely used in research on how to describe it, and the length of his discussion offers a good intuitive understanding of what it posits.[4]

Multi-Versal Teamwork That Makes The Confusion Worse

Do String Theory and Inflationary Multiverse Cosmologies provide adequate explanations for the fine-tuning of the laws & constants of physics, and the initial mass-energy distribution at the beginning of the universe? When examining these models and what they aim to explain, we should keep in mind the principle of Ockham's Razor. William of Ockham was a 13th-century theologian who contributed heavily to the development of modern science. He developed the principle of Parsimony, which holds that when explaining specific phenomena, scientists should avoid multiplying unobservable, theoretical explanatory entities as much as possible. In other words, the simplest answer is the most likely one. Oxford philosopher Richard Swinburne applies the principle of parsimony to these models. Positing a transcendent intelligent designer offers only one single explanatory entity: an intelligent, powerful, personal, transcendent causal agent as opposed to an infinite array of unobservable universes and multiple theoretical universe-generating mechanisms that often do not correspond to the physics of our universe by violating many known conditions.[5]

Taking the naturalistic approach and granting the multiverse requires one to accept two separate universe-generating mechanisms, not just one, in order to explain both the beginning and fine-tuning. On one hand, Inflationary models explain the fine-tuning of the initial conditions, but not the laws & constants of physics. This is because the entire inflation field obeys the same laws of physics as our universe, and each bubble universe therefore contains the same laws and constants as the field it is born into; only the mass-energy distributions of these universes differ. On the other hand, String Theory explains the fine-tuning of the laws & constants, but in most models, the initial distribution remains untouched.[6] An example of one of the rare models that does explain both issues, at the cost of postulating nothing observable and purely theoretical explanatory entities, is called the Cyclic Ekpyrotic String Theory Model.[7]



It posits that our universe exists in a thin membrane-like spacetime fabric of three dimensions called a 3-brane that resides in a higher, eleven-dimensional spacetime called the bulk. Some versions posit that only two 3-branes exist in the bulk, while others posit an infinite array or multiple pairs of 3-branes. The branes collide with each other every trillion years or so, through the attraction of a field called the radion field. The branes are separated by a tiny extra spatial dimension with a potential energy that slowly pulls them toward one another. As the branes approach one another, the potential energy of the radion field is converted into kinetic energy. When they collide, this kinetic energy drives a cascade of big bangs within one another, filling the branes with hot matter (strings) and radiation. If there aren't any other 3-branes but our universe's pair, then this model's multiverse is at least a duo-verse.[8]

"From the point-of-view of an observer on the stationary orbifold planes, the universe is expanding as the branes collide. The bulk brane is what causes their expansion, a gravitational backreaction effect due to its motion. The expansion is very slow as the brane moves across the fifth dimension, but assumes the usual big bang rate after collision and thermalization"[9]

The unreasonably multiplied explanatory entities within these theories include the 3-branes of spacetime, multiple universes that may exist in the bulk, the radion field, eleven extra dimensions of spacetime, and a process of collision that produces nearly 10500 universes in models that see bubble universes existing within the 3-branes. Some models posit vibrating membranes of energy, unobservable compactifications of extra spacetime dimensions, and lines of flux. As you can see, the extrapolation of the imagination is astonishing to avoid what the empirical evidence points to.

> "Conceptually, the ekpyrotic scenario appears to be simple: a bulk brane strikes our visible brane and a hot big bang universe is born. In actuality, to accomplish the transformation from a cold, nearly BPS state into an expanding, hot universe with nearly scale-invariant density perturbations without invoking inflation requires a series of seemingly incongruous conditions. Remarkably, these conditions can be satisfied simultaneously in heterotic M-theory."[10]

This means that creating a cosmological theorem that explains both the initial conditions and the physical laws and constants would require an inflationary mechanism operating in conjunction with string-theory vacua. This need for universal teamwork led to the formulation of a new hybrid theory, the Inflationary String Landscape Model. The theory of the Inflationary String Landscape was coined in the early 2000s by the American Physicist Leonard Susskind. Other physicists, such as Raphael Bousso and Joseph Polchinski, later advanced it. They proposed the decay of lines of flux around an initial vacuum universe, just like in Standard String Theory, but added that, in each vacuum, inflation would occur. As these vacua begin to expand from their inflaton fields, the fields decay in the local regions from fluctuations to produce bubble universes, each exhibiting different laws and initial conditions. While this theory seemed to explain fine-tuning by chance, it sacrificed observability in favor of a massive ontology of causal entities.[11]

But these String Landscape Models that feature the multi-verse scenario are subject to the BGV theorem and would thus imply an initial beginning to the universe anyhow.

Inflationary Absurdities

These models, though accounting for some of the issues raised against naturalism, did so at the cost of what philosophers of science call a bloated ontology. Some proponents of multiverse theories even admit this about their own models. A bloated ontology is when a model or theory is so unnecessarily complex, containing more theoretical explanatory entities than observable ones, to explain a given phenomenon. Say you walk into a broken-down cabin in the woods and see a hot cup of tea sitting on the table. You posit that someone either lives here or was just here, and we should get out. I posit that the place was abandoned years ago, that the cup of hot tea is actually old but was heated by the sun just long enough to warm it, and that we are fine to go in and explore. My explanation is far more complex, requiring multiple explanatory entities and unlikely conditions than your explanation.[11]

Or what if I claimed that aliens on the moon fired a cosmic ray from their raygun that passed through the cabin and hit the tea in the cup, heating it before we found the cabin. Now my explanation contains not just unlikely conditions, but completely unobservable and theoretical entities such as aliens on the moon, everything required for them to exist and travel here, a ray gun that passes through wood but not tea, and all of this happening just before we stumbled upon the cabin. My explanation suffers from a bloated ontology, as it is plagued by unrealistic and theoretical entities for which there is no evidence of their existence. The Inflationary String Theory does so by positing a very large number of purely theoretical and hypothetical explanatory entities for which there is just no evidence. The combination of the unobservable mechanisms of inflation and string theory grants the existence of too many entities that we cannot observe by their very nature within the models.

You would have to affirm the existence of multiple unobservable entities such as an inflaton field; the decay of the field through fluctuations to create bubble universes; each universe having different initial conditions; the inflation field expands forever and has been doing so infinitely in the past (affirming an actual infinite); all of the issues with an actual infinite are not that important; particles are actually one-dimensional vibrating strings; as these strings vibrate, lines of flux form around them; the initial universe had lines of flux that determined a positive cosmological constant with physics corresponding to our universe out of the near infinite vacua that do not; the validity of supersymmetry; gravitons and gravitinos exist; an infinite array of other universes; and an inflation field and string landscape universe generating mechanism that can produce a cascade that includes enough universes to reach a life-permitting one. And this is just some of the things you must affirm, for which there is zero evidence, to believe these models are correct.

The main issue with these theories is their extreme violation of Ockham's Razor, which is not a law per se, but an extremely good and proven method for finding the cause of an effect in question. The continuous speculation about unobservable entities just dulls the edge of his razor. So much so that it seems as if there are almost no observable entities within them, except for our darn universe. Not only do these theories multiply unobservable explanatory entities, making one accept obvious absurdities, but they also just push the fine-tuning issue back another layer, to the one they introduced to solve it. It obviously takes a lot more faith to be a proponent of these models than to believe in a transcendent mind that caused the universe.

Inflationary & String Theory Fine-Tuning

The universe-generating mechanisms proposed by these models seem to require prior fine-tuning to guarantee that a universe is produced with the laws of physics and initial conditions like ours, thereby trampling right over the exact issue they are designed to solve. Moreover, the fact that the equations of String Theory have near-infinite solutions means that when a theorist monkeys with the math to attempt to solve our universe, they are representing a transcendent mind monkeying with the universe-generating mechanism to limit the possible universes it can produce, leading to our finely tuned universe being the outcome with life as its end—an oddly theistic implication.

Inflationary Fine Tuning

To explain the homogeneity of the Cosmic Background Radiation, the inflaton field must have a specific energy level at the start of the expansion of the universe, as well as a specific decay rate to allow a life-permitting universe to result. This precise halt of expansion requires its own fine-tuning to one part in 10^{53}, all the way to 10^{123}. Not only is the halt fine-tuned, but so is the amount of time during which expansion occurs. Inflation begins around 10^{-37} seconds after the beginning and stops exactly at 10^{-35} seconds, with a size growth of 10^{26} times the universe's original size.

Moreover, recent research has revealed that the majority of universes that experience inflation will not inflate to a life-permitting universe. The inflaton field generates more universes not suitable for life than those that are. This is because the field is subject to random quantum fluctuations, with no goal for life. The estimated chances of generating a universe compatible with life are no less than 1 part in $10^{66,000,000}$ (ten followed by 66 million zeroes), a number that trumps the number of elementary particles in the observable universe at 10^{80}, multiple times over. This implies that the inflation itself requires prior fine-tuning, begging a cosmic fine-tuner even more than standard Big-Bang models.[12] But wait! There's more! The massive energy from expansion during the inflation period would increase the total entropy of the universe far more than the normal expansion of the Big Bang. In other words, the surge of expansion energy would increase the disorder of the mass-energy distribution (like dropping a bowling ball on top of a tower of cards, or slamming a heavy object on a table with dominoes standing up on it; the surge of energy from the ball or heavy object would cause the ordered dominoes or cards to decrease in the order they had before and fall over); thus, the distribution before expansion must have exhibited an even finer arrangement to account for the massive increase in disorder caused by inflation to retain the entropy it exhibits today, which is rather highly ordered

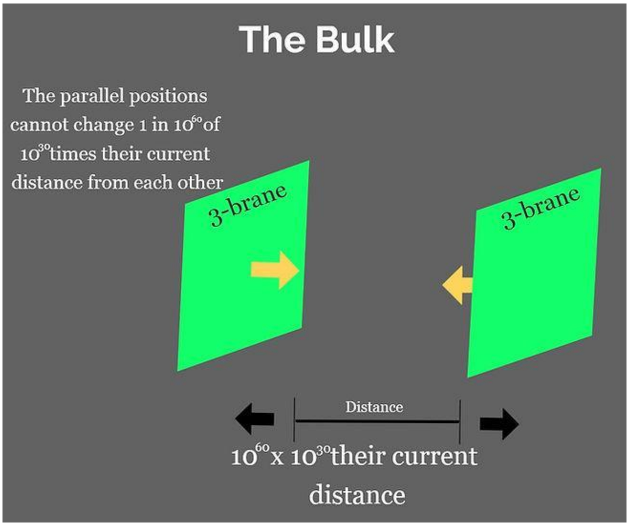
Thus, inflation requires an even lower initial entropy of the mass-energy distribution to account for the low-entropy, ordered structures we observe in our universe today. There are multiple layers added to the already existing multi-layered fine-tuning issue if inflationary models are entertained. This makes theism a simpler hypothesis than Inflationary Cosmologies.

Them Finely-Tuned Strings

String cosmologists imagine each solution to the equations of String Theory as representing a universe, or vacuum field, that contains a high-energy quantum gravitational field and begin exploring the string landscape of possible solutions. As time goes on, the lines of flux through space decay, allowing different configurations of the extra dimensions to take form, giving rise to different spacetimes and strings that emerge in the universe. A universe may sometimes experience a phenomenon called quantum tunneling, allowing it to jump into a new higher-energy state that essentially restarts a universe’s cascade. But the chances of a tunneling event are extremely low, meaning the probability that our universe is in a cascade becomes statistically small as well. Remember that the solutions of String Theory that correspond to universes with positive values for their cosmological constants are around 10^{500} to $10^{1,000}$ solutions. There are far, far more solutions that do not have a positive value; therefore, to ensure a cascade down the string landscape through as many low-energy solutions as possible, a universe must begin at a very high energy level, possibly the highest.

Meyer compares this to a game of high striker, or ring the bell. This is where someone must whack a plate to transfer the kinetic energy to a puck that slides up a vertical tower to a ringer or target. A player must hit the plate with enough force to cause the puck to slam into the ringer, winning the game. Likewise, the higher energy state a universe begins a cascade at, the more of the landscape will be covered in total. If one starts at the highest energy level, then this ensures that as many low-energy solutions are passed through as the lines of flux cascade through the landscape. Even then, there is no guarantee that a cascade beginning at a high-energy state would allow a life-permitting universe to be included in the cascade, and only a single solution within it would correspond to our universe.

As mentioned before, the String Landscape Models are all subject to the BGV Theorem and thus assume a beginning to operate. Exploring the string landscape would require a beginning, along with extreme fine-tuning, the same water they've been trying to bail out of the boat this entire time. This, in turn, implies the need for exquisite initial conditions because the highest-energy solutions are at least 1 part in 10500 rarer than all other solutions. But there is no guarantee that the entire landscape will be explored, which implies a fine-tuned mechanism that can guide the process toward exploring solutions compatible with life. Not only do the standard models invoke fine-tuning, but other models do as well.



The Cyclic Ekpyrotic Model, which introduces the 3-branes of spacetime that collide every trillion years or so, requires the 3-branes themselves to be specifically positioned along the 5th dimension to guarantee the correct collision occurs. The authors of the paper even admit that some constants in the theory must have specified values for the theory to work. The branes must be parallel to prevent large inhomogeneities in the resulting universe. They must remain parallel in the multi-dimensional bulk to 1 part in 10^{60} across not just their current distance from each other, but a distance 10^{30} times greater than the distance between them to generate a life-permitting universe, which is fine-tuning on an entirely different level than the observable universe alone. The energy potential between the colliding branes (originating from the radion field) is also fine-tuned to 1 part in 10^{50}.[13]

It seems that the attempt to explain one area of cosmological fine-tuning just pushes the issue to a new location, the one meant to solve the present issue.

Where's Waldo…

These theories do not just have fine-tuning issues that raise doubts about their validity; they also lack substantial empirical confirmation, unlike the Big Bang. Neither are they the best and simplest explanations for what they aim to explain. The standard Big Bang model can explain the homogeneity with simple fine-tuning parameters assumed, and physicists can easily account for the relatively uniform temperature of the Cosmic Microwave Background Radiation purely on mathematical grounds, without invoking inflationary mechanisms.[14]

> "The homogeneity and flatness problems are only considered problems by those who regard the existence of fine-tuning as a problem."[15]

The other issue these theories attempt to explain, the absence of magnetic monopoles, can also be accounted for by concluding they simply do not actually exist, and the unification theories that predict them are not accurate and are false. Moreover, they are all subject to the BGV Theorem, and therefore assume a beginning to the universe even without an initial singularity.

Failed Inflationary Predictions

Not only have inflationary Models taken hits in prior fine-tuning, as well as other absurdities, but they have all experienced their fair share of failed predictions; a red flag that a scientific theory or model is not correct. The first failed predictions are the variations in the wavelengths of the Cosmic Background Radiation, mainly because these theories predicted variations far larger than those observed. Inflationary models predict larger temperature variations due to fluctuations in the inflaton field. Once inflation ends, the inflaton energy is converted into standard mass-energy, thereby amplifying the previous variations into hot and cold spots in the CMBR. But the Planck Satellite has not detected the predicted variations of most models. The second failed prediction is the absence of detectable gravitational waves from quantum fluctuations in the universe’s overall gravitational field. These models predict that the gravitational quantum field experiences random fluctuations that should be detectable as random warps in space, since they would cause gravity to curve randomly at various locations. They predict that when photons interact with these warps, they will polarize in a distinctive, detectable way. To this day, no random warps of space have been found, and no photon has been either.

Scale Invariance: When the scale at which the patterns of an image are observed, i.e., how much the observer zooms in on the image, doesn't affect how the patterns look. Another, simpler definition is that objects do not change their fundamental properties, no matter how much their scale or size is increased.

The last major failed prediction in the phenomenon known as scale invariance in the imaging of the Cosmic Microwave Background Radiation variations. Inflationary models predicted a moderate invariance of the variations of the CMBR, but recent imaging of the CMBR shows an almost perfect scale invariance, more than the theories predicted.

Failed String-Theory Predictions

String theory has, as well, dealt some heavy blows when it comes to failed predictions. The prediction of gravitons and gravitinos said they were not going to be detectable, but other supersymmetrical elementary particles should. The Large Hadron Collider in Switzerland has never detected these predicted particles. String theory states that these particles should be detectable under specific high-energy conditions, which can be met in the Collider. To date, no supersymmetric particle has ever been detected, despite repeated attempts to do so.

Moreover, the idea of a particle responsible for gravity does not really jive with me personally. This is because for a graviton to travel and transmit the gravitational force, it would have to move through spacetime. But our most accurate models for gravity are interpreted as the curvature of spacetime itself, and that the curvature is gravity. Thus, how can a particle that travels through spacetime cause spacetime itself to curve? It just doesn't make sense unless spacetime and gravity are two distinct entities.

The Inflationary String Multi-Verse Does Not Explain Cosmological Fine-Tuning

As we have seen in this overview of inflationary and string theory cosmologies, they do not really offer a simpler, adequate, and more plausible explanation for fine-tuning. Inflationary theory posits an underlying inflation field that is eternally expanding, birthing new bubble universes as this field fluctuates, but requiring further exquisite fine-tuning for the universe-generating mechanism to produce a universe that is life-permitting, as well as the sheer probability of one spawning in the inflation field being something like 1 part in $10^{66,000,000}$. String Theory posits that the universe began as a tight compactification of spacetime (vacua) that was held into its current spacetime geometry via lines of flux that are actively decaying, allowing this vacuum to take on different geometries and laws of physics. But it failed to predict the very thing the theory is grounded in, as well as the prior fine-tuning required to ensure that a cascade includes as many low-energy solutions as possible that correspond to a life-permitting universe. The failed predictions of both these general theories lower their credibility as adequate explanations for the beginning and fine-tuning of the universe.

Moreover, positing a single intelligence offers a simpler explanation of the fine-tuning issue than does positing a whole host of individually fine-tuned mechanisms that still require an absolute beginning, given Special Relativity. It does so by positing a single explanatory entity that accounts for the evidence, as opposed to the bloated ontologies of multi-verse theorems that are offered. These models violate Ockham’s Razor, which states that when explaining phenomena, we should avoid multiplying unnecessary and unobservable explanatory entities as much as possible. The God hypothesis represents a simpler explanation via the single entity it posits: an intelligent, all-powerful, transcendent causal agent rather than multiple unobservable mechanisms and infinite separate universes and universe-generating mechanisms. Therefore, we can soberly conclude that the Inflationary and String Theory Multiverse models just push the fine-tuning problem to the very location that is meant to explain it. Theism stands as the best explanation for the beginning and the fine-tuning parameters of our universe.

But there is still one more type of cosmology that claims to solve the fine-tuning problem. It also claims to generate a universe from absolutely nothing!

Chapter 5 Notes

[1] (Stephen C. Meyer*, Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe* [New York: HarperOne, 2021], 501, note 11)

[2] (*Ibid*, pg 501, note 18)

[3] (*Ibid*, pg 333)

[4] (Leonard Susskind, *The Cosmic Landscape: String Theory and the Illusion of Design* [New York: Little, Brown and Company, 2005])

[5] (Richard Swinburne, *The Existence of God, 2nd ed*. Oxford: Clarendon Press, 1998, pg 185)

[6] (Meyer, *Return of the God Hypothesis*, pg 335)

[7] (This originated in a paper that introduced the idea of 3-brane collisions in heterotic M-theory, Justin Khoury, Burt Ovrut, Neil Turok, and Paul Steinhardt, *"The Ekpyrotic Universe: Colliding Branes and the Origin of the Hot Big Bang,"* Physical Review D 64, no. 12, 2001: 123522)

[8] (*ibid*, pgs 16-20)

[9] (*ibid*, pg 58)

[10] (*ibid*, pg 53)

[11] (Meyer, *Return of the God Hypothesis*, pg 336)

[12.] (Sean M. Carroll and Heywood Tam, *"Unitary Evolution and Cosmological Fine-Tuning,"* Physical Review D 78, no. 4, 2008: 044047. Referenced in Meyer, Return of the God Hypothesis)

[13] (Renata Kallosh, Lev Kofman, and Andrei Linde, *"Pyrotechnic Universe,"* Physical Review D 64, no. 12, 2001: 12352 , originally cited in Return of the God Hypothesis)

[14] (Meyer, *Return of the God Hypothesis*, Pg 505, note 41)

[15] (*Ibid*, Page 343)

Chapter 6
Does Quantum Cosmology Explain A Universe Coming From Nothing?

Have Stephen Hawking and Alexander Vilenkin Truly Created Universes From Nothing? Does Quantum Cosmology Remove The Need For A Beginning? Quantum Cosmology's Flaws And Its Startling Theistic Implications.

Thus far, we have reviewed the objectivity of truth and the best way to discover truth (correspondence theory). We also discussed the three modes of reasoning, and how each mode will serve in reasoning to the minimum nature of the cause of the universe, as well as the Kalam Cosmological Argument for the impossibility of an infinitely old universe. The scientific discoveries that led to the confirmation of the Big Bang Theory had startlingly theistic implications, positing an ultimate cause for the universe that transcends space, time, and matter. We also went over the evidence that we live in a very fine-tuned universe for the existence and thriving of biological life on Earth in its laws of physics and initial conditions, and refuting some naturalistic interpretations and multiverse models that claim to explain the beginning and fine-tuning issues. Now we come to the last naturalistic cosmology: Quantum Cosmology. Many claim that this model has proven that our universe originated from absolutely nothing, while other proponents claim that it explains how the universe is eternal in age (it cannot be both, as they contradict each other by definition). So now let us see if angry internet atheists are correct in these claims, or if they have fallen for blow-out-of-proportion article titles and political slogans.

Quantum Cosmology has its origins in the public eye in Stephen Hawking's book *A Brief History of Time: From the Big Bang to Black Holes*, published in 1988.[1] If you recall from chapter 3, Stephen Hawking aided in the formulation of the singularity theorems, but he found the implications of an absolute beginning in a singularity to be unsatisfying. His theory of Quantum Cosmology was designed to be analogous to phenomena in Quantum Physics, describing the universe before it was on the order of the Planck scale. At this scale, gravity as described by General Relativity does not dominate, and Quantum phenomena would take over in effect. This theory of particle physics describes the behavior and relationships of subatomic particles that exhibit wave-like properties. At some point in the universe's past, it would have been smaller than 10^{-35}m in diameter, a size physicists would have to take into consideration. At this incredibly small size, the laws of General Relativity break down, and Quantum Mechanics must be applied, which is a probability-based theory, as you will shortly see.

"Einstein's general theory of relativity fails to take into account the quantum fluctuations which must be present in any physical process involving gravity; therefore general relativity cannot be extrapolated in an unmodified form to predict what will happen at or below the Planck length. Quantum fluctuations also affect our measurements of time. The simplest way to define a unit of time is to measure the interval it takes for a swinging pendulum to complete a full oscillation. However, we cannot measure the precise location of the pendulum (Lidsey, 2000, p.118-119). The terms 'space' and 'time' do not have an adequate physical meaning below the Planck limit because neither can be measured. "[2]

Because General relativity could not be extrapolated back before the time the universe was the volume of the Planck scale, there must be another model that can account for the Quantum effects that would occur within the cosmological singularity.

Imaginary Time

When Hawking was working out this new model, he discovered that to calculate the state of the early universe, he needed to introduce a new concept called imaginary time. He then smudged this new time variable into Einstein's spacetime metric, sometimes called the metric tensor, which describes the geometry of spacetime.[3] He simply equated the ordinary time variable with this new imaginary time variable to calculate the possible states of the early universe, which he named the Wick rotation.[4] This changes the way the time metric operates. Remember our spacetime diagrams from Chapter 3? In a Lorentzian metric (space and time are treated differently), time is chronological and one-directional, and objects in space travel forward through time. Think of the Y-axis as time, and objects on the X-axis within space travel up the time axis. General Relativity uses this metric, but combines time and space into a four-dimensional spacetime. Quantum Cosmology uses a Euclidean metric in which time is not so independent, operating like a spatial dimension through which one can freely move, as one would in space. It essentially collapses the Y-axis for time into the X-axis of space.[5] Imaginary time is not a real metric, in that it has a physical, objective grounding in reality. It is simply a mathematical tool that removes singularities from the equations and cleans up the math.

When Hawking performed the Wick rotation, the result depicted an early universe with spatial dimensions but no absolute direction of time. Imagine the depiction of the Big Bang Theory as a pointed cone. This is because, as the universe contracts backward in time, the volume of space approaches a value of 0, leading to the point where the singularity would be—Hawking basically made the point that the cone is a curve, eliminating the pointed temporal beginning. His math treated time as another dimension of space, but eliminated the need for a temporal beginning, only if he continued to use the time variable in a Euclidean manner (imaginary time). He claimed to have overcome the challenge of an absolute beginning in the past in A Brief History of Time,

> "So long as the universe had a beginning, we would suppose it had a creator. But if the universe is really completely self-contained, having no boundary or edge, it would have neither beginning nor end; it simply would be."[6]

A few years later, after Hawking produced his Quantum Cosmological Model, Alexander Vilenkin would also create another Quantum theory, one that attempts to explain how the universe originated from a singularity that came from nothing.

Lack Of Physical Meaning And Arbitrary Value

When Hawking first published his paper introducing the concept of imaginary time and Quantum Cosmology as a whole, many pointed out that his decision to create the imaginary time variable had no physical justification or observational confirmation.[7] It seemed to many that his only reason for doing so was that it enabled him to make the calculations he wanted about the early universe. When imaginary time replaces ordinary time in the metric tensor, the resulting mathematical structure has no correspondence to anything in the physical universe. It has no grounding in reality and therefore cannot be valid; rather, it exists as a figment of the imagination.

> "Instead, time, when confined to the imaginary axis of the complex plane... has no physical meaning. Hawking himself acknowledged as much. As he explained, imaginary numbers are a mathematical construct; they don't need a physical realization; one can't have an imaginary number of oranges or an imaginary credit card bill."[8]

Hawking himself offered a justification: since science does not tell us anything objective about the universe, only creating models to explain what we see at the time, it is therefore acceptable to make a model using mathematical entities that do not correspond to the physical. What if we steelman his argument and make it as strong and broad as possible? If we take the logic of his argument seriously, we can blatantly see that his own model also tells us nothing objective about the universe either! It is a self-defeating argument, and thus it vetoed its own credibility trying to justify itself. Therefore, Hawking's method of treating time as another dimension of space does not result in a mathematical description with any physical meaning; nothing that corresponds to anything in our universe. You see, in General Relativity, time and space are linked (x, y, z, and ct), but they are treated fundamentally differently. Events happen in space in a temporal, chronological sequence, but Hawking collapses time into a dimension of space; thus, his math does not offer a description of spacetime that applies to the universe we inhabit.

Stephen Meyer informs us that Hawking discusses the lack of realism in his mathematics (in favor of instrumentalism). Still, he then draws scientific and metaphysical conclusions characteristic of a realistic approach, primarily in his claim to eliminate the need for a temporal beginning. But moreover, whenever Hawking's equations are changed back into the real domain (back into a Lorentzian metric), singularities reappear in the math.

> "Only if [we] lived in imaginary time would [we] encounter no singularities... In real time, the universe had a beginning and an end at singularities."[9]

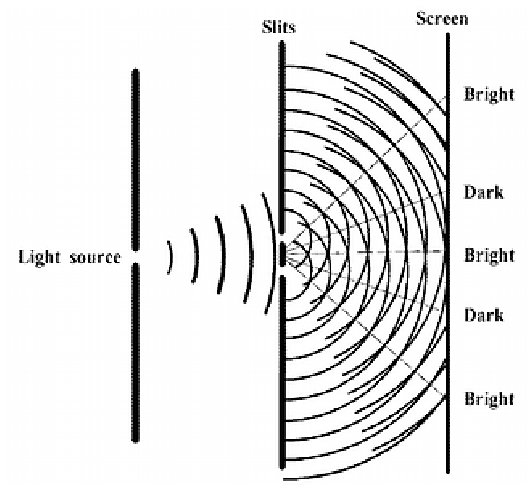
Quantum Cosmology does not, in fact, remove the need for a singularity at the beginning of the universe, as when the Wick rotation is done from a Euclidean metric to a Lorentzian one, they reappear. It does not avoid the cosmological singularity; it presupposes it as part of the very logical structure of the equations.

Analogous To Quantum Physics

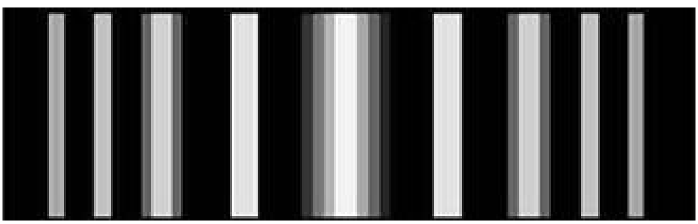
The creation of Quantum Cosmology is not tied to Hawking alone, but to a line of prior scientists and mathematicians. When developing the model, theorists sought to apply phenomena from Quantum Physics to the early universe. Quantum Physics was created to describe the behavior of wave-like particles (photons, electrons, and other subatomic particles). So to understand Quantum Cosmology, you must first understand the formation of Quantum Physics, and I will do so as briefly and easily as I can.

The Development Of Quantum Physics

Before 1801 AD, opinion within the scientific establishment on the nature of light was split down the middle. One side believed light was a particle, a little ball of electromagnetic energy far too small for the human eye to see. Isaac Newton described light as a particle, claiming that this view offered a better explanation of optical reflection. And the other side believed light was a wave because it could be split into different wavelength colors by passing white light through a prism. In 1801, Thomas Young performed the famous double-slit experiment. He would go on to publish his discoveries in the Philosophical Transactions of the Royal Society just a year later.[10] He passed a single wave of light through a slit in a divider between one chamber and another. The wave then passed through another divider in the next chamber with two slits, finally terminating on a detection plate in the last chamber. Whenever he passed light through the second divider with two slits, the detection plate had a wave-interference pattern that was consistent with wave behavior.



When two waves overlap, they create points of increased height where their peaks line up (constructive interference), and areas where their peaks do not align cancel out (destructive interference). Where there is constructive interference, the plate shows light stripes, while areas where the peaks cancel out show darker stripes (shown below). The lighter stripes are where the waves interfere constructively, and the dark stripes are where they interfere destructively.



This seemed to confirm that, since light behaved like a wave, it must be a wave; *Michael Faraday and James Clerk Maxwell* would also develop the theory that light was an electromagnetic wave, culminating in the 1960s. But there was another particle-confirming phenomenon to be explained: the photoelectric effect. In 1887, Heinrich Hertz conducted an experiment where he bombarded a piece of metal with light, causing the atoms in the metal to emit electrons from its surface.[11] Many predicted that since light was a wave, the amplitude (height of the wave) of the light was determining the kinetic energy of the electrons emitted, but it turned out to be the discrete frequency of the light, which was characteristic of particle behavior. Max Planck then proposed that energy is emitted and absorbed as discrete packets called quanta, marking the first step in the theory of Quantum Physics.

In 1905, Albert Einstein suggested that light energy propagated through space in concentrated packets of energy (quanta) he called photons. This is because photons wouldn't cause electron emission until they reached a specific energy threshold. So Einstein proposed that light traveled in tiny discrete packets of energy called quanta.[12] Light was then seen as behaving like a wave in some circumstances, but also like a particle of energy in others. A sort of wave-particle duality that baffled even the brightest minds of the time. In 1909, Geoffrey Taylor performed the same double-slit experiment that Thomas had performed over a century earlier. This time he did something different: he lowered the light intensity so that the photons were sufficiently separated to pass through the divider slits one at a time, practically speaking.[13] In theory, no interaction should occur between the photons, and thus no wave-interference patterns should emerge. This prediction rang true. When he passed each quantum of light through a divider with one slit only, small particles appeared one at a time on the plate. He also passed them through a divider with two slits, resulting in small dots of particle-like packets of energy hitting the detection plate, one photon through one slit and another through the other.

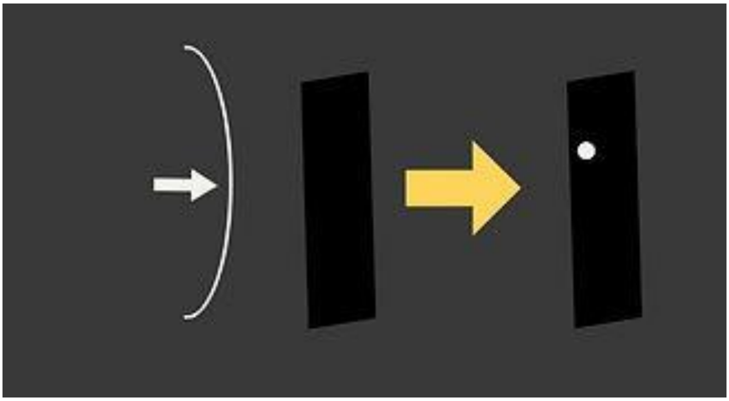
As more and more photons arrived at the detection plate, the same wave-like interference pattern emerged. This oddly suggested that photons were passing through the slits as single waves, creating two smaller waves as they went through the two slits, which then interfered and reached the plate. But as they made contact with the detection plate, they seemed to collapse into a specific position along the wave's spread. Later experiments confirmed the wave-particle dual nature of light and other sub-atomic particles. In 1911, Ernest Rutherford discovered that atoms consist of positively charged particles surrounded by electrons, and he created the first model of the atom. But his model had a major issue. According to classical electromagnetism, an electron should be constantly accelerating to remain in its orbit and radiate energy, causing it to decay. This decay would cause it to lose energy and collapse into the nucleus in about 10^{-11} seconds. Classical electromagnetism lacked something, and a new model was needed to describe particle behavior at the Planck scale. Two years later, Niels Bohr made one of the first successful quantum models of the atom, building on Rutherford's prior work.

He would solve the issues with the classical models by positing that electrons occupy only certain orbits corresponding to their individual energy levels. While an electron is in an orbit that corresponds to its stable energy level, they do not radiate energy as it would in classical models. When an electron jumps between energy levels, it emits a photon with the energy of the difference between the orbitals traversed. His mathematical description of this perfectly described the emission of hydrogen, along with other issues that previous models couldn't explain. By the 1920s, a mathematical framework was being developed that could describe the wave-particle nature. What resulted from this was the Schrödinger equation, named after Erwin Schrödinger. This equation allows physicists to calculate the probability that a specific particle will manifest at any given location within the spread of an energy wave. Before a particle makes contact with a detector, film, or plate, physicists cannot know its exact location; they can only know where it may manifest upon observation, and they will not know until they make a measurement.

The Schrödinger Equation

The Schrödinger equation is a differential equation: an equation that generally describes the behavior of objects (in this case, particles) in a physical system or apparatus. Their solutions do not represent specific numbers, but rather entire functions. Differential equations also have infinitely many possible solutions when left alone. Each solution is a function itself, having its own specific constants that must be defined after a mathematician fixes these values by providing what are called boundary and initial conditions. Here's an example: An equation describes how much damage a car may experience during a collision, but to predict how much damage will be done, a physicist must know the mass and material of the car, and the initial conditions of the vehicle must be known, like the initial velocity and forward momentum. A physicist must also know how fast the car is moving and what it may collide with (boundary conditions). Before this information was entered, the amount of damage could have taken many possible values. Still, once these conditions were applied, it limited the possibilities to a fixed value that would occur if a car of (x) mass traveled at (y) mph into a wall made out of (z) material. Similarly, the Schrödinger equation must have boundary conditions specific to the system being observed to be solved.

When the Schrödinger equation is solved, it produces a wave function that is represented with the symbol Ψ. The wave function can only be produced once a physicist fixes boundary conditions in accordance with the experimental apparatus she is using. Since the wave function allows a physicist to calculate the possibility that a particle will manifest in a specific location along a wave, the wave function represents the wave before observation, and the collapse of the wave function is when the wave collapses into a manifested particle with a position. This concept also introduced the idea of superposition. Before an observation is made on a wave of energy, particles exist as mathematical possibilities in multiple undetermined states at one single time, only manifesting a location in space after an observation.



A wave of light (on the left) makes contact with a detection plate. A mathematician will use the Schrödinger equation to derive the many possible solutions representing the possible locations a photon may actualize along the wave. These solutions for possible locations are called wave functions. When the wave hits the plate, a particle will actualize at some point along that wave (on the right).

This is why quantum physics is fundamentally a probability-based theory; there is no 100% prediction of where or how a particle will behave, only predictions of possibilities. When this was discovered, that particles existing in the Planck length exhibited a probabilistic behavior, cosmologists sought to apply this to the early universe, when it was at a size smaller than 10^{-35}m; therefore, quantum cosmology is analogous to quantum physics.

Quantum Cosmology

Since the universe we inhabit is expanding, and we know this from direct observation, reversing it back in time would result in a smaller universe at every successive point in the past. At some point, the spatial volume of the universe becomes so small that those of the quantum realm overpower gravity’s effects. To date, there have been no successful models for quantum gravity, requiring Hawking to make a model that is analogous to the phenomenon on the quantum level we are aware of. His goal was to make a theory of cosmology at the quantum level that was mathematically analogous to ordinary Quantum Physics.

Recall how the Schrödinger equation is a differential equation that allows a wave function to be derived, which includes all of the possible locations a particle may manifest along the spread of a wave. In Quantum Cosmology, the equation that is analogous to this is called the Wheeler-DeWitt equation.[14] This differential equation allows a cosmologist to develop a wave function for an entire universe, instead of the observed particle(s) within a system. A Universal Wave Function. The universal wave function describes possible universes with varying spacetime curvatures and mass-energy distributions that affect their overall gravitational fields. Each solution derived from the Wheeler-DeWitt equation represents each universe, similar to String Theory. The universal wave function then describes the different possible spatial geometries and mass-energy configurations that a universe may manifest.

Superspace

Before a wave is observed in ordinary Quantum Physics, a particle is said to exist in many different indeterminate locations along the wave simultaneously, a phenomenon called superposition. In Quantum Cosmology, this concept is also taken into consideration. The mass-energy distributions within space that affect the curvature of spacetime determine what kind of gravitational field a universe may have. The universal wave function describes different pairings of spatial geometries and mass-energy distributions, represented as ordered pairs that exist in an abstract space of pure mathematical possibilities called Superspace. The ordered pairs, representing different universes, are written as: Ψ(Spacetime Curvature, Mass-energy Distribution). This idea of superspace was analogous to the concept that a particle may manifest in many possible locations along the spread of a wave of energy in superposition.[15]

Quantum cosmologists use the Wheeler-DeWitt equation, which enables them to derive a universal wave function that describes the possible states of the entire universe and then calculate the probability that any specific universe will emerge from the initial singularity once the Wick rotation is performed again.[16]

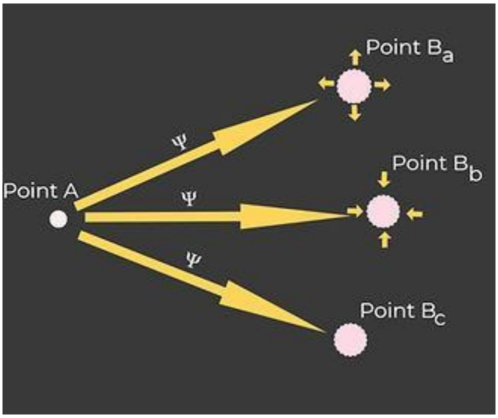
The Quantum Cause

For quantum cosmology to offer an adequate explanation for the origin of the universe, the Wheeler-DeWitt equation must produce a universal wave function that includes our universe as a reasonably probable outcome. Stephen Myers says,

> "Understanding how physicists use quantum cosmology as an origin theory requires keeping just three main elements in view: first, the origin of the universe... the thing to be explained; second, the universal wave function, the mathematical entity that does the explaining; and, third, the Wheeler-DeWitt equation and the mathematical procedure for solving it, and the alleged justifications for treating the universal wave function as an explanation of the origin of the universe."[17]

Stephen Hawking developed his model with James Hartle based on the previously mentioned Wheeler-DeWitt equation. They were attempting to remove the need for a singularity by explaining the beginning of the universe on purely naturalistic terms. In doing so, they used a method called sum-over-histories. In ordinary quantum physics, the sum-over-histories method is used to sum all the mathematical expressions that describe the possible paths a particle may take in an experimental apparatus, thereby constructing a wave function. Hawking and Hartle wanted to apply this method to sum the expressions describing possible paths from the presumed singularity through superspace to possible universes with different gravitational fields.[17]

In the figure on the next page, the universe comes from the singularity Point A and travels through superspace to many possible universes, Point $B_{a\text{-}z}$. In this diagram, Point B_a represents a universe with a positive cosmological constant (C) and a distribution that allows expansion; Point Bb represents one with a negative C and a distribution that overcomes gravity, causing collapse; and Point Bc represents a static universe for ease of understanding. The yellow arrows represent different paths through superspace. They assumed the universe originated from a singularity (Point A), with many different trajectories to possible Point Bs, or other universes. These trajectories travel through superspace and into one of the many possible gravitational fields. If Hawking and Hartle summed up all the possible paths, just like in quantum physics, they could construct a universal wave function. When this universal wave function is made, it produces a probability distribution that allows them to calculate the probability of any universe (Point Bs) emerging from Point A. If the wave function includes a universe like ours as a probable outcome, then they could claim to have explained the universe's beginning in quantum terms.



But they could only solve the Wheeler-DeWitt equation by replacing ordinary time with imaginary time. When Hawking and Hartle performed the Wick rotation, the resulting mathematical expression temporarily described a universe with no temporal singularity. They were also able to make a universal wave function that included our universe. They began by calculating a ground-state function for the universe. In quantum physics, a ground-state function describes a particle in its lowest energy state, allowing a physicist to determine the probable location of said particle in its lowest orbital. By analogy, a ground-state universal wave function allows cosmologists to calculate the possibility of any given universe emerging from superspace in the form of a singularity. But Hawking and Hartle's function only described closed universes, ones that do not continue to expand, but re-collapse into a singularity (our universe is an open universe). To explain this problem, they postulated that some closed universes can undergo quantum tunneling into an open state with continuous expansion. In doing so, they still never removed the singularity, but continued to assume its existence.[18]

But their model had some first-glance issues. *First*, they didn’t actually eliminate the cosmological singularity that they presupposed many universes could emerge from. Their interpretation of a non-temporal beginning was based solely on a mathematical expression lacking physical meaning. *Second*, Hawking and Hartle had to arbitrarily limit the total number of possible paths through superspace to derive a universal wave function that includes our universe. They only chose certain paths, ones that met criteria they made up. They included only universes that were isotropic, closed, spatially homogeneous, and had a positive cosmological constant. In other words, they had to restrict the mathematical freedom of the Wheeler-DeWitt equation arbitrarily, as well as posit a rare quantum event of tunneling into a higher energy state of continuous expansion.

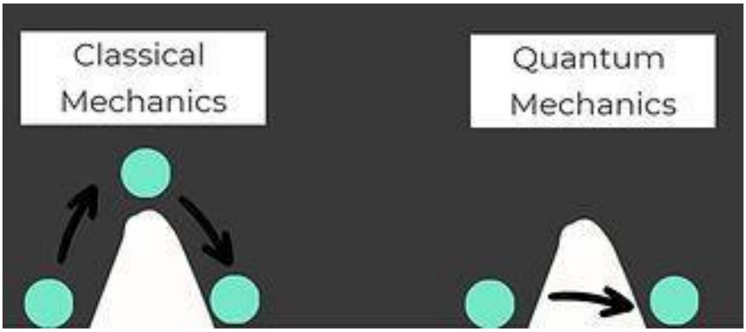
Redefining Nothing

Apart from Hawking and Hartle, another person was attempting to develop a quantum model that explained the creation of the universe from nothing. Alexander Vilenkin lays this out in his book Creation of Universes from Nothing. In it, he proposed that the universe began from an initial singularity but then underwent a quantum tunneling event into space, allowing it to expand. This was because the probability that the universal wave function would produce our universe was extremely low, so he introduced the tunneling event to increase it. The probability of the tunneling event was determined using the universal wave function Vilenkin used. He would claim that the universe originated from a quantum state that represented absolutely nothing.

But quantum fields are exactly the opposite of absolutely nothing (because there is surely something there, the fields!). Nothing is a negative universal, meaning there is absolutely no thing present. From a cosmological standpoint, this means there is absolutely nothing, no space, no time, and no energy fields. Lawrence Krauss would further popularize this version of Quantum Cosmology in his book A Universe from Nothing, in which he claims that the laws of physics can explain how the universe came from nothing. By positing the existence of transcendent mathematical entities, you subtly imply that a mathematical equation that was created in the human mind caused the universe to come into being. A position with some startlingly theistic implications.

Quantum Tunneling

For the universe to reach a state of continuous expansion, the singularity must have experienced some sort of quantum tunneling phenomenon. In quantum physics, tunneling is a process in which a particle can overcome an energy barrier despite lacking sufficient kinetic energy to do so. The wave function not only allows a particle to manifest along the spread of a wave, but also allows a slight chance that a particle may manifest on the other side of a barrier.



Above is an analogous depiction of quantum tunneling, in which a particle can overcome an energy barrier (represented by white humps) even though it lacks sufficient kinetic energy. They posited that such a closed universe could randomly undergo quantum tunneling, overcoming the gravitational barrier and continuing to expand past the Planck scale. In the Standard Big Bang Model, finely tuned initial conditions can account for the continued expansion of space. Still, in quantum models, the universe tunnels through the gravitational barrier created by extreme curvature, thereby allowing continued spatial expansion. Hawking and Hartle posited that tunneling occurs, allowing the universe to transition from a closed state to an open state capable of expansion. But this didn't account for the beginning of the universe, only for its development after the singularity was created. Their model produced a solution that described an initially closed universe that tunneled into an open state of indefinite expansion. One thing it didn't do was avoid an absolute beginning, even if the universe didn't originate from a singular point in a singularity. Therefore, Quantum Cosmological models no more avoid the universe's beginning than do the Inflationary/String Theory models.

Can Quantum Tunneling And The Laws Of Physics Explain A Universe From Nothing?

So then, does quantum tunneling offer a physical mechanism for how the universe originated from nothing? Vilenkin assumed an already existing universe before it tunnels through its gravitational energy barrier; likewise, Hawking and Hartle assume an already existing closed universe that tunnels into an open state of expansion. In both cases, an already existing universe is presupposed that is able to undergo tunneling. But does this explain the origin of the universe? It does not. It only explains the universe's later development to be suitable for life. How, then, could the process of tunneling preexist the universe, when it is the universe that is experiencing tunneling? Moreover, for the wave function to be solved, an experimental system must already exist so that it can describe the possible paths of a particle. It logically follows, then, that a universe must already exist for cosmologists to create a universal wave function that describes its possible properties within superspace. The system and particle logically precede the Schrödinger equation in quantum physics; thus, a universe with possible features must also precede the Wheeler-DeWitt equation. Quantum tunneling cannot explain the origin of the singularity because it presupposes it in order to describe it.

Neither can the laws of physics account for the universe's beginning from nothing. Some people, including Lawrence Krauss, claim that the laws of physics explain the origin of the universe. When they do this, they refer to the mathematical structure of the equations in Quantum Cosmology. They envision these laws causing a physical event to occur… but this logic is making a category mistake. Say a wide receiver is open, and his quarterback throws him the ball. When he catches the ball, a linebacker rushes him and hits him. The law of the conservation of momentum would allow someone watching to describe the movement of the wide receiver being hit mathematically, but the law itself did not cause the receiver to slam into the ground and go for a slip & slide for 8 yards; the linebacker hitting him is what causes him to go flying. Similarly, the law of gravity is not what causes objects to fall to the ground on Earth; it only describes the interaction of material objects with each other after they are inside space. The laws of physics describe the interaction of matter and energy that already exist.

Causes are events that precede other events in time that meet specific material conditions to produce said effect. Since laws describe relationships between events and variables in nature, and descriptions of nature do not cause events in nature, the laws of physics do not cause events. Neither do they explain where the stuff they describe came from:

> "...there is, at the bottom of everything, some basic, elementary, eternally persisting, concrete, physical stuff. . . . And what the fundamental laws of nature are about, and all the fundamental laws of nature are about, and all there is for the fundamental laws of nature to be about, insofar as physics has ever been able to imagine, is how that elementary stuff is arranged. . . the laws have no bearing whatsoever on questions of where the elementary stuff came from, or of why the world should have consisted of the particular elementary stuff it does, as opposed to something else, or to nothing at all... And the fundamental laws of this theory . . . have nothing whatsoever to say on the subject of where those fields came from, or of why the world should have consisted of the particular kinds of fields it does, or of why it should have consisted of fields at all, or of why there should have been a world in the first place. Period. Case closed. End of story."[19]

The universal wave function only describes the superposition of the universes that could exist without ever specifying anything that can cause one path through superspace to be favored over another. Also, in both main models, universes arise from an already existing singularity with zero volume. Quantum cosmology presupposes a singularity while never providing a cause for the origin of the universe in the wave function or the superspace that may come out of it. According to proponents of these models, before the universal wave function, there was no space, no time, and no energy to describe possible gravitational fields. There is nothing physical prior to the wave function, and superspace represents an immaterial, timeless, spaceless, and infinite realm of purely mathematical possibilities with no necessary physical existence. Thus, no material condition preceded the beginning, and it cannot be by definition, not even in quantum cosmology.

Prior Information And The Problem Of The Mind

With the fact that the laws of physics cannot cause the universe, and mathematical equations do not cause events, what is it that does anything at all with these equations in quantum models? Alexander Vilenkin acknowledged that his process of quantum tunneling is subject to laws that should be there before the universe itself: “Does this mean that the laws are not mere descriptions of reality and can have an independent existence of their own? In the absence of space, time, and matter, what tablets could they be written upon? The laws are expressed in the form of mathematical equations. If the medium of mathematics is the mind, does this mean that the mind should predate the universe?”[20] If the laws of physics predate the universe, then what caused the universe, if equations, again, cannot cause anything alone?

“What is it that breathes fire into the equations and makes a universe to describe?” [21]

This left them with two options for explaining the problem. They could either claim that the laws exist only in the minds of humans and thus have no causal power, or they could claim that the laws exist separately from the human mind and, through an unknown mechanism, produce universes, as the strong anthropic principle seems to claim. But there was another option —if they were willing to entertain it— namely, that these laws exist inside of and originate from a preexisting transcendent mind. Math has no material causal powers apart from minds that can use it to understand nature and manipulate it. To deny that is to treat math like an actual material entity, which is logically fallacious. We have no unified experience of mathematical equations creating a material state or affecting it. Thus, if mathematical entities preexist the universe, they alone would have no causal adequacy to produce a universe, themselves only describing possible ones existing at once in superspace. It seems like a mind must act upon these laws, and from our experience, these laws must originate from a mind as well.

These models also presuppose the possible existence of universes before the very mechanisms they claim can explain their origin have the opportunity to act. But not only do cosmologists presuppose a universe, but they also smudge information into the equations before a universal wave function is derived. An act that reflects a transcendent intelligence. The Wheeler-DeWitt equation admits an infinite number of solutions. To calculate a specific solution, a physicist must choose boundary conditions and impose them on the equation before solving it. But this raises an issue: how will they impose boundary conditions when they claim there is no physical system to derive them from in existence yet?

Differential equations describe the behavior of systems, and without specific boundary conditions of a particular system, they will have an infinite number of possible solutions. Once the conditions of the system being observed are derived through observation, differential equations allow one to predict and describe the future behavior of objects in the system. The Wheeler-DeWitt equation also has an infinite number of solutions, but physicists need information about specific boundary conditions to solve it. "

> "In ordinary quantum mechanics, the boundary conditions for the wave function are determined by the physical setup external to the system under consideration. In quantum cosmology, there is nothing external to the universe, and a boundary condition should be added to the Wheeler-DeWitt equation"[22]

Thus, physicists themselves must arbitrarily limit the mathematical freedom of the Wheeler-DeWitt equation in order to solve it and derive a wave function that includes our universe. They do this by applying boundary conditions that limit the total values in superspace, creating what they call mini-superspace. Furthermore, Vilenkin made arbitrary assumptions about the nature of the possible universes that could emerge, namely, ones that were isotropic, homogeneous, and closed. Therefore, the wave function they produce is the result of very arbitrary limitations they themselves apply to the equations… or fine-tuning from an intelligent agent!

On the other hand, Hawking and Hartle also committed the same act by choosing only certain kinds of universes with specific geometries to include in their sum-over-histories approach. They chose only paths through superspace that included universes that were isotropic and homogeneous and had a positive cosmological constant. They further restricted the equations' freedom by only choosing paths that exhibited an imaginary time variable, and none that had ordinary time.[23] Stephen Meyer claims that these models that restrict superspace, "constitute ad hoc constraints on the process of constructing the universal wave function. In a recent interview, James Hartle acknowledged as much. 'I have to tell you in confidence,' he explained, 'that whenever we do one of those calculations, we have to use very simple models in which lots of degrees of freedom are just eliminated. It’s called mini-superspace…. It’s how we make our daily bread, so to speak.’”[24]

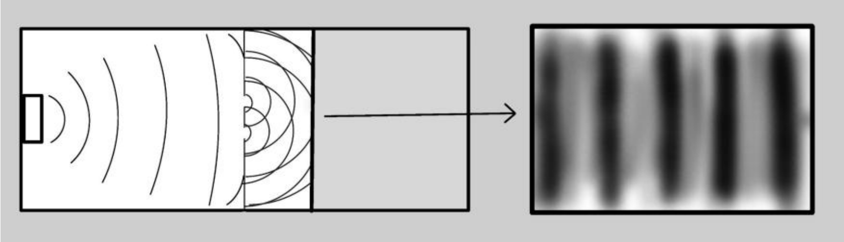
Someone commits the ad hoc fallacy when they provide a new, unsupported, or untestable explanation to support their argument—often seeming to be too unrealistic or of a "storytelling" nature in a debate or discussion. In this scenario, claiming to explain the universe from nothing, while obviously not explaining the beginning and origin from nothing and redefining nothing to be something, exhibits an unrealistic, untestable, doubtful response to these criticisms mentioned above.

The Problem Of A Prior Mind And The Death Of Materialism

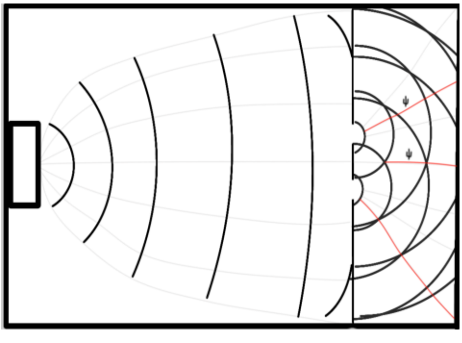
The problem of boundary conditions being applied to the mathematical structure of the Wheeler-DeWitt equation implied a pre-existing mind that could limit the mathematical freedom of the universal wave function, allowing a life-permitting universe to be a probable outcome of its direct observation-like action. Remember that the wave function collapses into a particle’s position when a mind observes it. One could argue that the measuring equipment is actually what causes it, rather than a mind, thereby avoiding the necessity of a mind to act on the equation. But the entire apparatus was set up by a mind agent, so that the entire chain of causation began with the mind action of an intelligent agent. Likewise, the Wheeler-DeWitt equation seems to require a mind to limit its freedom.

But Quantum Physics raised another issue, even without its incorporation into a cosmological framework. When Max Planck calculated that electrons lose energy (decay) by emitting discrete bits of energy, he called them quanta, instead of a gradual, continuous decay rate. These quanta (photons) were being emitted by electrons without a direct cause from a force or material mechanics, unlike in classical physics. This mystery, dubbed quantum jumps, sparked the overall curiosity to develop the mathematical structure of Quantum Physics. As previously mentioned, following Planck's discovery, an entire framework was formulated that describes the behavior of quantum events. This theory suggested that the universe as a whole was not entirely deterministic but probabilistic at the most fundamental level. Naturalism views nature and human nature as wholly deterministic, the result of neurons firing in a super complex fashion that produces conscious experience.

This probability issue led to the creation of the wave function, which describes all the possible positions a particle may occupy within the spread of an energy wave. Another way to state it is that the wave function describes the possible states or paths a particle may have or take upon observation or interaction with a macro-scale object. In the single-slit apparatus, the particle exists in all possible positions at once. Still, once the wave reaches the point of detection, it collapses into a single point where the particle actualizes. This implies that external observers are necessary for a wave to collapse, because a mind sets up the experiment and makes the measurement; the experimental apparatus is merely the medium through which the mind observes the wave. And according to some interpretations of Quantum Physics, observers bring about the existence of particles. How could the act of an observer cause the actualization/collapse of the wave function? Why is the collapse of the wave function dependent on our observations, rather than particles just behaving and interacting independently of them?



The figure above features the double-slit experiment performed by Thomas Young in 1801. It was performed to see whether light was a wave or a particle, and its behavior would determine which it was. If light behaved like a particle, a single slit would produce a single slit on the detection plate and two slits when passed through a double-slit; if it were a wave, it should reveal a spread of energy on the plate through the single slit, and a wave-interference pattern through the double-slit. When



one particle at a time was shot at the double-slit divider, each particle arrived at a seemingly random part of the detection plate. As more particles were fired, the wave-interference pattern would slowly emerge, while the trajectory of the particles beforehand appeared to be random. But when a detector was placed on one of the slits to try to see whether the photon was a wave or a particle, the wave interference pattern disappeared, and only a two-slit pattern appeared on the detection plate. The very act of observing the waves before they passed the two slits caused them to behave differently. They existed as waves before entering the slits, as demonstrated by the previous setup without a detector. Still, as the waves passed through the slit and interacted with the detector, they collapsed into particles, thus not behaving like waves after they passed through the slits. This implied that the collapse of the wave function occurred before the wave of potentiality (possible locations) could interact with the two slits, thereby creating an interference pattern. How were the particles interacting with each other if they were being fired through the apparatus individually?

This led physicists to view the wave of "energy" instead as a wave of potentiality. Each particle traveled as a wave of all the possible paths it could take (the grey paths through the apparatus). As it approaches the divider and detection plate, it interacts with its possible paths, limiting the ones it may take (red lines representing the most likely paths it may take), and then collapses into one of the most likely paths to the detection plate (one of the red paths). All of the possible trajectories exist mathematically simultaneously prior to an observation being made until the wave of potentiality collapses into one of those positions along the wave, or superposition. This suggests that matter does not exist as a wave of energy before an observation is made, but as a wave of the possible paths the particle of energy may take upon being fired. This was further corroborated by the accuracy of the math when describing the wave behaviors of atoms and groups of atoms, which wouldn't be possible if they existed as independent particles of matter. This implies that no particle is actually present before an observation is made. The narrowing of the possible paths a particle may take is called Quantum Decoherence.

Decoherence is responsible for the classical universe (macro-scale) retaining its structure and form when not observed, but this does not refute the mind dependence of the collapse of the wave function. We have discovered that these same quantum laws apply to particles that are isolated from decoherence. (Fattening up Schrödinger's Cat, September 24, Nature). There have even been small metal plates entangled, as well as a 30-micrometer paddle put into superposition, observed to be both still and slightly moving at the same time. (Alain Aspect, "Experimental Realization of Einstein-Podolsky-Bohm Gedankenexperiment). To date, there has been no physical or local mechanism responsible for the cause of the collapse, which seems to mean that the actualization of matter from potentiality must be dependent on the existence of a mind. And none of this can account for why our finely tuned life-permitting universe was able to actualize from these potentialities.

If the evidence we have about the collapse shows that a mind must be present to cause the wave function to collapse, and all matter and energy are subject to the laws of Quantum Physics, the most common-sense inference is that a conscious mind is the cause of the collapse. Moreover, if you were to enter a room and look at the light bulb, the chain of causation caused by your observation started with your mind-agency to the light being emitted from the bulb, to the glass of the bulb itself, to the filament within the bulb, and to the electrons in the atoms of that filament and the particle interaction present along the way. If we were to reverse this chain of causation, it would start with the electrons, go to the filament, and stop with you. The only logical place to stop the reverse extrapolation is at the observation action you made when you decided to look at the light bulb. It stops at a causal entity that is not bound by the same natural laws and mechanisms as the light bulb, and everything included with it, or at something that transcends it (the same applies to the beginning of the universe in Quantum Cosmology). In simpler words, a conscious observer is at the start of the causal chain that produced the collapse of the wave function, and this has theistic implications.

Returning to Quantum Cosmology, the evidence warrants the existence of something not bound by the same laws of Quantum Physics that could cause the ultimate collapse of the universal wave function. The most logical conclusion is that a mind is evidently and philosophically the cause of the collapse of the universal wave function for all matter. Even taking Quantum Physics alone raises this exact question. What is causing all of the unobserved matter to remain constant, rather than being randomized to the potential states it could take upon observation? Why is the moon the same moon, even when I'm not looking at it?

The reality is that conscious action seems far more fundamental than matter. It leads to the conclusion that consciousness is not a material entity itself, but rather more real than matter ever can be. The very nature of Quantum Physics leads to the rejection of a materialistic worldview, which sees the most fundamental things in the universe as matter and energy. It leads to the conclusion that consciousness is not a material entity but something that transcends the boundaries of the material world and is not subject to its laws. The action of conscious observers actualizes matter and energy. But what determines what state the universe is in out of its many potentialities, and furthermore, what state smaller parts and objects within it are in while it's not observed?

If conscious experience began with the emergence of life, as materialism believes, then where did it come from if it is more fundamental than matter and energy according to Quantum Physics? There would need to be some sort of cosmic consciousness that transcends the universe, that is aware of the universe at all times, to be able to hold its possible states to the one we observe, which is a very improbable fine-tuned universe. This also annihilates the claim that consciousness emerged from matter and energy being arranged in a complex manner, as Quantum Physics implies matter and energy are emergent from conscious activity. But we know that our consciousness began before any human or animal existed; no minds yet existed to collapse the universe's overall potential states. Therefore, there must exist a larger transcendent mind that causes the actualization we observe later on. This theory is called Cosmic Consciousness, or the Quantum God model, popularized by the philosopher and apologist Michael Jones, better known as Inspiring Philosophy.

Quantum Physics And Molinism

Attempts to avoid the theistic implications of an absolute beginning of the universe have resulted in a conclusion that seems strikingly like Molinism. Molinism is a Christian theological framework that attempts to reconcile God's divine sovereignty with human free will. How could God be all-knowing, yet man still retains free choice? Introduced by the Jesuit scholar Luis de Molina in 1588, middle knowledge is a theological concept he coined that is central regarding the universal wave function.[25]

Molinism hinges on three logical events God performed before initially creating the universe (the Heavens and the Earth, Genesis 1:1), not on chronological ones. Because time as we know it would not have existed, and God is not subject to it, these moments cannot be chronological by the very nature of God's atemporality. They are, therefore, in a logical sequence, not bearing a strict sequence as they would if God existed in time. (1) The first logical moment is God's Natural Knowledge. Because God is an omniscient being (all-knowing), He would have intuitive knowledge of all necessary truths, like those of mathematics, logic, and possible worlds that could be created. (2) The second moment is God's Middle Knowledge. God would also know what any free-willed creature would choose in any set of circumstances by virtue of His being omniscient. God knows what you would and wouldn't do in any state of affairs. These situations in philosophy are called counterfactuals of creaturely freedom (If person A were in situation G, they would freely choose X). Because God is loving and we have free will, God cannot force us to do anything, as that would violate our free will. God is all-powerful, but he cannot make a square circle. Omnipotent means that God can do all things logically possible, just like how Omniscience means He knows all things or propositions that are logically possible or true.

These circumstances in which God cannot force a person to do something freely are called feasible worlds/truths that God can achieve, given that the person has free will. (3) The third moment is God's Free Knowledge. Once God chooses to create a feasible world in which His will is best achieved, given that people have free will, He intuitively knows all contingent propositional truths that pertain to the world He chose. Molinism explains several theological questions that are still raised today. How can God be sovereign without fully determining human choices? God does not force decisions; instead, He selects a feasible world in which free creatures make free choices that best accomplish His will for creation. How can believers be "predestined" without God strictly determining who is saved and who is not? Molinism says God foreknows all free choices via being Omniscient, but those choices are still free. If I travel to the future and see you wake up tomorrow, make coffee, shower, and scroll through Instagram reels, and come back to the present and wait until tomorrow rolls around, did I determine what your choices tomorrow would be? No, I just have foreknowledge of what you would do, while you still freely choose to follow your morning routine. Likewise, God's foreknowledge of free choices does not mean He is determining those choices for us. How could God be all-loving, yet allow evil in the world? Molinism's answer is not absolute, but it offers a good reason why our questioning of it does not disprove God's being loving. Even if our world includes evil, it may very well be the best balance of free choices and outcomes for God's will to be done. Perhaps, given the option to choose God or not God, there is no feasible world in which all humans just happen to choose God, and none do not. We are not in a good ontological position to question the decisions of a transcendent God. But I digress.

This concept of God knowing all possible worlds before his creation decree highly resembles the superspace that Quantum Cosmology posits. In superspace, all potential universes exist simultaneously as a wave of potentiality; before creation, God knew all the logically possible worlds that could be created. In superspace, a mathematician must impose boundary conditions which limit the number of possible universes that may actualize; before creation, and with the idea of human free-will in mind, God limited the number of feasible worlds he could create. In superspace, the universal wave function collapses into our universe to produce a singularity by some unknown mechanism that must be similar, but more real than human consciousness; before creation, God would have chosen the feasible world in which His will could be achieved, or our universe! It does seem that modern science has come rather close to what theologians have been theorizing all along.

"At this moment it seems as though science will never be able to raise the curtain on the mystery of creation. For the scientist who has lived by his faith in the power of reason, the story ends like a bad dream. He has scaled the mountains of ignorance; he is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of theologians who have been sitting there for centuries." [26]

Quantum Cosmology utterly fails, as do the other models, to adequately account for the beginning and fine-tuning of our universe. The bloated ontologies and theistic implications, along with the requirement of a prior mind, all point to the same conclusion: a transcendent, personal, and intelligent mind. Finally, the implications of Quantum Physics itself beg for the existence of a cosmic mind to retain the state our universe exhibits from before we existed, to today, and until the end.

Chapter 6 Notes

[1] (Although the Wheeler-Dewitt equation [to be discussed later in this chapter] was introduced by Bryce Dewitt and John Wheeler, which was then utilized in quantum cosmology by Hawking and James Hartle in Wave Function of the Universe [1983])

[2] (Saints and Skeptics, *"Has Hawking Explained God Away? God, Physics and the Beginning,"* 2014)

[3] (C. Allan Boyles, *God and Quantum Physics*, pgs 94-99)

[4] (Wiltshire, *An Introduction to Quantum Cosmolog*y, pg 488)

[5] (Hawking, *The Boundary Conditions of the Universe*, Physical Review D [1983])

[6] (Hawking, *A Brief History of Time*, pgs 140-141)

[7] (Some of his biggest critics at this time include Roger Penrose, Lee Smolin, George Ellis, and Leonard Susskind)

[8] (Stephen C. Meyer, *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe*, New York: HarperOne, 2021, pg 352)

[9] (Hawking, *A Brief History of Time*, pg 136)

[10] (Thomas Young, *"On the Nature of Light and Colours,"* Philosophical Transactions of the Royal Society of London 92 [1802]: 12–48)

[11] (He never published an independent work on the photoelectric effect, but the first mention in his work appears in *On an influence of Ultraviolet Light upon Electrical Discharge [1887]*, with the concept being further developed by figures like Albert Einstein *[1905]*)

[12] (Albert Einstein, *"Über einen die Erzeugung und Verwandlung des Lichtes betreffenden heuristischen Gesichtspunkt,"* Annalen der Physik 322, no. 6, 1905: 132–148)

[13] (Geoffrey Ingram Taylor, *"Interference Fringes with Feeble Light,"* Proceedings of the Cambridge Philosophical Society 15 [1909]: 114–115)

[14] (Most commonly attributed to John Wheeler and Bryce Dewitt, *Quantum Theory of Gravity. I. The Canonical Theory*, Physical Review [1967])

[15] (Meyer, *Return of the God Hypothesis*, pg 362)

[16] (Wiltshire, *An Introduction to Quantum Cosmology*, pgs 496-498)

[17] (Meyer, *Return of the God Hypothesis*, pg 363)

[18] (*ibid*, pgs 508-509, notes 47-49)

[19] (David Z. Albert, *"On the Origin of Everything,"* The New York Times Sunday Book Review, March 23, 2012, review of Lawrence M. Krauss, A Universe from Nothing: Why There Is Something Rather Than Nothing)

[20] (Alexander Vilenkin, *Many Worlds in One: The Search for Other Universes* [New York: Hill and Wang, 2006], pg 205)

[21] (Hawking, *A Brief History of Time*, pg 174)

[22] (Alexander Vilenkin, *"Quantum Cosmology,"* in *The Encyclopedia of Mathematical Physics*, quoted in Meyer, *Return of the God Hypothesis*, pg 378)

[23] (Hawking and Hartle, *Wave Function of the Universe*, pg 2967)

[24.] (Meyer, *Return of the God Hypothesis*, pg 381; the James Hartle quote is from an interview done with *Closer To Truth*, see https://closertotruth.com/video/harja-003/?referrer=7710)

[25] (Luis de Molina, *Concordia liberi arbitrii cum gratiae donis,* divina praescientia, providentia, praedestinatione et reprobatione, Lisbon, 1588)

[26] (Robert Jastrow, *God and the Astronomers*, 2nd ed. [New York: W. W. Norton & Company, 1992], pg 107)

Chapter 7
Reasoning To A Cause Of The Universe

How Can We Think Through What The Cause Of The Universe May Be? Which Worldview Seems Most Plausible? A Review Of The Evidence & The Four Main Worldviews.

Thus far, we have covered the evidence that confirmed the second premise of the Kalam Cosmological Argument. This evidence included discoveries made in astrophysics and cosmology, as well as developments in mathematical theorems that led to the most evidence-confirmed theory to date: the Standard Big Bang Theory. A model that posits the universe, space, time, and all matter all came into being at some point in the finite past from a single point where its spacetime curvature approached an infinite value that corresponded to a spatial volume of zero. Finer imaging of the full spectrum of the Cosmic Microwave Background Radiation would then undermine alternative models like the Steady-State Model and Oscillating-Universe Models, leaving the Big Bang the victor. One of the main characteristics of a theory that makes it a "scientific one" is that it offers predictions about what we should expect to see given the hypothesis. A testable theory means that we can observe nature and actually see if the model/theory is at most possible. And when scientists did exactly that, their attempts to avoid a beginning ultimately failed on empirical and philosophical grounds.

I then briefly explained some of the features of the universe that bear some strikingly improbable values that exceed any probability from human experience. Inflation and String Cosmologies turned out to just make the fine-tuning problem worse, and Quantum Cosmology just warrants a pre-existent mind to collapse the universal wave function to a life-permitting universe out of the infinite possible ordered pairs of other potential universes. It also aligned very well with what Molinism posits, supporting a theistic worldview to adequately explain the cause of the universe. Keep in mind that I am not saying Molinism is not absolute doctrine, as there are many who do not hold to it. What it does do is offer us a way to at least understand what God may have done in a certain circumstance, even if we cannot fully comprehend it or know for certainty. Now that we have covered the many different hypotheses, we can begin to discuss, with the help of PhD Philosopher of Science, Stephen C. Meyer, how we can reason to the best explanation, among the many differing ones offered. The models we have gone over are purely naturalistic. This means they aim to posit that only the things within nature, space, time, and matter/energy are the things responsible for the beginning of the universe.

> "The broader ontology typically associated with atheism is naturalism—there is only one world, the natural world, exhibiting patterns we call the 'laws of nature,' and which is discoverable by the methods of science and empirical investigation... There is no separate realm of the supernatural, spiritual, or divine; nor is there any cosmic teleology or transcendent purpose inherent in the nature of the universe or in human life"[1]

Naturalism is the view that there is nothing beyond the natural world; that matter and energy are the form from which all comes, or the Prime Reality. It essentially sees all explanations, when reduced to their most fundamental levels, stop at the laws of physics and nothing more. It is a form of scientism, or the theory of truth that states anything that can be verified through the scientific method and senses can be taken as real and true. But in chapter 1, we saw that this is a reductionistic philosophy that ignores the other theories of truth, along with the entire field of epistemology, making it inadequate and false. You see, within philosophy, there are three main branches: Metaphysics, Epistemology, and Ethics. Or, what is real? How do I know what is real is true? And how can I apply this new truth to my life? Is it good or bad? Within Metaphysics, there is a sub-branch called ontology that is concerned primarily with the nature of being. In our case, the nature of nature's being. It asks questions like what is the prime reality, or the being from which all else comes, which enables a person to compare the existence of objects and beings via their natures, or individual ontologies.

There are four general answers to the question of the ultimate, or prime reality, represented by four main metaphysical hypotheses (because they are positing a prime reality for which they cannot directly confirm with 100% confidence that represents the source for all things real). Materialism, or naturalism, posits that matter and energy is all that is and ever will be; Pantheism, which claims an impersonal deity exists that is one with the universe, or coequal with it; Deism, which claims a personal transcendent deity created the universe but has never been involved with it since; and Theism, which posits a personal transcendent deity that created the universe but was involved with it after the fact. These four different worldviews encapsulate several belief systems and scientific models for the universe, and by examining each one, we can test their expectations & predictions and see which one best explains what we see in our current universe. These four worldviews represent four individual answers to the ontological question of what caused the universe. For example, we could ask the question “Does God exist, and what would we expect if God did not exist?” or “If God is personal, is there evidence of Him acting within creation, or of cosmic design?” Each worldview will answer each of these smaller questions in its own unique way according to the beliefs each system holds.[2]

Materialism may say that God cannot exist because nothing beyond space, time, and mass-energy exists. Pantheists would say God does exist, but that He is impersonal and one with time, space, and mass-energy. Theism holds that nature reflects an orderly system of causes and effects that exist within an open system, one where God can act within the universe from outside of it, one where God may act as a causal agent. Each worldview answers basic questions about existence in drastically different ways that affect how we live our lives, view relationships, work, people, institutions, science, animals, nature, etc. Your worldview determines every other aspect of your life: how you view authority, justice, and love, and hate.

Reasoning To A Cause…

Recall from chapter 1 that there are different methods of reasoning to truth, like starting from the pieces and working toward the whole, or inductive reasoning. Or beginning from the whole and breaking it into logical parts, deductive reasoning. Each mode of reasoning can be used in different circumstances and under different conditions in order to reach truth, all being just as valid as the others. Historical scientists and historians use abductive reasoning, or inference ot the best explanation, when considering events that took place in the past. They use it to infer competing explanations for past events based on clues and evidence left behind in the present. This is exactly what our situation is: examining evidence and clues about the universe from the present to infer the best explanation about what happened to the early universe. Inference to the best explanation is not just limited to history, though, as it is used in a plethora of fields such as forensic science, theoretical physics, astronomy, or any one person attempting to infer the cause of an unobserved phenomenon or event.

In fact, we use abductive reasoning every day! Take the cabin in the woods example from chapters 3 and 5. Say you and your friends stumble upon an old cabin in the woods while on a hike, and when you enter the broken-down door, you see a cup of steaming hot tea and a wind-up firetruck rolling across the floor blaring its siren. There are many potential explanations to account for how the tea and firetruck got there, such as the work of natural forces randomly assembling the cup and truck, or people who were there long ago but have since left, or maybe an alien that escaped a secret lab nearby took shelter there and made itself at home. However, it could also be from someone who is still inhabiting the cabin to this day. Every explanation is possible, but not every one is plausible. The cup of tea is currently hot, which is obvious from the steam it is emitting, implying it was prepared recently, as the heat has not fully dissipated. The wind-up firetruck was still moving, also implying someone was recently present to wind up the toy.

It seems as though the explanation of natural forces, people long ago, and the aliens do not suffice as adequate or plausible explanations for what you observe. Of course, an alien very well could have been there, but you must affirm far too many improbable events that must have happened leading up to this: like the alien life originating somewhere else, it traversing space to get here, it crashing despite it having the technology to get here, it getting captured and placed in a secret lab nearby that nobody knows about, as well as it somehow escaping and then also settling at the cabin and making a cup of tea of all things. The best and simplest explanation is that there was somebody there just before you entered, or that person is still present and has been living in the cabin. Every time you have to choose an explanation out of a variety of others, you are using abductive reasoning, and we do this many times daily just to function in society and survive.

In the situation above, you would have used inference to the best explanation to conclude that someone was in the cabin to make tea and wind up the toy firetruck. There were multiple competing hypotheses as to what caused the toy and cup to be as they were, and only one of those explanations offered the most explanatory power and plausibility. In other words, the idea that people were present in the cabin adequately explains much more of the evidence than do natural forces or some extraterrestrial lifeform. The 19th-century logician coined the term abductive reasoning: Charles Sanders Peirce (1839-1914). He described in detail the different modes of inference that we all use to derive conclusions from evidence, facts, and recorded data, or in other words, create a hypothesis.

Inference To The Best Explanation

A reminder on the three modes of reasoning would help us continue to examine these different worldviews. Deductive reasoning, to put it in the simplest words, is reasoning from the laws of logic. If one were to form an argument or idea, they would use the laws of logic to see if it is logically valid. Deduction offers certainty in its conclusions, where one thing is a matter of course from another, and therefore the conclusion must be true. It begins with the whole and works to the parts. For example, if (a) is true, then (b) would be a matter of course, or necessarily happen. Say (a) is given to be true; therefore (b) is true as well. Something like if the bathroom is humid and the mirrors are blurry with steam (a), then I must have just taken a shower (b). Say you walk into the bathroom and it's warm, humid, and mirrors are blurry (a is given true); therefore, I must have just taken a shower. Because the only thing that produces steam and humidity in my bathroom is a shower, and the bathroom is just that, we know for certain that I just took a shower. If the premises are true, then the conclusion logically follows as well.

Inductive reasoning is a method of reasoning used to confirm the premises of an argument. An argument may be logically valid, but its premises are false, making the argument invalid. With deduction alone, one has no way to know whether their premises are true; in the case of the bathroom-shower syllogism, we can observe the bathroom every time I take a shower to see if the temperature and humidity rise, causing the mirrors to become blurred with steam. That is induction: observing, repeating, and recording data to test the truth value of a premise in an argument. A sound deductive argument produces certain conclusions; while induction produces probable conclusions, and with enough data are rendered probabilistically certain beyond a reasonable doubt.

Abductive reasoning is when you have multiple explanations or hypotheses that claim to account for the evidence and data one has gathered. When we have evidence and multiple competing explanations that account for it, we cannot use observation alone to validate the hypotheses. The different hypotheses represent different explanations for the phenomenon in question. We then look at each hypothesis and extrapolate the predictions and expectations it provides concerning the effect/phenomenon. By comparing the explanatory power and scope of each hypothesis, the simplest one comes out as the most likely explanation. The way to state the bathroom-shower syllogism in an abductive fashion would be that if the bathroom is warm, humid, and the mirrors are blurred with steam (a), then I may have taken a shower beforehand. Since we see the bathroom is humid and the mirrors are blurred, there is reason to suspect that I just took a shower. There is no absolute certainty produced, only potentiality.

Instead of "(a), then (c): (c) is given, therefore (a)," it is "if (a), then (c): (c) is given, *perhaps* (a)." Instead of a term of certainty, a term of probability is used (*perhaps*). Abduction only produces possibility based on facts and data, not certainty. This is why abduction best fits our situation, as we have multiple competing metaphysical hypotheses, or worldviews. We may find reasons that one hypothesis is more plausible than another by using inference to the best explanation. Peirce suggested that by comparing the explanatory power of competing hypotheses, we can strengthen abductive inferences and render one of them plausible beyond a reasonable doubt.

Epistemic Support For A Hypothesis

Abduction only produces probabilistically confident, and not absolutely certain, conclusions. This is why abduction fits this situation perfectly, as we have multiple competing, possible, metaphysical hypotheses, or worldviews. We can discover reasons that one hypothesis is more plausible than another using this method of reasoning. Charles Peirce suggested that by comparing the explanatory power of the competing hypotheses, we can strengthen certain abductive inferences to render one of them plausible beyond a reasonable doubt. Ever since Peirce coined the concept of abduction, philosophers have refined how abductive inferences are able to offer epistemic support for a specific hypothesis. Epistemology, the second branch of philosophy, deals with how we can know the truth. What methods can we use in order to confirm our beliefs correspond to reality? Epistemic support, therefore, is any evidence, fact, data, or reason that offers justification for a certain belief. For example, say I am diagnosed with Diabetes, and my doctor informs me that I must use insulin to regulate my blood sugar levels to stay alive. I refuse to believe him and choose to eat Tums because I think that is a better treatment. I have zero justification for what I believe, as I have no evidence that Tums are an efficient treatment for Diabetes. My doctor, on the other hand, has decades of experiments, records, research papers, experience, and knowledge proving that my body needs insulin to survive because my pancreas has shut down. My doctor has more epistemic justification for his belief than I do for mine; therefore, I do not need Tums, but insulin to survive.

Since abduction alone only offers rather weak support for just one hypothesis, scientists often compare each hypothesis' explanatory power over the evidence to see which one best explains the event in question. The hypothesis with the most explanatory power is viewed as the most plausible. In fact, we have already used this method in Chapter 3 when we had multiple models (the Big Bang, the Steady-State, and the Oscillating-Universe models) all competing to explain the evidence for the beginning of the universe. But as more evidence came in about the expansion of the universe and the Cosmic Microwave Background radiation, the Big Bang Theory is the model that came out victorious, offering the best explanatory power and plausibility to be ruled as accurate at least beyond a reasonable doubt. We shall use abductive reasoning to determine what caused the universe: God, or naturalistic cosmologies.

Can Science Explain Everything?

Before we continue comparing the four major worldviews, I want to address a very important subject that many people totally misunderstand. Can science explain everything? Scientific naturalism has taken a major hold on the academic establishment for well over a century, seeping into just about every nook and cranny of our culture and education. Many falsely believe that science is able to explain quite literally everything. From the behavior of nature to numbers, abstract objects, love, consciousness, the beginning of the universe, where everything came from, who we are and where we came from, and where we are going. Cambridge Professor of mathematics and theologian John Lennox has written a wonderful book that covers science, the nature of explanation, and the truth of Christianity. In "Can Science Explain Everything?" Lennox demonstrates how science is not the only avenue to truth, and I will use a little bit of his book on the nature of explanation.

Science is not the only way to discover truth, as there are many other ways of doing so. This belief in science, sometimes called scientific naturalism, is a belief system called scientism introduced in chapter 1. Lennox argues that if indeed science was the only avenue to truth, one would have to give up half of the faculties of education and academia, such as history, literature, languages, art, ethics, morality, etc. This idea that science is the only way to truth has led to the common conflation of the term scientific with rational. This is not the case, as all of the previously mentioned faculties rely on reason, as does most of a person's life. From basic human experience, we know that reason is not confined to science itself, or the second mode of reasoning, induction.[3]

Lennox offers an example to demonstrate this, and I will offer an altered version of it that keeps the same idea behind it. Imagine I cook a beautiful steak, and then the world's best scientists gather in a lab with us and the steak I just prepared. The biochemists would be able to tell us about the structure of the meat, what part of the animal it came from, its fat and protein content, the nutritional value and contents, and everything involved in its biological makeup; chemists would tell us about the elements involved and chemical reactions in the proteins of the meat when it was cooked; the mathematician would be able to describe the behavior of the particles involved in making a perfect medium-rare, on and on down the list of different disciplines. With what they would tell us, we would know just about everything about how the steak was made of, prepared, and cooked to perfection. But suppose we say "that's all pretty cool, but can you answer me this," and proceed to ask them, "why was this steak made?" Surely these top-notch scientists would be able to answer that basic question: why? It is blatantly obvious that although science was able to explain how the steak was made, it cannot answer why it was made. It can describe the processes and mechanisms involved in butchering, preparing, and then cooking the meat; but unless I tell them why I made it, they will never know the answer to the question.

> "Unless she reveals the answer, they will never know. The natural sciences can cope with questions about the nature and structure of the cake, but they cannot answer the 'why' question of purpose. Science has its limitations."[4]

With this taken into account, we can reasonably conclude that science cannot, in fact, explain everything, not even why there was a beginning and fine-tuning parameters of the universe. All it can do is describe the processes leading to the beginning, and the various features of the fine-tuning that we observe in our universe. But some will still claim science can explain God away, but is this true?

Can Science Explain God?

Isn't God just a gap argument that humans of antiquity have created to explain things that they had no knowledge of their natural mechanics and causes? Lennox says this is a null argument, because if God does exist, then Atheists are the ones coping with reality, constantly running away from an ultimate day of judgment before a perfectly righteous and holy God.

> "The important thing to understand here is this: if you define God to be a god of the gaps—a place-holder, an 'x' to stand temporarily for something that science has not yet explained—then of course you have to choose between science and God, because that's the way you have defined God."[5]

The God of theism is not a God of the gaps. The gods of pagan antiquity were described as originating from the heavens and earth, or eternally existing matter. They were the products of the primeval chaos of matter, making them gods of matter. By direct contrast, the God of Christianity and the Hebrews is described in Genesis and elsewhere as creating the heavens and earth, not coming from them. God is not described as being born out of a prior state of eternal chaos and energy, but rather the being who brought all of matter and energy into existence in an orderly system that reflects his intelligence. The God of the Bible is not a god of the gaps: He is the God that began the universe and all of the objects within it (even the parts we don't understand yet). Actually, the more the human mind understands something complex, the more it learns to appreciate its beauty and admire the mind of the person responsible for it. The more I learn about mechanical and electrical systems, the more I appreciate the sheer combined genius required for such things to even operate on a basic level.

The more a person understands about a painting, the more they admire it and the painter. The more early natural philosophers (scientists) understood nature, biological systems, and the universe, the more they admired the genius of God who designed it in such a complex and improbable way. Lennox's point is that science does not compete with God as an explanation because science offers a different kind of explanation. So what does science explain? Let's use gravity for an example. The law of gravity, created by Isaac Newton, does not tell us what gravity is; it describes how it operates. It does not offer us a complete explanation of gravity.

> "At the basis of the whole modern view of the world lies the illusion that the so-called laws of nature are the explanations of natural phenomena... the modern system makes it appear as though everything were explained."[6]

A scientific explanation is oftentimes not a complete explanation. The laws of nature themselves merely describe the universe, but explain nothing. The fact that there are even laws to be discovered is a miracle. This is something that is not understood at all: why the universe can be described in the language of mathematics. This revelation was for Einstein a concept he could never wrap his head around, believing it pointed to the action of some sort of universal spirit “vastly superior to man”. In his own words, this “god” he envisioned was more of a pantheistic or strict panentheistic god rather than anything like the Christian God. Another thing to point out is that a scientific explanation is not the only rational explanation that is available. You could ask why Jason's steak is sizzling, and answer with the heat from the flames of the grill causing the molecules in the meat to become agitated and excited, raising the temperature and transforming the meat. You could also say because Jason was hungry and was craving that T-bone. The first explanation is a scientific one, and the second is a personal one; and each one is not competing with one another, and both must be present to get a full picture of the citation of me cooking a steak.

> “... we may say that God no more competes with science as an explanation of the universe than Henry Ford competes with science as an explanation of the motor car. God is an Agent-Creator explanation of the universe; he is not a scientific explanation. Aristotle, were he alive today, would be surprised to find just how many people appear unable to see the difference.”[7]

It is obvious that science cannot explain everything, but paired with other lines of reasoning, we may be able to get a fuller explanation of the cause of the universe. Especially when this cause, per the evidence, must be immaterial and timeless (characteristics of abstract objects with no material grounding, like numbers, mathematical laws, love, abstract reasoning, and the laws of logic.

God And The Beginning

In this short part, we have only gone over the method of reasoning we will use to examine which worldview best explains the beginning and fine-tuning of the universe. By examining the predictions and expectations of multiple hypotheses for what caused the universe, or the state of it, we can observe which ones have the most explanatory power. By using abductive reasoning and inference to the best explanation, we can stack each worldview against the others to see which one is more reasonable, probable, or plausible beyond a reasonable doubt. In the next chapter, we will examine the many different hypotheses for the universe and try to see which one has the most explanatory power for the beginning and fine-tuning of our universe. We shall also see if Materialism, Theism, Pantheism, or Deism are reasonably probable explanations for the beginning of all space, time, and mass-energy. Anything is possible, but not everything is reasonably probable, as we will see.

Chapter 7 Notes

[1] (Sean Carroll, The Big Picture: On the Origins of Life, Meaning, and the Universe Itself, New York: Dutton, 2016, pg 11, quoted in Stephen C. Meyer, Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe, New York: HarperOne, 2021, pg 219)

[2] (Meyer, Return of the God Hypothesis, pg 221)

[3] (Lennox, Can Science Explain Everything?, Kindle edition, pg 22)

[4] (Ibid)

[5] (Ibid, pg 28)

[6] (Tractatus Logico-Philosophicus [Kegan Paul, Trench, Tubner and Co, 1922], p 87, quoted in Lennox, Can Science Explain Everything?, Kindle edition, pg 31)

[7] (Ibid, pgs 33-34)

Chapter 8
God, The Universal One, Or Nature?

Does Theism, Deism, Pantheism, Or Atheism Offer The Best Explanation For The Beginning and Fine-Tuning Of The Universe?

"It is said that an argument is what convinces reasonable men and a proof is what it takes to convince even an unreasonable man. With the proof now in place, cosmologists can no longer hide behind the possibility of a past-eternal universe. There is no escape, they have to face the problem of a cosmic beginning."[1]

With this method of reasoning in place, we can now examine each explanation, extrapolate predictions, and see which one accounts for the most clues and evidence we see today. To answer the ultimate metaphysical question of "where did everything come from?", there are four main generalized answers that represent metaphysical hypotheses, or worldviews. These include Naturalism/Materialism, which denies anything beyond the existence of nature; Pantheism, which equates God with the universe; Deism, which posits that the universe was created by a transcendent God that didn't act after their creation decree; and Theism, which posits a transcendent personal God who is active within the universe after the fact.

Although there have been deductive arguments provided for the existence of God, the main worldview of modern academic institutions is that of materialism, or naturalism, and they often see inductive arguments as the only valid way to reach truth. This reductionistic philosophy is known as scientism, and it views the inductive method of reasoning as the only real way we can know what is real. This view is not logically sound: as it assumes science is the only valid method of reasoning before performing science, and can thus not be proved using science, but is a deductive downstream from the a priori assumptions of materialism. Thus, inductive reasoning is not the only valid method for finding truth. In the previous chapter, we looked over abduction, a method of reasoning that compares the explanatory power of multiple competing hypotheses to see which one offers the best explanation, also called "inference ot the best explanation." Deduction produces certainty, but abduction produces probability, much like inductive reasoning.

This is perfect when we have more than just a single explanation for an event or phenomenon that aims to explain the event, and by comparing their explanatory power against one another, we can filter out which one has the best explanatory power, and make an inference to the best explanation.

Comparing Multiple Hypotheses

Subscribing to a specific presupposition about nature and reality is a fallacious move, and we want to remain as unbiased as possible. Thus, in this examination of the four worldviews posited, we will be open to the possibilities of each one. By keeping an open mind and considering each worldview's beliefs about reality, we can extrapolate predictions and statements about nature to determine which one best explains the evidence we see. A specific hypothesis will provide a specific cause for the effect in question, corresponding to the beliefs each system holds. This means that each worldview's explanations for the beginning and fine-tuning of the universe will each have a different amount of explanatory power as to the effect in focus. If explanatory power can offer support for a hypothesis/worldview, it should be possible to see if recent discoveries in astrophysics and cosmology support a Naturalistic, Pantheistic, or Theistic/Deistic hypothesis.

Each worldview, representing a metaphysical hypothesis about existence, would need to explain two main facts about our universe. The first being the many discoveries made in astrophysics and cosmology that led to the conclusion that our universe is expanding and, in the past, had an ultimate beginning. The second fact is that our universe exhibits extremely fine-tuned present and past entropy, constants of the laws of physics, their relationships to one another, and the initial conditions and distribution of mass-energy at the beginning of the universe that allow for the thriving of life on Earth.

God And The Cosmic Beginning

We will begin by seeing which hypothesis best explains the evidence that the universe had a beginning. In order to compare the explanatory power of each metaphysical hypothesis, we need to examine what the expectations of each one are concerning a finite and fine-tuned universe.

By doing so, we should be able to filter out the worldviews that are not able to account for the effects in question, and which ones offer better explanations. Let’s begin with Theism. Do theists have grounds for expecting a finite universe with an ultimate beginning to all things physical? Stephen C. Meyer says that the Philosopher Ernan McMullin, who denies that anything but deductive arguments can be made for God, mentions that a beginning to the universe fits the Theistic expectation about the universe. If a person believes the universe has an ultimate creator, then there would be reason for them to suspect to find evidence that it did indeed have a beginning in the past. Even one of the men who discovered the Cosmic Microwave Background Radiation, Arno Penzias, said that what we see in the universe, the expansion of space, is exactly what he would expect if "I had nothing but the first five books of Moses."[2]

"The best data we have are exactly what I would have predicted, had I had nothing to go on but the five books of Moses, the Psalms, the Bible as a whole."[2]

Indeed, the Bible does mention God creating the entire universe per the term "heavens and earth”, which is an ancient term meaning everything on earth, and in the skies, or the entire universe (Genesis 1:1). It also describes God creating time and causing the heavens to expand and “stretch” (Psalm 104:2; Isaiah 45:12, 51:16; Jeremiah 10:12; Zechariah 12:1; 2 Timothy 1:9; and Titus 1:2):

"The Lord wraps himself in light as with a garment; he stretches out the heavens like a tent" (Psalm 104:2, italics added)

"He alone stretches out the heavens and treads on the waves of the sea." (Job 9:8, italics added)

"He sits enthroned above the circle of the earth, and its people are like grasshoppers. He stretches out the heavens like a canopy, and spreads them out like a tent to live in." (Isaiah 40:22, italics added)

Verses like these from the Bible reveal that what we observe in the universe, as well as what we expect from Big Bang cosmology, are exactly what we would expect given a Christian or theistic worldview, rather than a naturalistic one. In an abductive fashion, this may be stated as:

(1) If Christianity's position on God creating the universe is true (if a), then we have *reason to expect* that the universe had a beginning (then b).

(2) We observe evidence that the universe had an ultimate beginning (b is given).

(3) Therefore, we *have reason to suspect* that the Christian's view of the beginning of the universe *may be* valid (perhaps a).

This means that the Big Bang, and all of the evidence, arguments, and data supporting it offer epistemic support for a Theistic/Deistic worldview/hypothesis, although not producing deductive certainty. This is the same way that scientific evidence confirms or denies the validity of a theory or model; as there may be multiple hypotheses offered, but as more evidence is gathered, they are filtered out and failed predictions and expectations are identified, and their models thrown out. The theory that accounts for the most evidence and data is deemed the most probable.

More Than Just The Bible

The Bible is not the only reason a Christian would expect a finite universe. There are more reasons to expect a finite universe, given Theism, than just a few verses. Theism holds that God is a personal agent with causal powers and free will. Humans, too, have causal powers and free will so that we can cause new things to come into existence (for example, turning an ingot of steel into a hammer). So by extrapolating from our uniform experience (that human minds have causal powers) of personal causal agents causing new things to come into existence, and assuming God exists, we should also expect God to have the same ability to cause new things to come into existence. Since God, by definition and His very nature, is the Creator of everything, it would not be surprising if the causal powers of God are much greater and transcendent than human agents within the universe. We should also expect God to have caused the universe to come into existence, as well as the evidence of this act of creation within the universe.

Theists believe that God is the Prime Reality, that from which all else comes. Therefore, theists should expect to discover evidence of a beginning in the universe. Moreover, General Relativity describes matter and energy as existing within the same space and time. Special Relativity gave us $E=mc^2$, which tells us that energy and matter are linked, and the concept of spacetime implies that space and time are linked. So if God in fact created all of matter and energy, we should also expect space and time (where and when the matter and energy will go) to be created along with it, being logically necessary. So the entire universe, as well as the time for it, would have all begun at this beginning point. If you have no time, no change can occur, and thus nothing meaningful is even possible. If you have no space, then there is nowhere for matter to exist, and thus no meaningful events could happen either. If you have no matter and energy, then there is nothing to exist within space and time, and you have nothing for meaningful events to happen through. If one of God's goals were to have a universe where meaningful events could occur, all three (matter, time, and space) must all be present and linked to each other in order for a cause-and-effect universe to be produced.

Theism Vs. Naturalism With Reference To The Cosmic Beginning

But why is evidence of a beginning to the universe more expected given Theism than Naturalism? In other words, does Naturalism better account for the beginning of the universe? Having a beginning requires a cause for such, and if nature had a cause, then the cause cannot be nature. This means that if the universe didn't have a beginning, there would be no need for a creator, since matter would be eternal. But we do not see evidence of this. Under a naturalistic view, there is nothing beyond nature, so it expects that nature would be eternal and self-existent, only changing its form since the infinite past and into the future. Historically speaking, from a naturalistic point of view, evidence for a cosmic beginning was extremely surprising. For this very reason, other naturalistic models and explanations have been offered in an attempt to explain away the beginning, such as the Inflationary, String, and Quantum Cosmologies.

Naturalism can offer no causally adequate explanation for the cause of the universe. Nothing exists beyond space, time, and matter to do any cause. Moreover, naturalists prior to cosmology and astrophysics readily posited an infinite and eternal universe, implying they had very few expectations for a beginning and no expectations for evidence of eternal age. Yet the CMBR, Redshifts, the BGV Theorem, the Singularity Theorems, and General Relativity all represent examples of evidence that suggest the universe had a beginning. The Singularity Theorems posit that time, space, and matter are all emergent properties of the universe with the singularity. But again, Naturalism posits nothing beyond nature to cause, and the evidence suggests that nature came into existence; yet it has no explanation for such an event since the cause would have to be something separate from the effect (the universe). If the universe converged on a single point in the past where the curvature of space reaches an infinite value, and the spatial volume reaches a value of zero, there is no place for energy to be composed, and no fields to do any causing. Naturalists were not expecting to find this evidence, and thus this worldview's predictions about the universe are false.

Before this singularity, no energy, space, time, or quantum fields existed to do any causing. And the BGV Theorem applies to any universe that is expanding, including Inflationary Cosmological Models. All energy would eventually reach a recessional velocity of the speed of causation/light in the reverse direction of time, marking the beginning of the expansion, even if there is an infinite amount of space. It makes zero sense to say that before space, time, and energy came into existence, there was more space, time, and energy to cause them. X cannot cause itself; another entity, like Y or W, must act to cause X. The cause cannot be the same as the effect, as that violates the principles of causation. Theism provides a better explanation for the beginning.

Theism also offers a simpler explanation for the beginning of the universe than Naturalism does. Since Theism posits a being with relevant causal powers that transcend space, matter, and time, God could easily have acted to bring them into existence. So, given Naturalism, no being beyond space and time exists that could act to bring the universe into existence. Therefore, Theism offers a simpler, more likely, and causally adequate explanation than Naturalism does with reference to the cosmic beginning.

Mind Or Material State?

Regardless of the issues Naturalism has with the beginning of the universe, naturalists will still attempt to posit some prior material state that caused the universe, such as the other models they offer. Positing a material state before the universe would result in an infinite regress of material states, all causing one another in sequence. To avoid this regress, there must either be (1) an initial uncaused material state, or (2) that the sufficient conditions to produce a universe have always existed in the past, and there are major issues with both of these solutions. (1) An uncaused first material state would violate the principles of cause and effect and deny common-sense reasoning. In fact, this is the exact issue some atheists use to argue that God cannot exist because He would require an infinite regress of creators. That is assuming God is material, or that his decisions are wholly determined by external factors; instead, it is positing a material state that results in an infinite regress, with a solution that denies reason. (2) If you posit the idea that the sufficient material conditions to produce a universe have just always existed in the past, then we should expect to see evidence that the universe began an infinite time ago.

This is because the moment the correct conditions for a material event are met in the state prior, that event will happen necessarily. So the moment that the conditions for causing a universe were met in an infinite past, the universe should have been caused an infinite amount of time ago. But we do not see evidence of this; thus, the universe did not begin because a material state met the correct conditions for it an infinite amount of time ago. Rather, positing a personal, intelligent, and transcendent agent with free will resolves this issue. Having free will entails the concept that a causal agent can start new chains of causation without being compelled by any prior external material conditions or states. A mind with free will is causally adequate to cause a universe, which eliminates the requirement of infinite regress before the universe began, since no material conditions are needed to produce the cause.

> “Free agency also eliminates the need to posit an uncaused material first cause, which would violate the principles of causality and sufficient reason. It does so because having free will—familiar to us all because of our own introspective awareness of the powers of our own minds—means that our decisions or acts of mind can alter material states of affairs without being wholly determined by a prior set of necessary and sufficient material conditions."[3]

The technical term for this is libertarian freedom. It refers to a person's choice, action, evaluation, or judgment that is not causally determined by something or someone else. Or, the ability to think, act, or choose such that prior conditions are insufficient to causally determine or necessitate one’s thought, action, or choice. If one possesses libertarian freedom (free will), then no material conditions need to be posited for any choice they make. For example, say your friend walks into a room with a bottle of pop, and leaves it sitting on the table while she searches through her deep freezer for something to eat. Say you grab the bottle of pop and quickly shake it, and whenever your friend goes to open it, they are met with an explosion of suds and soda. No external prior conditions prompted you to decide to shake up their bottle of pop . And since God would have knowledge of all feasible worlds he could cause (natural and middle knowledge), he could choose between the full range of possible worlds he could create; whichever one best suits his plan for human redemption.

Attempting to explain the beginning under Naturalism results in an explanatory halt and bloated ontology of postulated universe-generating mechanisms; but positing a mind with free agency that transcends the universe seems to offer a better and simpler explanation for the beginning of the universe, and fits the logical requirements for producing one. Even the idea of positing a material state makes no sense, since again, before the beginning, no space, time, or mass-energy existed to cause, and thus no material to be formed into a specific state with causal adequacy for producing a universe. It is a fancy form of X that caused X to begin to exist. As John Lennox often says, "Nonsense means nonsense, even when it is uttered by high-powered scientists."

Theism Vs. Pantheism With Reference To The Cosmic Beginning

Now that we have established the fact that naturalism cannot possibly explain what caused the universe, we are left with another possibility, or worldview, left in the ring. Does Pantheism offer a better explanation for the cause of the universe than Theism does? Many Eastern religions and some philosophies subscribe to the idea that the universe is coequal with God, such as Hinduism, Stoicism, Spinozism, Taoism, Neopaganism, and any religion that equates God with the universe. In general, Pantheism does affirm the existence of a god, but this god is impersonal as the ultimate reality from which the material world is unified and not transcendent to the universe itself. God, nature, and consciousness are all part of the same essence; they equate God with the entirety of nature, and people with matter. But it fails to explain what caused the universe to come into being. The Pantheistic god is coexistent with the physical universe, which fails to offer an entity external to the universe that is able to cause it to come into existence. If there were no universe, then there couldn't be a Pantheistic god, and thus nothing before the universe to cause it. It fails for the same reasons as Naturalism.

According to the best evidence, given Pantheism, God must have had a beginning, as the universe is currently expanding, requiring a more “real” entity to cause it to come into existence. Do you see how that makes no sense? Actually, Pantheism is simply Naturalism with the word god painted over it, which fails to offer an entity separate from the universe as the cause.

Moreover, it equates the infinite God with the finite universe; thus, many Pantheists believe that the universe is eternal and self-existent. This contradicts all of our discoveries and assumptions about nature and cause and effect. I personally know a Pantheist, and their number one defense is that the evidence for the beginning of the universe is invalid because we have no idea if the laws of physics work differently elsewhere in the universe. Yet this person, and people like them, completely forget that with General Relativity, we can accurately describe the motion of objects in space, and that is why we accept it as the best theory of Gravity. Moreover, the fact that we can use Spectroscopy to determine the elemental makeup of stars means that the laws that govern the behavior of their particles and atoms, the forces involved, and their masses behave the same as they do on Earth, or else we wouldn't be able to determine the elemental makeup of distant stars via the light that arrives on Earth.

Finally, since the Pantheistic god is not personal, it has no free will, and thus no explanation for how the universe could have come into existence without falling into an infinite material regress that plagues Naturalism so heavily.

God Explains The Beginning

The God hypothesis is the simplest and best worldview to explain a very foundational metaphysical question: Where did everything come from? As it aligns with what the evidence in the universe suggests: that there was a cosmic beginning. Naturalism and Pantheism fail to explain anything external to themselves to cause the universe, since neither posits beings beyond the physical universe to do the causing. Thus, Theism and Deism offer the most rational, causally adequate, and simplest explanations for what caused the beginning of the universe. If time, space, and matter all had a beginning, the cause of such must have been spaceless, timeless, immaterial, and personal.

These attributes fit the entity posited by Theism and Deism, or more simply, God (with a capital G). Theism and Deism are the only worldviews that meet this criterion for causing the universe to exist a finite time ago.

God And The Fine-Tuning Of The Universe

The next enigma that these four worldviews must explain is the fine-tuning of the constants of the laws of physics and the initial conditions of the universe from the very beginning. Could Naturalism actually offer a better explanation for the fine-tuning parameters of the universe than Theism?

Well, for starters, in all of human experience, intelligent agents are the only ones able to produce finely tuned systems that exhibit improbable structure and functional outcomes or goals. A car engine has many improbably arranged parts that, when put together, perform the specific outcome of transforming heat energy from fuel into rotating mechanical energy through an apparatus of gears to move a car. A recipe for a meal is another fine tuned system as it exhibits specific steps, ingredients, and cooking techniques that an intelligent causal agent follows to produce a specified outcome or goal, like say a steak As previously mentioned in chapter 4, physical systems that manifest extremely improbable constructions or arrangements, as well as a recognizable pattern or functional outcome always result from the action of an intelligent agent, and never from undirected material processes and random chance.

Furthermore, intelligent agents must choose from a range of possibilities in order to achieve a specific goal, like a physicist applying boundary conditions on the Universal Wave Function in Quantum Cosmology. This act of choosing, or constraining possibilities, is what is meant by the term "fine-tuning." In our repeated experience, only intelligent, free-willed causal agents are known for creating finely tuned systems. Thus, theists have a very good reason to expect the universe to have evidence of fine-tuning for the development and thriving of life. Stephen Meyers offers another abductive syllogism to display this argument. Stated abductively, this would look like:

(1) Given what we know about intelligently designed objects and systems, if an intelligent causal agent caused the universe (if a), then we may expect the universe to exhibit living organisms whose thriving and existence depend on extremely improbable fine-tuned conditions and laws (then b).

(2) We observe our universe contains extremely improbable fine-tuned conditions and laws which life itself depends heavily on that permit the existence and thriving of it (b is given).

(3) Therefore, we have reason to believe a transcendent intelligent causal agent may have acted to create and design the universe for such an outcome.

Indeed, Theism does expect to discover the values of the constants of the laws of physics and the initial conditions of the universe that permit life to exist.

Theism Vs. Naturalism With Reference To Cosmic Fine-Tuning

The idea that an immanent intelligence, like aliens, may be responsible for the fine-tuning, as many naturalists posit aliens as the cause for the origin of life, is not an adequate explanation either. Rather, the evidence of the beginning of nature and the presence of fine-tuning from the start suggest the intelligence was transcendent to the universe, and not within it. Thus, the fine-tuning evidence also offers epistemic support for the Theistic and Deistic hypotheses, as they posit an intelligent personal being that exists outside of the universe that can cause it and has the abilities to choose out of a range of possible worlds. Because of this, the postulations of Theism and Deism offer explanations that are causally adequate to produce a finely-tuned universe. But what about Naturalism?

Do naturalists have a reason to expect such a finely-tuned universe that allows for the thriving of life? Naturalism denies the existence of anything beyond the physical universe, as previously mentioned. It assumes that the laws of physics can explain all phenomena (scientism). But the laws of physics cannot explain the fine-tuning of the constants within them, as well as the initial distribution of mass-energy and other conditions of the universe. The laws of physics simply describe phenomena in nature that obey a repeated pattern or behavior. The structure of the equations allows for various values to be used, as well as the constants being features of the equations themselves, and they are not something the laws themselves can explain on their own. Furthermore, the laws of physics do not explain why the universe had the precise initial conditions and mass-energy distribution it did at the start, as the laws simply apply to those conditions to govern their development with time. In simpler terms, the laws presuppose the material conditions of the universe in order to describe it accurately.

If you read chapter 6, you may recall discussing how differential equations, or mathematical formulas used to describe objects within physical systems, have a near-infinite amount of possible solutions when left alone. There must be initial conditions of the system, as well as the boundaries of it, determined by measurement of the material conditions of the system, before they can accurately describe a phenomenon in nature. Once this is done, the number of possible solutions is limited, and the equation can now include solutions that describe the material system in question. Neither the boundary conditions nor the initial conditions are determined by the equations themselves; in this case, the laws of physics. The laws simply describe what will happen once the conditions are discovered and applied. And those are discovered by external input; thus, the laws do not explain why the system has the boundaries or initial conditions it does; they just describe what will happen. “That information is logically extrinsic to the structure of the form of the law”.[4]

The fundamental laws of physics in no way determine the fine-tuned initial arrangement of the laws, as well as the initial distribution of mass-energy at the beginning of the universe that determine its larger-scale structure later on in its development. In mathematical logic, the initial and boundary conditions are not determined by the laws, but the physicist must take them into account from the very beginning and onward; in other words, they are contingent values. The laws of physics presuppose the initial conditions and distribution of mass-energy.

What Does Naturalism Expect?

Since our repeated and unified human experience has shown us that finely-tuned systems result only from intelligent agency, and since Naturalism denies the existence of any intelligence beyond the universe, Naturalists should not expect to find fine-tuning evidence in the universe, which life depends on crucially. They should expect a universe in which every single event that happens can be reduced to the laws of physics, but as we have seen, there are many phenomena that the laws of physics cannot explain, but instead presuppose to make sense of the universe, and it offers a different kind of explanation than the one we are looking for.

But why shouldn't they expect fine-tuning? As mentioned in chapter 4, we went over how Roger Penrose calculated the total possible entropy for the universe, as well as the total entropy of the universe if it were a black hole, thus exhibiting as many possible distributions of matter as possible, or the most chaotic system for the universe physically possible. What he discovered is that the laws of physics are consistent with a very large range of possible universes, each with different constants and initial mass-energy distributions. And since the laws of physics do not determine the values of those conditions, there is nothing that favors one universe over another; it is completely random. Penrose showed us that the probability of a lifeless universe given Naturalism is vastly greater than that of a life-permitting one. He calculated the total entropy of our present universe to be 10^{101}, yet the total entropy of the universe as a black hole was 10^{123}, which is substantially greater than 10^{101}. In fact, subtracting 10^{101} from 10^{123} just yields 10^{123} again, because 10^{123} is 10^{122} times greater than 10^{101}. This represents the total number of universes that would result in a black hole universe as opposed to a life-permitting one.

But also given the fine-tuning of other parameters, like the expansion rate of the universe. If it were changed slightly, we would be in either an eternally and uncontrollably expanding universe or one that is overcome by gravity and re-collapses in on itself. There is a greater reason to expect a lifeless universe given Naturalism than a life-permitting one. Positing an intelligence resolves this issue because a mind can organize and limit possibilities to achieve the goal of life in a cause-and-effect universe without being compelled by an external agent or material state.

Theism vs. Pantheism with Reference to Cosmic Fine-Tuning

Now we can move on to Pantheism. Does it offer a better explanation for the discovery of the fine-tuning of the laws of physics and the initial conditions of the universe? The god of Pantheism is not a conscious being or personal agent who can make decisions or communicate with other intelligent agents. This means there is nothing to do any choosing for the goal of life, but there are more issues. There is a very fine line between things that are alive (life) and inanimate things (matter) concerning the physical world, yet pantheists see them all as the same thing, part of the "Universal One." They see everything about consciousness as an illusion, because we are all part of one big impersonal personality.

Therefore, Pantheism, like Naturalism, fails to explain anything outside the universe to account for what determined the initial distribution of mass-energy at the beginning of the universe. This is because there is no prior intelligence to make choices about the values of the constants and distribution to allow for the development of life in the universe. Pantheists see god and the universe as sharing the same self-existence. Since god is eternal, and so is the universe, the universe is not created; but we do not see evidence for this proposition. If the universe began to exist, then there is no intelligent agent outside of it because nature and god are the same being. This, in turn, fails to explain the fine-tuning of the universe, as the universe itself cannot choose the initial conditions that are decided and imposed external to it.

God Explains Cosmological Fine-Tuning

The fine-tuning of the constants in the laws of physics and the initial conditions of the universe represent effects that require an explanation. A “why” type of explanation. This explanation must have the attributes that fit the criteria that allow it to produce the effect in question. Since the effect is the emergence of space, time, matter, the initial distributions of it, and the fine-tuning of the constants of the laws of physics and their relationships to one another, the cause must have the attributes of transcendence, intelligence, and personality to have decided to create a universe finely tuned for the existence of intelligent life on Earth. Theism and Deism both posit explanatory entities with these attributes, along with free will, infinite intelligence and creativity, and infinite power. God possesses the correct skill set, as Stephen Meyer would put it, and the causal powers to create a finely tuned universe with the goal of life.

> “Similarly, positing a specifically transcendent intelligence to explain the fine-tuning is warranted by the nature and the timing of the appearances of the effect itself—and by attributes of the posited cause, namely, God.”[5]

Neither Naturalism nor Pantheism offers any possibility of the existence of an entity with the attributes required to create a universe and explain the fine-tuning of the constants and initial conditions of our universe. Therefore, Theism and Deism offer better explanations for the beginning and fine-tuning of the universe we live in today than Naturalism or Pantheism.

The Divine Cause

We have attempted to stay as objective as possible in our search for what caused the universe. We found that there are four main hypotheses to explain the beginning and fine-tuning of the universe. Naturalism, which denies the existence of anything beyond nature from which all else can come; Pantheism, which equates god with the physical universe and denies anything external to it; Deism, which posits a transcendent God who created the universe and did nothing more after; and Theism, which affirms God created the universe, but also acts within it afterward. Of those four worldviews, Deism and Theism emerged as the only postulates that are causally and explanatorily adequate to account for the discoveries that our universe is finite in the past and fine-tuned from second zero.

More wild forms of Naturalism, like String Theory or Quantum Cosmology, only push the fine-tuning issue back to unobservable realms, and themselves have theistic implications of minds acting on prior information limitations. They also lack the predictive success that more accepted theories of physics and cosmology have had, meaning they lack observable confirmation. They represent more bloated ontologies and confusing explanations than the Theistic hypothesis. The discoveries discussed thus far imply that the cause of the universe cannot be something within the universe, as even sufficient reason tells us that it is irrational.

The cause of the universe must be transcendent, and no Naturalistic theories offer something external to nature to cause. The existence of God is well supported by modern scientific discoveries, and it motivated the development of science into the systematic institution of discovery it is today. In the next chapter, I will discuss the final implications of this truth. Coming to a closing conclusion on what caused the universe. What we can say for now is that God is the best, simplest, causally adequate, and logically consistent explanation for the cause of the universe. May He reach you, and seep into your heart, and open you up to the love and grace He has prepared for you.

Chapter 8 Notes

[1] (Alexander Vilenkin, *Many Worlds in One: The Search for Other Universes*, New York: Hill and Wang [2006], pg 176)

[2] (Quote from an interview in The New York Times, March 12 [1978])

[3.] (Meyer, Stephen C. *Return of the God Hypothesis: Three Scientific Discoveries* That Reveal the Mind Behind the Universe. New York: HarperOne, 2021, pg 253)

[4] (*Ibid*, pgs 267-269)

[5] (*Ibid*, pg 277)

Chapter 9
The Causal Adequacy Of God
As The Cause Of The Universe

A Final Look At The Implications That God Represents The Best Explanation For The Beginning And Fine-Tuning Of The Universe.

Where did everything come from? Is the universe self-existent? Is it eternal? Can actual infinities exist within the universe? Is the past infinite? Did the universe have a beginning? If so, can an appeal to matter and energy be made? Why does a singularity mark the beginning of the universe? Aren't naturalistic models more probable? Can't the laws of physics explain why there is something rather than nothing? Is God a reasonable hypothesis?

In this entire volume, we have been examining the evidence that confirms the main philosophical argument supporting the existence of God as creator of the universe. If the universe began to exist at some point in the past, and all things that begin to exist have a cause for their beginning, does that not mean the universe has a cause? Even the most common-sense interpretations of the evidence point to this, as well as the entirety of causation and the foundations of the institution of scientific endeavor. In the first chapter, we separated the wheat from the chaff by going through the different theories of truth. What is the truth? It is that which corresponds to its grounding in reality; telling it like it is. Is truth subjective and relative? Subjective truth is subjective, in that its grounding in reality is the preferences of a subject. What is not subjective is truth entirely, as all truth has an objective grounding in reality (even subjective truth claims are grounded in the very real subject making the claims). I then briefly covered the three modes of reasoning, deduction, induction, and abduction, and how they will be utilized in this book.

Then the Kalam Cosmological Argument was put forth and explained in chapter 2. This philosophical argument has three very simple premises, and if two of them are true, then the third one logically follows. It states that all things that begin to exist have a cause for their beginning, a common-sense intuition that doesn't even require familiarity with the workings of causation. The second premise states that the universe is a being that began to exist. Chapter 3 displayed the evidence and history leading to the Big Bang Theory, which posits that the universe is expanding and had a beginning point in a cosmological singularity that represents a beginning to the universe's expansion and emergence of space, time, and mass-energy. We covered positive evidence for a cosmic beginning, whether in an inflationary/string model or not, through the revelations of the BGV Theorem. We also went over the various reasons to reject the infinite past, as you cannot reach an infinite limit by adding past events, along with logical absurdities that arise if the past truly is infinite.

Since the universe, as far as we can tell, has had a beginning, the universe has a cause. With the help of Stephen C. Meyer & John Lennox, we examined the four main answers to the question, Where did everything come from? Or, what caused the universe? These four answers represent four metaphysical hypotheses to the question of what it is that everything else comes from. The cause of the universe could be the result of nature (nothing beyond the natural world), or Naturalism; Pantheism (God is equated with the natural world), Theism (an intelligent and personal transcendent God created and acted within creation), or Deism (an intelligent and personal transcendent creator who has not acted since creation). We also covered another argument, that from design, or the Teleological Argument. We noticed that not only did the universe have an absolute beginning some time in the finite past, but that it also exhibits properties of extreme fine-tuning in both the initial distribution of mass-energy and the arrangement of matter and antimatter, along with the constants of the laws of physics that govern it.

After that, we went over multiple naturalistic alternatives for the origin of the universe that all failed to offer simpler and more probable explanations for the beginning of the universe, as well as making the fine-tuning problem much worse. Then we compared the explanatory power of each metaphysical hypothesis about the beginning and fine-tuning of our universe, and the two hypotheses of Theism and Deism came out to be the most adequate explanations. Using sound reasoning and inference to the best explanation, we concluded that theism and deism offer the best explanations for the beginning and fine-tuning problems that plague naturalistic models.

God Of The Gaps?

One of the most immediate objections to the conclusion that God created the universe based on evidence is that this commits a God of the gaps fallacy. This is when someone invokes God's action to explain a natural phenomenon, and science eventually discovers that natural laws produced it, making the conclusion initially faulty. Gap arguments use gaps in scientific knowledge or explanations to justify the postulation of an act of God. It is assumed that since science cannot explain a process yet, God is responsible for it, and it serves as proof of God. But is the God hypothesis, as laid out by many philosophers, apologists, theologians, scientists, and more, actually a God of the gaps argument? Can we say that science will discover natural laws that explain the cause of the universe ex nihilo (from nothing), or if it had an external cause transcending it? Does saying that God caused the material world to come into existence commit a gap fallacy? Is it truly a logical fallacy to posit an immaterial causal agent as the first cause of the material world?

Although we are concerned with the explanatory gaps in naturalistic models, we surely do not conclude that God is a better one based on them alone. We use "straightforward considerations of causal adequacy along with parsimony and other theoretical virtues to assess the explanatory power of competing metaphysical hypotheses"[1] and, by utilizing inference to the best explanation, Theism and Deism come out as the best and most plausible ones. God and science do not even compete as explanations for the beginning and fine-tuning of the universe. We do not conclude God based on gaps, but on positive evidence and arguments for such. The God explanation does not commit a gap fallacy in any shape or form. Science offers a different type of explanation (descriptive) than does God (personal), and oftentimes you need both a personal and scientific explanation to get a full picture of a highly ordered and complex object, event, or phenomenon.

If the universe came into being some time in the past, the cause of its beginning cannot be bound by space, time, mass-energy, or the laws that govern their regular behavior. It must be transcendent, omnipotent, creative, personal, and intelligent. These attributes fit the concept of God as held by theists. Therefore, God is a sufficient explanation for the fine-tuning of the initial conditions and the beginning of the universe, more so than materialism. This argument offers positive evidence to support its position. A gap fallacy does not offer support; it makes the conclusion based on another argument's gap in explanation. It may fill the gaps in materialism, but that is not the only reason we posit

God. The God hypothesis stands as the most causally and explanatorily adequate explanation for the beginning and fine-tuning of the universe.

A good explanation for the cause of the universe will have to account for two aspects of the universe. It's the absolute beginning in the finite past, and the fine-tuning of the constants of the laws of physics and the initial distribution of mass-energy at the very beginning.

The Causal Adequacy of Nature and God

By comparing the causal adequacy and explanatory power of a hypothesis, one can determine which out of a range of competing hypotheses is the most likely to be true based on the simplicity and parsimonious nature of its postulations. By extrapolating predictions based on the beliefs of each worldview, we can determine what to expect in the universe if each were true, and which one most likely expects and explains the two features in question.

Materialism Fails

We went over how naturalistic theories like the Steady-state and Oscillating universe models eventually died out as more observational evidence was gathered. The Big Bang came out as the most observation-confirmed. Quantum Cosmology did not offer an adequate materialistic explanation for the beginning of the universe and had direct theistic implications with the lack of causal relation between mathematical entities and physical objects. Positing an immaterial mathematical reality seems to imply an immaterial mind able to act on the range of probabilities within, because nowhere in our unified experience does an equation cause something to happen; rather, they are descriptions of the cause and effect, not literally cause and effect, that exist and are utilized inside of a mind. Inflationary models and String theoretical models suffered from bloated ontologies and unobserved explanatory entities. They simply posit far too many unobservable mechanics to say with any confidence that observation confirms them, as well as many failed predictions over the decades.

Before matter and energy came into existence, they did not exist to do any causing. Thus, matter and energy cannot be invoked as an explanation for the past beginning of the universe; doing so just affirms the prior existence of the very thing coming into existence that did not exist prior, which is irrational. The laws of nature cannot be invoked either, as laws of nature are mathematical descriptions of events. The laws of nature describe how nature regularly operates, and how different parts of it relate and interact with each other. They do not cause the material world to come into existence, as without nature, you cannot have a description of it. This reveals the futility in waiting for a Theory of Everything to be discovered, where classical gravity and quantum gravity, along with the three other forces, can be described by a single equation. This equation is seen to describe everything, even why the universe had a beginning fine-tuned for life. No laws of physics/nature can fill the explanatory gap materialism creates, and simply changing how you view mathematical entities as causal agents doesn't just change the reality of the situation either.

The laws cannot explain their own fine-tuning or the fine-tuning of the initial configuration and distribution of mass-energy at the beginning. Moreover, the laws of physics themselves require external inputs of information about the initial and boundary conditions of the system being observed. Yet the laws are fine-tuned, and the initial conditions of the universe are too; therefore, the laws of physics cannot explain away the causal gap materialism obviously provides here.

God Succeeds

On the other hand, positing God does not jump straight to that conclusion based on the critique just made about materialism. This argument provides positive evidence for the causal adequacy of intelligent agency as a possible cause for a specific event: the beginning of the universe. We also reviewed evidence and logic that support the causal adequacy of a transcendent and intelligent mind as the best explanation for the origin of space, time, and mass-energy, as well as the fine-tuning of the initial conditions and laws of physics in the universe. Any cause capable of producing a universe must stand causally isolated or transcendent to the universe, a basic principle of causation. The cause must be immaterial, spaceless, powerful, intelligent, and personal.

Invoking God does not lead to an infinite regress of material conditions or an infinite array of unobservable universes that exist inside prior existing spacetime, as the best evidence suggests a finite universe rather than an infinite one. God, as held by theists, philosophers, and theologians, is viewed as exhibiting specific attributes that enable Him to produce certain effects based on them. In other words, God has certain attributes that, when taken into account, can be expected to produce a certain effect that correlates to those attributes. Therefore, in the words of Stephen Meyer, by articulating those attributes, philosophers can provide a theoretical rationale for affirming the causal adequacy of a God hypothesis. Indeed, by thinking about the attributes and what they entail, we can extrapolate predictions based on those attributes that warrant a specific effect. Moreover, evidence from the physical world provides further confirmation of the adequacy of God.

We also covered how we can extrapolate from the creative capacity of the human mind to a possible cause of the universe. Human minds, uncompelled by prior external conditions that must be met, can alter material states or create something new by rearranging the prior matter. So it is reasonable to posit a powerful (even omnipotent) transcendent intelligence as the cause of the universe. A divine mind would also explain the fine-tuning very well. We have a unified experience of minds choosing from a range of probabilities to produce information, even complex information. Quantum mechanics has also shed light on this, as the wave function implies that particles result from the actualization of information from an ensemble of possible states enabled by the interaction of an observer or macro-scale object.

> "In other words, in quantum mechanics matter results from an informational input as an observation or interaction with a larger macroscopic object results in the actualization of a specific material state from an ensemble of possible states described by a wave function." [2]

Since human minds exhibit this ability to choose and actualize a material state from a range of possible states, it is wholly reasonable to postulate a transcendent mind with expectedly greater causal powers that would by definition transcend the universe, that can choose among the many probabilities described by, say, a universal wave function. If the universe truly did exist as pure mathematical probability (as quantum cosmology proposes), and the only thing we know of that can use that immaterial reality is an intelligent mind. It is with sufficient reason to posit that intelligent mind as the cause for its actualization.

But still, some people expect that some material process or law that describes the entire universe's history will be found. But as we have seen, neither the fine-tuning nor the beginning of the universe is the type of event that the laws of physics themselves can even in principle explain. This should be a red flag to us that there may be an issue with the assumption that the laws of physics can explain everything in the first place. Beyond a misplaced hope in science as the only avenue to truth, there is a deeper logical issue at play. Excluding explanations involving an intelligent agent may cause one to miss the actual explanation.

> "A more intellectually rigorous approach to the challenge of explaining crucial events in the history of the life and the universe would permit scientists and philosophers to consider competing possible explanations even if they posit the activity of a creative intelligence." [3]

We should allow the evidence, void of a priori assumptions about nature, guided by sufficient reasoning, to find its way through the forest of explanation. There is nothing that warrants the exclusion of intelligent agency, only prejudice against anything other than naturalism.

> "More succinctly, we cannot allow God as an explanation for the events that leave gaps in our materialistic accounts of the origin of life and the universe, because we know that scientists will eventually develop adequate materialistic explanations of those events. How do we know that? Because the only alternatives to materialistic explanations commit the 'God-of-the-gaps' fallacy. And around and around we go." [4]

You run in a materialistic circle by leaving out any other explanations but those that hold to the a priori assumption of naturalism and scientism. We must have more open and logical minds when considering the cause of everything, and try to avoid choosing what we simply like, or what pleases our tendencies, as we "dance to our DNA."

What was the Cause?

So far, we have gone over what has been written in this book. What we have not done is an in-depth discussion on the two arguments for God's existence provided here. Those are the Cosmological Argument for the Existence of God and the Teleological Argument for the Existence of God. Because the universe had a beginning, and all material reality, the cause cannot itself be material, confined in time, or bound by an extended body in space and governed by natural laws. In philosophical terms, the cause is transcendent or extrinsic to the universe.

The Cosmological Argument

This argument is a host of smaller arguments that seek to demonstrate the existence of a first cause of the universe. We covered the main argument, the Kalam Cosmological Argument, but there are two other arguments I want to mention before moving on. These arguments practically deal with the beginning of the existence of the universe, and they can be generalized as the Kalam Cosmological Argument (for a first cause), the Leibnizian Cosmological Argument (for a sufficient reason for existence), and the Thomist Cosmological Argument (for a sustaining ground of being).

The Leibnizian Cosmological Argument for a Sufficient Reason for Existence

The Leibnizian Argument was coined by the 17th-century polymath Gottfried Wilhelm Leibniz, who sought to coin an argument for the contingency of the universe. It seeks to counter the claim that the universe is a brute fact, or a necessary being. Contingent means that the object could have been otherwise, and that its existence depends on something separate from itself. In other words, something caused it to exist that very well could not have. Leibniz is famous for writing, “the first question which should rightly be asked is this: why is there something rather than nothing?” [5] This question was a universal one that was applied to all things we observe to exist.

He based his argument on the principle of sufficient reason that he defines in The Monadology: "no fact can be real or existent, no statement true, unless there be a sufficient reason why it is so and not otherwise." He stated that believing the universe is a necessary brute fact is not a sufficient answer to his question. He also argued that this sufficient reason cannot be found within the universe itself; therefore, there must be an ultramundane (other than the mundane world) or supernormal being that is metaphysically necessary in its existence. In other words, the reason cannot be found in what exists; therefore, there must be a being whose non-existence is impossible in order to offer grounds for any other finite and contingent existence.

> “It is a sufficient reason for its own existence, as well as for the existence of every contingent thing.”[6]

William Lane Craig, in *Philosophical Foundations for a Christian Worldview*, notes that the biggest objection to this argument is that Leibniz's sufficient reason seems to be misdefined. There cannot be an explanation for the existence of any contingent states of affairs. If the explanation itself is contingent, it would also need an explanation. However, if the explanation is necessary, then the states of affairs it explains must also be necessary. As a response, some people agree that at some point an unexplained brute fact will eventually arise. The Philosopher Richard Swinburne argues that the best explanation other than a brute fact is God. As an infinite being, not made of any parts, God is far simpler than a material, variegated, extended, and finite universe. It would thus be very important that we look at the premises of the argument.

- ***Premise*** 1: Everything that exists has an explanation for its existence, either in the necessity of its own nature or in an external cause.
- ***Premise 2***: If the universe has an explanation for its existence, that explanation is God.
- ***Premise 3***: The universe exists.
- ***Conclusion***: Therefore, its explanation is God.

Premise one requires that anything that exists has an explanation for its existence that will either be in the necessity of its own nature or in another isolated cause. This gives rise to two types of beings. Necessary beings exist out of their own nature and do not require an external cause to exist. Contingent beings are those whose existence is dependent on external causes or states of affairs in order to exist. Premise two is a bit more debated among atheists because, on atheism, the universe is the only brute fact, and nothing extrinsic to it exists. But when the atheist responds with this, that the universe is a brute fact, they recognize that if the universe did have an explanation (if it were not a brute fact), then that explanation would be God. For why would they appeal to an eternal self-existent universe rather than a finite one if the explanation isn't God?

Premise three states that the universe is an existing thing that has an explanation for its existence. This premise is obvious due to the observational evidence with the red shift, CMBR, and singularity theorems that the universe is expanding and had a beginning a finite time ago. Still, the atheists may respond that the universe is the necessary being whose existence is explained in its own nature. The main issue with this is the overwhelming evidence against this, as our universe is obviously finite and past incomplete, along with the fact that the laws of physics are consistent with differently arranged universes. And the fine-tuning evidence that implies contingency, it is obvious that our universe is not wholly necessary, as it very well could have been different. The atheists must then provide a better reason for suggesting the universe is a necessary being other than avoiding theism.

The Thomist Cosmological Argument for a Sustaining Ground of Being

This argument also seeks to demonstrate the contingency of the universe and is named after the 13th-century theologian Thomas Aquinas. He coined an argument for a first cause, not based on temporal events like the Kalam, but in the sense of rank. "If the world and motion have a first beginning, some cause must clearly be posited for this origin of the world and of motion."[7] According to Aquinas, who was influenced by Aristotle, all existing things are composed of essence and existence and are "radically" contingent. Essence is a thing's individual nature that defines what it specifically is. Aquinas states that if essence exists, there must be an act of being, and if this act of being did not constantly sustain everything that exists, all things would be annihilated (or not exist). Craig further notes,

> "Essence is in potentiality to the act of being, and therefore, without the bestowal of being, the essence would not exist."[8]

Potentialities cannot actualize themselves; an external cause or mind must act on them, because the object would have to exist already in order to bestow being on itself (x caused x to come into being), which is contradictory. If all material reality is contingent and could not have been, and any finite substance is sustained in existence by a ground of being, then this ground of being cannot be composed of essence, existence, or smaller parts and would require no sustaining cause itself. It would be a being that just exists, like the name of the God that revealed Himself to Abraham as "I AM" (Exodus 3:14). Craig continues,

> "We cannot say that this being's essence includes existence as one of its properties, for existence is not a property, but an act, the instantiating of an essence."[9]

This being's essence must simply be existence, the pure act of being. This argument would further establish, on top of the Leibnizian argument, that the universe is a contingent being dependent on a necessary being for its existence that is not the universe itself. Not only does God offer a sufficient reason for why there is something rather than nothing, but He also provides a necessary being whose existence is explained in the necessity of His own nature. The only issue with the Thomist Cosmological Argument is that it is difficult to jump from naturally contingent beings (dependent on material conditions) to metaphysically contingent beings (dependent on a necessary being's sustenance of being for existence). We need another argument to solidify our conclusion, for we have not yet established a fully necessary being. We need some confirmation that our universe truly is contingent and finite.

The Kalam Cosmological Argument for a First Cause of the Universe

This is the argument that we discussed in a previous chapter. It aims to show that the universe has a beginning at some point in the past. Since something can not come from nothing, the universe must have a cause that transcends it. This includes both deductive arguments for the impossibility of an infinite regress and the existence of an actual infinite, and also inductive arguments based on the observational evidence found in astrophysical cosmology that led to the most accepted cosmological model, the Big Bang Theory. This theory posits that the universe originated ex nihilo or from nothing at a finite time in the past. And since, again, something cannot come from nothing, the universe has a transcendent cause. The premises are as follows.

- ***Premise 1***: Everything that begins to exist has a cause for its existence.
- ***Premise 2***: The universe began to exist.
- ***Conclusion***: Therefore, the universe has a cause for its beginning.

One of the properties of metaphysically necessary beings is to be eternal, or without beginning or end. If the universe began, then that means it is a contingent being, because if it were not, it would not have begun. Also, if the universe started, it cannot be a metaphysically necessary being, or, as the atheists would put it, a brute fact. The Kalam

Cosmological Argument aims to demonstrate that the universe had a beginning in the past. It shows that the universe did in fact begin, and is a contingent being. But this contingency is unlike any object in the universe, as it came into existence ex nihilo. Therefore, the atheist is forced into a weird position, as they would have to affirm that the universe is a brute fact and that it came from nothing for no reason... and that's worse than magic! Premise one is thus obviously true as it is grounded in the mere impossibility of something coming from nothing. To affirm the opposition leads to logical absurdities. It fails to offer a reason why anything isn't coming from nothing right now. It is making a contradictory statement that something came from nothing, which is a contradiction of the definitions of something and nothing.

The word nothing is a negative universal quantifier that means "not anything". A universal quantifier is a statement that applies to all things, hence the word universal. So when cosmologists say the universe came into existence from nothing, that is what they mean, not something in a state of nothingness. They are saying that there was nothing before the universe came into existence. Academics like Lawrence Krauss say that there are a variety of forms of nothing, or that the universe is actually mostly nothing, or that quantum mechanics tells us that nothing is unstable. People like these are misleading people on a semantic basis by treating nothing as if it were actually referring to something. Doing this does not change anything; nothing still refers to not anything, and is still a universal negative.

> "On the atheistic view, there was not even the potentiality of the universe's existence prior to the big bang. But then how could the universe become actual if there was not even the potentiality of its existence?" [10]

Craig is right; if an atheist stays honest with the definition of nothing and what the evidence in the universe suggests, then the universe truly did not come from anything. It makes much more sense to say that the potentiality of our universe was in the hands of God rather than matter, and that he existed as an immaterial being that caused it. Theists do not say that the universe came from nothing; we say that the universe came from nothing physical, which aligns with the best cosmological theory. Now, premise 2 has been supported by both deductive and inductive arguments that provide observational evidence that the universe is expanding and began at the cosmic singularity. It justifies postulating God. Some of the deductive arguments will be listed below, and after that, the inductive evidence.

The Impossibility of an Actual Infinite

A potential infinite is where the infinite serves as an upper max limit, and some natural number increases to that maximum. A key aspect of a potential infinite is that it will never be reached, which directly ties into an actual infinite. An actual infinite is an actually existing infinite collection of things. In this case, the universe's past would need to be an infinite regress of temporal events. Since change happens over time, and time is a measure of change within space, there is no such thing as truly instantaneous causal events. Likewise, there is no infinitely slow event, as that would just mean it isn't changing. Therefore, any causal event in the universe will have a nonzero duration, or in other words, will be finite. This means that if the past is truly an infinite collection of actual events, an infinite amount of time is entailed. So then, is the universe's past infinite or finite?

But an actual infinite cannot exist. Take my lollipop example. Say I have a chest full of an infinite collection of lollipops, and I hold an event where every person entering gets a lollipop. Say 5,000 people attend, and all get lollipops; how many lollipops do I have left? I still have an infinite amount. Say the candy government taxes 1/3 of my lollipop supply; how many do I have left then? Still an infinite number of lollipops, but even worse, the division the government took is also infinite.

Probably the best way to demonstrate the complete absurdity of affirming the existence of an actual infinite is the use of a hypothetical called Hilbert's Hotel created by the German mathematician David Hilbert. Imagine a hotel called Hilbert's Hotel, and its capacity is filled to the max. If someone comes in and asks for a room, Hilbert, the manager, would just apologize to them and turn them away at the front desk. Now say Hilbert's Hotel has an infinite number of rooms, and a guest still occupies every room. There is not one room with no guests staying in it. Suppose a couple enters the hotel and asks the manager for a room. Hilbert can simply move the people in the first room to the second room, the people in the second room to the third, and the people in the third room to the fourth, and so on. Now room 1 is empty, and the new guests can stay the night despite the hotel having no vacant rooms to begin with.

Say an hour goes by, and an infinite number of guests arrive at the hotel. "No problem," says Hilbert. He moves the couple that just entered room1 into room 2, and the people in room 2 into room 4, then those in room 3 into room 6, each time moving the person in a room into a room that is double the number of the one they are in. When Hilbert does this, all the guests move into an even-numbered room, leaving the odd-numbered rooms empty (which turns out to be infinitely many), making room for the new guests. Because a division of an infinite yields another infinite. Despite the infinite hotel still being full before they arrived, Hilbert was able to make room for an infinite amount of new guests.

These absurdities do not arise because we lack knowledge of infinites. They arise because we know so much about them that we can identify reasons why they can't exist in the real world. If the universe truly were infinite in the past, then all of the absurdities mentioned (and more) logically follow. If an actual infinite cannot exist in the real world, and an infinite regress represents an actual infinite, then an infinite regress of events cannot actually happen. Therefore, the universe must have had a beginning for today to happen.

The Inability of Successive Addition Reaching an Actual Infinite

The next step is to consider the impossibility of successive addition forming an actual infinite. This is also called the impossibility of traversing an infinite, which brings to mind the concept of a potential infinite, where an increasing collection can never reach the maximum limit. If the universe were eternal, the past would most certainly have to traverse an infinite past to reach today. In other words, there must have been an actually infinite series of events preceding today. This means that today was preceded by the prior day, and that day was preceded by another day, preceded by months, and years, on and on ad infinitum (to infinity). Therefore, if the universe never began in the past, then the present day would never have arrived, and we would not be observing it.

If a collection of natural objects formed by successive addition cannot be an actual infinite, and if the past is a collection of events that were formed by successive addition, then the past, without a reasonable doubt, cannot actually be infinite.

The Impossibility of an Infinite Past from the Second Law of Thermodynamics

The last deductive argument I will mention is the impossibility of a truly infinite past based on the second law of thermodynamics. The second law states that any process within a closed system will always tend towards decay, or equilibrium. This means that everything is running down. If you leave your car out in the sun with its new paint job, it will eventually lose its clear coat and begin to oxidize and peel; then the metal underneath will begin to rust, and your car will be unusable. Naturalism sees the universe as a closed system, as space, matter, and time are the only things that exist. This means that given enough time, the universe will run down, and all of the energy available to perform work will be transformed into useless heat, and the entire universe will reach a state of equilibrium. This is known as the heat death of the universe.

If the universe were infinitely old or eternal, then it would have reached thermodynamic equilibrium an infinite amount of time ago. This implies that at some moment in the past, the universe was "wound up" or organized, indicating the start of its deterioration. To make this point clear, imagine you walk into your friend's house while they are at work. When you open the door and look down the hall into the kitchen, you see a small wind-up racecar zooming around a small toy track. You walk up to it, and soon the toy car begins to slow down and stops. You may reasonably make the inference that someone was present who was able to wind up the toy just before you came in. Likewise, we experience the same thing when we think about the second law of thermodynamics and an eternal universe. If the toy car had been there an infinite amount of time before you walked in, then there is no reason for it to be still moving when you walk in, unless an intelligence was present to do so, which has theistic implications.

Observational Evidence in Astrophysics And Cosmology

The last bit of support I will offer is the inductive observations from astrophysics and cosmology. We reviewed how Albert Einstein formed his General Theory of Relativity, which was a theory of gravitation. It viewed space as a four-dimensional geometric model that unifies the three spatial dimensions with a fourth continuum of time. This model suggested that space and time are ultimately linked, birthing a new entity, spacetime. Einstein applied space-time to the entire universe, which led him to some revelations. He realized that if gravity were the only acting force in the universe (that objects with mass warp the spacetime around them so that less massive objects essentially "fall" into them), then the universe would have collapsed in on itself, but that obviously didn't happen. This led him to punch in his fudge factor, a repulsive force called the Cosmological Constant, that counteracted the attractive force of gravity.

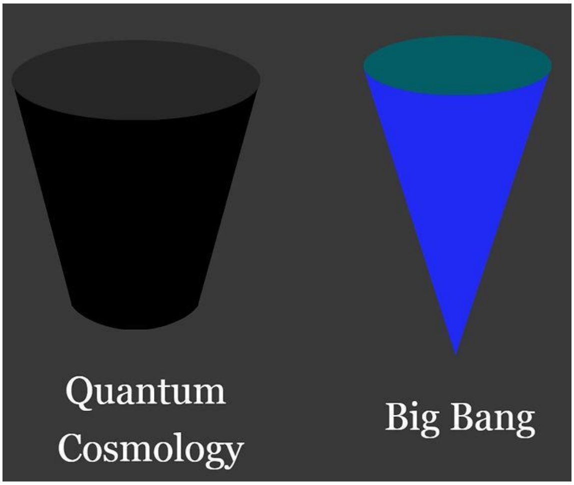
Around the same time, discoveries in the heavens were being made. Edwin Hubble would expand on the previous work of many astronomers to collect evidence that suggested the universe was expanding. This was the record of redshift. Where a universe moving towards us will squish its light to the blue end of the spectrum, those moving away will stretch it out to the red end. He essentially made the correlation that the more distant a galaxy was, the more redshifted it was. He formulated this relationship to create Hubble's Constant, which states that for every megaparsec, the universe expands about 73-77 ± 14 Km/s. Then Aleksandr Friedmann and Georges Lemaitre produced the solutions to Einstein’s field equations that demonstrated that the Cosmological Constant was so fine-tuned that practically any other value would either cause the universe to rapidly expand forever (a heat death) or collapse in on itself as gravity overpowers the Cosmological Constant (the big crunch). This, combined with the evidence of expansion, led to the consensus that the universe was expanding.

If the universe is expanding, then it must have had a beginning, because at some point in the past, there would be a point in time when all of the space and matter of the universe was so small that it basically did not exist prior. This period represents a singularity, where spacetime curvature, temperature, and density reach infinite values, and the volume of space becomes zero. It represents a boundary of spacetime, as there is nothing that exists outside of the singularity. This is because the universe is everything, including space, so there was nothing for anything to exist in beforehand. Video representations of the Big Bang are very misleading, as there is no outside for which someone could see the bang, for there is nothing but the universe under naturalism. This was the Friedmann-Lemaitre Model that became the Standard Big Bang Theory, which postulates that the universe had an absolute beginning ex nihilo. Not only does mass-energy, but also space and time, emerge at the singularity.

> “It belongs analytically to the concept of the cosmological singularity that it is not the effect of prior physical events. The definition of a singularity.... entails that it is impossible to extend the spacetime manifold beyond the singularity.... This rules out the idea that the singularity is an effect of some prior natural process.” [11]

The Big Bang Theory has been confirmed time and time again in its predictions, trumping alternative theories in prediction, parsimony, and explanatory power. Furthermore, in 2003, Arvind Borde, Alan Guth, and Alexander Vilenkin formulated a theory that applies to all universes that are, on average, expanding, including the eternal inflationary multiverse, which must be past incomplete, or not eternal. This comes from the principle that no information or energy can travel faster than the speed of light. In an infinitely expanding space like ours, as time is reversed, the space around objects receding from each other becomes smaller, along with the space in between them. As time is reversed further and further back, their apparent velocities speed up, eventually reaching the speed of light, which would mark a physical barrier for the energy. This would necessarily mark the beginning of the expansion (See [2] for an in-depth explanation, reference, and drawing).

Moreover, William Lane Craig offers a very interesting critique of Quantum Cosmological Models. James Hartle and Stephen Hawking's theory posits that classical spacetime emerges from a "quantum gravity regime" (describing space before its size at the Planck Length, or in other words, when the universe was smaller than 1×10^{-35}m) that essentially makes the pointed edge of spacetime a round curve that is smooth with no edge.



The Big Bang posits that the universe is expanding; in the reverse direction of time, the universe grows smaller and smaller in volume until it reaches a point of zero volume and infinite curvature. Quantum Cosmology, on the other hand, smooths the point to many possible universes described by the universal wave function.

It is not past eternal in the classical sense, but this is not the issue at hand. The quantum gravity regime, which includes superspace, cannot literally exist timelessly because it is in a state of constant fluctuation, which implies before and after relations. Since it is seen as existing before classical time, and classical time actually emerges from it, there seems to be some type of temporal relationship between superspace and classical time. Even if it is not temporal in the classical sense that we understand, there would still be some sort of time. But if it is temporally infinite (past eternal), and unstable due to fluctuations, then it would have produced a universe an infinite time ago, but we do not observe that. Moreover, this would entail all of the absurdities previously mentioned about an actual infinite. Craig's critique can be paired with the problem of what "breathes fire" into the universal wave function to collapse into our universe. The period before the classical universe cannot be eternal, because if it were, that would not explain why it did not produce a universe an infinite time ago, since it would inevitably do so.

In addition, simply postulating mathematical entities does nothing to produce a universe, as mathematical entities do not stand in causal relation to material affairs. Mathematical entities can only be incorporated into a change of material states via the activity of an intelligent agent able to utilize them. In 2013, cosmologist Aron Wall developed a new singularity theorem that appeared to rule out the possibility of a quantum gravity theory resolving challenges related to thermodynamics and time. Given the second law of thermodynamics in the quantum gravity era, he says, the universe must have had a beginning unless one posits a reversal of time, which would still imply a thermodynamic beginning. Wall concludes,

> “It is reasonable to believe that the results will hold in a complete theory of quantum gravity.”[12]

These arguments offer massive support for the Kalam Cosmological Argument. The second premise seems to be confirmed, where the conclusion necessarily follows that the universe has a cause for its beginning. There seem to be some minimal properties that this being must have to be adequate to cause the universe in the Cosmological Argument. It must transcend space and time, and exist a-temporally (timelessly) and nonspatially (spaceless) without the universe's existence. This means it will be a changeless and immaterial being, since it is not bound by a space to exist in and time to change. Timelessness entails changelessness, and changelessness also implies immateriality. The cause of the universe must therefore be beginningless and uncaused; it must be an immensely or all-powerful being to produce the entire physical universe; and it must be a personal being in order to have the properties needed to cause a material state without prior material conditions compelling it to do so. It must also be a person due to its ability to choose from a range of possible universes, ours.

The Cosmological Argument does not lead someone to conclude that the universe caused itself, or is a brute fact; instead, it leads to it being a contingent being with an absolute beginning in the past. This means that the universe's cause cannot itself be a contingent being, since the universe is seen as "all that is," and cannot be bound by the universe itself; in other words, it must transcend spacetime reality. In this case, it is transcending nature, or supernatural. No natural entity or process can meet the required attributes needed to produce a universe from nothing physical. God, as conceived by theists and revealed in the person of Jesus Christ, is such an entity that is wholly explanatorily adequate to produce the universe we observe today.

"In the beginning was the Word, and the Word was with God, and the Word was God. He was with God in the beginning. Through him all things were made; without him nothing was made that has been made. In him was life, and that life was the light of all mankind. The light shines in the darkness, and the darkness has not overcome it." (John 1:1-5)

The Teleological Argument for the Existence of God

Any account of the origin of the universe must not just account for the beginning of it some time in the past, but also the fine-tuning of the constants of the laws of physics and the initial distribution of mass-energy at the beginning of the universe. Despite the Cosmological Argument alone being a rather solid argument for the existence of God based on the beginning of the universe, there is one other argument that, when paired with the Cosmological Argument, is near unstoppable. The argument from the fine-tuning of the universe is known as the Teleological Argument for the Existence of God. Teleological, derived from the Greek words telos (τέλος), meaning end or goal, and logos (λόγος), meaning explanation, and emphasizes understanding why things exist, instead of merely how they came into being. The Teleological Argument refers to the appearance of design in the natural world, hence its aim at demonstrating that the universe is designed for life, or an argument from fine-tuning.

It seeks to show the existence of God from the appearance of design, or fine-tuning, built into the very structure of the universe that the universe itself cannot explain. It does seek to demonstrate God based on the design of biological systems, but that is not the focus of this series. Suffice it to say that the Teleological argument seeks to prove the existence of God based on the fine-tuning of both the universe for life, and the life within it. Indeed, the universe seems to exhibit complex and sensitive initial conditions that guarantee the thriving of life. The chances of our universe appearing from random chance are far too great to brush off as mere coincidence. As well as the sheer fine-tuning of the relations of the constants of the laws of physics, as well as their individual values, with respect not just to each other, but to themselves concerning the later development of the universe.

When the regular behaviors of nature are given a mathematical description, they contain constants whose values are not mandated by the laws of physics themselves; in other words, the laws of physics cannot explain their own fine-tuning. Therefore, to call upon the laws of nature to explain fine-tuning does not suffice, as the fine-tuning is of the laws themselves. A car engine itself cannot explain why it may or may not have a certain number of 10mm bolts, or a specific hose size; the engineer must be asked. When we say these values are fine-tuned, we mean that the values of the constants are set so that if they are altered even slightly, it renders our universe life-prohibitive.

Einstein's field equations help determine the universe's spatial configurations based on mass-energy distributions. Initially, this distribution needed small fluctuations in addition to being uniform to allow large-scale structures to accumulate in the universe. Einstein's famous equation E=MC2 shows energy and matter as forms of the same substance. At the universe's start, it was a dense energy point, not yet forming matter, affecting future large-scale structures like stars and galaxies. If the initial mass-energy distribution varied slightly, it would either lead to a universe of black holes or one too sparse for gravity to form structures, preventing elements, stars, and galaxies. General Relativity posits that mass bends spacetime, affecting gravity. The initial energy distribution, which cooled into matter, determined future structures. This distribution is fine-tuned to 1 part in 1055, meaning any change would lead to different universe outcomes. Physicists call this initial distribution the universe's initial entropy. A high initial entropy would create black holes, while low entropy results in ordered structures. Our universe's later ordered structures (galaxies) indicate low initial entropy.

To evaluate the necessary entropy, we must determine alternative configurations that lead to a life-permitting universe and assess potential fine-tuning. Black holes have the highest possible entropy due to the many chaotic forms matter takes within, while galaxies have low entropy due to their ordered structure. The universe's current low entropy, with more stars and galaxies than black holes, implies lower past entropy that increased over time. Roger Penrose calculated initial mass-energy configurations for a life-permitting universe. Assuming no universe could exceed a black hole's entropy, he used the Bekenstein-Hawking Equation to find the maximum entropy for our universe. He calculated 10^{43} per baryon, multiplied by 10^{80} baryons in the observable universe, resulting in 10^{123} entropy for a black hole universe. Penrose then calculated the current universe entropy, assuming each galaxy has a central black hole with one million solar masses, yielding an entropy of 10^{21} per galaxy. Multiplied by total baryons, this gave a universe entropy of 10^{101}. The universe's initial entropy was improbably low compared to the possible mass-energy configurations, as 10^{123} is far greater than 10^{101} (subtracting 10^{101} from 10^{123} yields 10^{123} again!). Thus, our universe's initial entropy was extremely improbable, resulting in a life-permitting universe.

A universe capable of supporting life depends not only on its initial conditions, but also on various other factors that could have been different, and if they were, intelligent life on Earth would not have flourished. Another key aspect is the universe's expansion rate, which significantly influences whether a universe can support life. Stephen Hawking calculated the universe's expansion rate to be fine-tuned to 1 part in 10^{17}. This means that if the expansion rate were reduced by $1/10^{17}$th of its current value, gravity would have dominated expansion, leading the universe to collapse under its own gravity. However, the expansion rate is influenced by other factors that are also finely tuned. The mass-energy density would have been approximately 10^{24} kg, and a change of even one kilogram per meter³ would have prevented galaxy formation. Thus, the expansion rate is fine-tuned to 1 part in 10^{17}, with an additional fine-tuning of 1 part in 10^{24} in its mass-energy density per meter³. Moreover, the cosmological constant (Λ), which represents the mass-energy density in the equations governing the expansion rate, is fine-tuned to 1 part in 10^{90}. This indicates that the expansion rate is fine-tuned on multiple levels.

Roger Penrose not only calculated the total entropy of the universe, but also the chances of the low-entropy energy condition (high order) being met from random chance is no less than 1 part in 1010^{123} (that is 10, to the power of 10, to the power of 123). [13] What we have done in comparing the explanatory power of competing metaphysical hypotheses is using Inference to the Best Explanation (abduction) to make an inference to design. With William Dembski's Design Inference, what testifies to the activity of an intelligent agent is a highly improbable collection of things or events that conforms to an independent pattern or functional end we recognize from our experience as intelligent agents. Appealing to the cosmic fine-tuning under the Teleological Argument can be stated as follows:

- ***Premise 1***: The fine-tuning of our universe is either due to necessity, random chance, or the design of an intelligent agent.
- ***Premise 2***: It is not due to necessity or random chance.
- ***Conclusion***: Therefore, the fine-tuning of our universe is due to the design of an intelligent agent.

We will now discuss each premise below, starting with whether the universe's fine-tuning is due to necessity or random chance.

Can the Fine-tuning of Our Universe be due to Necessity?

This claim posits that the values of the constants of the laws of physics and the initial distribution of mass-energy must have had the values they did. This would require believing that a life-prohibitive universe is impossible. But if the distribution of mass-energy at the beginning of the universe were slightly different, or if the universe expanded slightly slower, or if the gravitational constant were slightly greater, the universe would not be compatible with life. Moreover, the laws of physics are consistent with many arrangements of mass-energy, and again, nothing is mandating the values of the constants. So another universe with different values surely seems logically possible. Still, some may hold to a theory of everything. But as already mentioned, a theory of everything has its limits. On one hand, it has the limits of confusing the explanatory category of the laws of physics. A theory of everything would still not explain the fine-tuning of the values within it, even if it did produce a universe.

On the other hand, parts of theories of everything cannot explain themselves. For example, string theory requires our spacetime to be anywhere from 11 to 26 dimensions, yet it does not explain why space should be this way. But there are other initial conditions, as Paul Davies notes,

> "Even if the laws of physics were unique, it doesn't follow that the physical universe itself is unique. ... The laws of physics must be augmented by cosmic initial conditions. There is nothing in present ideas about 'laws of initial conditions' remotely to suggest that their consistency with the laws of physics would imply uniqueness, far from it. It seems, then, that the physical uni- verse does not have to be the way it is: it could have been otherwise." [14]

Any attempt to reduce or explain fine-tuning under naturalism just makes the fine-tuning problem worse and pushes it to another location. As seen with models like the Chaotic Eternal Inflationary Multiverse, the cosmological constant (the force behind inflationary expansion) must be fine-tuned to at least one part in 10^{53}. It then seems reasonable that necessity does not suffice as an adequate explanation for the fine-tuning of the universe.

Can the Fine-tuning of Our Universe be due to Random Chance?

If the fine-tuning cannot be due to necessity, as many consistent probable universes do not allow life, could the fine-tuning be the result of mere chance? Could the universe simply have assumed the values it has because it is more likely than not to? Proponents of the chance hypothesis usually hold to a many-worlds interpretation of the fine-tuning. They believe that there are other causally isolated universes other than ours, even an infinite ensemble, so much so that the chances of a life-permitting universe are rendered more probable than not. Indeed, if there is an infinite number of universes, then there is bound to be a life-permitting one. But there's an issue with affirming an actual infinite, as this means there would be an infinite division of life-permitting universes, not just one that is probable. All types of universes are equally probable to an infinitesimal degree. This too would represent a metaphysical hypothesis, because there is simply no direct evidence for the existence of a multiverse, and it postulates a source from which everything came. Claiming that it is scientific simply because our universe exists is fallacious. The many-worlds/multiverse interpretation is no more metaphysical than the theistic hypothesis, so both will be treated with the same respect.

But, as we have seen, the multiverse interpretation is an inferior hypothesis compared to the theistic one. The theistic hypothesis represents a simpler explanation. Ockham's Razor states that we should try to avoid multiplying unnecessary explanatory entities, or causes beyond those which are necessary to explain the effect in question. Positing a single mind is vastly simpler than a bloated ontology of an infinite array of universes governed by an equally, if not more, fine-tuned system(s) than our current universe. Atheists would need to posit a mechanism simpler than mind action that can produce a universe, but none have ever been able to do so. There is simply no evidence for the existence of any other universe other than the fine-tuning evidence, which is better explained by the theistic hypothesis. The many-worlds interpretation bases its entire motivation on avoiding theism. Compare this single piece of evidence for the multiverse to the long line of arguments and evidence for God, including fine-tuning, and it becomes clear that the God hypothesis is a better explanation.

Moreover, the most probable universe with observers is one that appears fine-tuned but is actually illusory to the observer, as it is just a small random fluctuation that happens to form observers in a small local region. In other words, a smaller world with the illusion of fine-tuning is much more probable than an actually fine-tuned universe for observers. This idea originates from the 19th-century physicist Ludwig Boltzmann. He hypothesized that the universe as a whole exists in an equilibrium state that is not ordered like it appears to be, but that over time fluctuations in energy would occur, and at some point, a small area of the total equilibrium would become disequilibrium. Boltzmann called these regions of disequilibrium "worlds." And since in the infinite ensemble of worlds, there is bound to exist a few universes in disequilibrium, and the one we observe is just that. The issue with this hypothesis is that if our universe were simply a fluctuation of energy in a larger collection of energy, then shouldn't we expect to observe a much smaller region of fine-tuning than we do? A small world with the illusion of fine-tuning is much more probable than a larger one that begins at an extremely low level of entropy that decayed over time into a still low-entropy system.

Roger Penrose calculated the odds of our universe forming from random chance at 1 part in 1010^{123}. He also calculated the chances of only our solar system appearing from random chance at 1 part in 1010^{60}, which is a tiny fraction of 1010^{123}.

"In fact, Boltzmann's hypothesis, if adopted, would force us to regard the past as illusory, everything having the mere appearance of age, and the stars and the planets as illusory, mere 'pictures' as it were, since the sort of world is vastly more probable given a state of overall equilibrium than a world with genuine, temporally and spatially distant events." [15]

This issue has led to the Problem of the Invasion of the Boltzmann Brains: the most plausible universe is a single brain that pops into existence, observes its universe and life in a random fluctuation, and then disappears. So, if we were to hold to a many-worlds interpretation, the most likely explanation for our existence (individually) is that we are that single brain that is only a random fluctuation of energy in a total ocean of energy in equilibrium. You would be forced to believe that you are the only person who exists, everything is illusory, even you, and there truly is no meaning to anything. Nobody sane truly lives like that. Therefore, it is extremely unlikely that there exists an infinite array of universes, even under atheism. The solution to this problem is to postulate a transcendent mind that can order and fine-tune that system to produce a finely-tuned universe able to produce fine-tuned life and bestow it with meaning. Any form of the many-worlds hypothesis, without the existence of God, would lead one to a random fluctuation of one brain, and that nothing in human perception is actually real and objective. The fine-tuning is not due to random chance.

Fine-tuning is Due to Design

The second premise has been confirmed: that the fine-tuning of the initial conditions and distribution of mass-energy, and the constants of the laws of physics, are not due to necessity or random chance; therefore, the most reasonable explanation is that it is due to the activity of an intelligent mind. And since this fine-tuning has existed since the beginning of the universe, we may appeal to the same transcendent cause that produced that beginning to have also produced the fine-tuning.

An objection to this is that a cosmic designer would remain unexplained. It claims that an intelligent mind exhibits more complexity than a fine-tuned universe, so if the universe requires an explanation, then so too does the designer. But this misunderstands the nature of explanation. For an explanation to be the best, a person does not need to explain the explanation, as that would inevitably lead to an infinite regress of explanations for even the simplest phenomena. If you stumble upon a log cabin in the deep forests of Alaska, you do not need to explain the people who were there in order to recognize that they are the most likely explanation for the cabin's existence. In a similar way, the conclusion that design is the best explanation does not depend on our ability to explain the designer. Nor does this objection make much sense, as we would need to understand something transcendent to our existence, which is impossible. If God exists, then we would not expect to be able to explain Him fully. He would have to reveal Himself to us in some way.

Besides, this objection is false. The complexity of a mind differs from that of the universe, as a mind is inherently simple. It is an immaterial entity without pieces or parts. Furthermore, attributes such as intelligence, consciousness, and volition are not contingent properties that a mind might lack; they are fundamental to its essence. If you do not have an entity with those properties, then it is not a mind. Therefore, postulating a mind is not the same as postulating an uncaused and uncreated universe. As we have explained in the series, mind agency is simpler than material agency, as a mind can act on material affairs without being compelled by prior material conditions, unlike a material cause. It is therefore much simpler than a material agent.

A Colossal Material Failure

Materialism limits the types of explanations that can be offered, which in turn places a wall in front of materialism. Every single materialistic/naturalistic model for the origin and fine-tuning of the universe does not offer a simpler explanation than Theism and Deism do. The many-world interpretation, of its many flavors, makes the fine-tuning problem worse, and seems to imply the existence of a first cause as well, or that there was an immaterial mind that can act on mathematical possibilities to stand in causal relation to the universe. The singularity marks a point from which nothing can exist external to it, essentially putting a limit on spacetime. This boundary represents an absolute beginning, as nothing exists external to the universe to cause or continue its existence. If the spacetime curvature of the singularity approaches an infinite value and the total volume of space is zero, then it is physically impossible to place nature outside of it. If nothing exists outside the material universe, then the universe, or more space, time, and energy, cannot be appealed to for causing. Therefore, the universe was not caused by nature.

The God hypothesis solves all of these issues by positing an immaterial entity able to act without prior material conditions being met. According to the nature of the event, the beginning of the material world, the cause must be transcendent to the effect, in this case, the universe. It represents the simplest explanation not based on the explanatory gaps of materialism, but on positive evidence supporting the explanatory power it offers. Positing God as the cause of the universe does not commit a gap fallacy, as the conclusion is not based on gaps in the first place! Those gaps are identified and discussed when comparing the explanatory power and causal adequacy of different metaphysical hypotheses, in this case materialism and theism. This is a valid form of abductive reasoning and is in no way fallacious. The objector would thus be required to offer a reason for denying this conclusion that cannot be reduced to an avoidance of theism. But none can be offered based on the nature of the cause and explanation required.

God Caused The Universe

Theism and Deism specifically offered the best explanations for the beginning and fine-tuning of the universe we observe today. What is left now is determining whether the God who caused the universe to be fine-tuned for life has acted within His creation or ignored it. We will examine the origin of biological life and the appearance of design in biological systems on the microscopic level.

Suffice it to say that the universe did not appear out of nowhere from nothing, nor has it always been here. But what can we make of the nature of the cause? William Lane Craig offers a conceptual analysis of the evidence to identify the minimal attributes the cause must have to account for the beginning and fine-tuning of the universe. (1) The cause of the universe must be *uncaused* itself, since an infinite regress of causes is impossible. Ockham’s razor tells us that there is no good reason to posit causes beyond the origin of the universe constantly. Because we shouldn't posit causes beyond necessity, an uncaused cause to the universe represents a simpler explanation than does an infinite array of past causes and material states. (2) The cause must also be *beginningless*. Since whatever has a beginning has a cause, and beginning implies a temporal relation, and time begins in the singularity, the cause can not be subject to time and be atemporal.

This cause must be (3) *changeless*, since an infinite temporal regression of changes cannot exist. Change is a measure of time, and since time is an emergent property with the singularity, the cause is not subject to time and therefore not subject to change. It must be changeless insofar as it exists independent of the universe. And from its changelessness, we can derive its (4) *immateriality*. Everything that is material experiences change at some level, and the cause of the universe is changeless. We also know that before the singularity, there was no matter to do any causing; there was also no space or time. Whatever caused the universe is not bound by space, time, or matter, and is therefore immaterial. The cause of the universe must be (5) *timeless*, at least insofar as it exists transcendent to our time.

> "It is true that some philosophers have argued persuasively that time could continue to exist even if all events were to cease (Shoemaker, 1969; Forbes, 1993), but such arguments are inapplicable in the case at hand, where we are envisioning, not the cessation of events, but the utter absence of any events whatsoever. In any case, the timelessness of the First Cause sans the universe can be more directly inferred from the finitude of the past."[16]

The cause must also be (6) *spaceless*, since immateriality and timelessness are impossible for any spatial entity, and it pre-exists space as a being entirely. If something is immaterial, it could exist in space only in its relation to other material things in space. If so, it then could not be timeless, since it changes in its relation to those material beings. Hence, the first cause must transcend time and space in order to cause them to come into existence. This cause must also be (7) *extremely powerful*, or omnipotent, to cause the entirety of physical reality (the universe) without a material cause doing so. And finally, the cause of the universe must be personal, and Craig offers three reasons for this.

First, as *Richard Swinburne and John Lennox* point out, there are two types of causal explanations. A scientific explanation that will offer a description of the mechanisms and processes that led to the complex object or event in question. And a personal explanation in terms of intelligent agents and their volition. Craig argues that the origin of the universe cannot have a scientific explanation because there is literally nothing before the universe, and since science presupposes material conditions in order to describe events, it cannot be accounted for in terms of physical and mathematical laws operating on a set of initial conditions. This type of event can only be accounted for with a personal explanation in terms of personal causal agents and their wills and goals.

The second reason is that the personhood of the cause can already be deduced from the seven properties I've already mentioned in a conceptual analysis. Only two possible entities can be posited for the cause of the universe:

"...either abstract objects or an unembodied mind. Abstract objects like numbers, sets, propositions, and properties are very typically construed by philosophers who include such things in their ontology as being precisely the sort of entities which exist necessarily, timelessly, and spacelessly. Similarly, philosophers who hold to the possibility of disembodied mind would describe such mental substances as immaterial and spaceless, and there seems no reason to think that a Cosmic Mind might not also be beginningless and uncaused."[16]

Nobody has ever posited anything but a mind or an abstract object, and it cannot be abstract objects alone. Abstract objects are not causal agents; they have no volition and do not cause changes in material conditions. If they were taken to be causes, the only way they can be conceptualized is as mindless events or states; but they cannot cause events in the material world because they do not exist within space and time. A more realistic approach is that abstract objects are only able to be utilized by a mind, and if abstract objects were utilized in creating the universe, then a mind must have been using them. Therefore, the cause must be an unembodied personal mind. The third reason is that only personal free agency can account for the origin of the first effect from an immaterial and changeless cause.

"We have concluded that the beginning of the universe was the effect of a First Cause. By the nature of the case, that cause cannot have any beginning of its existence nor any prior cause. Nor can there have been any changes in this cause, either in its nature or operations, prior to the beginning of the universe. It just exists changelessly without beginning, and a finite time ago it brought the universe into existence. Now this is exceedingly odd. The cause is in some sense eternal and yet the effect which it produced is not eternal but began to exist a finite time ago. How can this be? If the necessary and sufficient conditions for the production of the effect are eternal, then why is not the effect eternal? How can all the causal conditions sufficient for the production of the effect be changelessly existent and yet the effect not also be existent along with the cause? How can the cause exist without the effect?"[16]

Our best evidence suggests that the cause of the universe, under sufficient reason, is a being that is uncaused, beginningless, atemporal, changeless, immaterial, timeless, spaceless, omnipotent, and personal. These attributes all match perfectly with what theists have conceived as God for thousands of years. Thus far, we have concluded that a God-like being caused the material universe to come into existence some time in the past. But has He acted in His creation? Has God created life in the universe? Or has the first cell appeared out of nonbiological molecules in a blind chemical process guided by random natural forces? And being a mind possessing libertarian freedom, God could choose to change the universe from a state of non-actualization to an actualized state now existing without being determined by prior material conditions. The evidence seems to fit the nature of mind action, not material action.

> "It will always mean that when one thinks, acts, or chooses, one is not causally determined or necessitated to think, act, or choose by something or someone else"[17]

Positing a transcendent, immaterial, all-powerful, all-knowing, personal cause for the beginning of the universe is a much simpler explanation than an infinite regress of more fine-tuned material systems. By examining the design and origin of life, we may be able to see whether this God has acted within creation and, if so, whether He has contacted us in any way to make Himself knowable. In doing so, we will review the major world religions and worldviews to see if we can discover if God has actually reached down to man, and if Jesus Christ is the reliable Object of Truth from which all else is grounded. But those questions are reserved for other investigations. For now, it will suffice to say that the cause of the universe was not nature, but rather God. Remember, you can deny the evidence; but you do so on no ground of reason, and exert your God-given Right To Be Wrong.

Chapter 9 Notes

[1] (Meyer, Stephen C. *Return of the God Hypothesis: Three Scientific Discoveries That Reveal the Mind Behind the Universe.* New York: HarperOne, 2021, pg 417)

[2] (*Ibid*, Chapter 20, n. 20, pg 516)

[3] (*Ibid*, pg 425)

[4] (*Ibid*, pg 425, emphasis mine)

[5] (Leibniz, Gottfried Wilhelm. T*he Principles of Nature and of Grace, Based on Reason*. In *Philosophical Essays*, translated and edited by Roger Ariew and Daniel Garber. Indianapolis: Hackett Publishing Company, 1989)

[6] (Moreland, J. P., and William Lane Craig. *Philosophical Foundations for a Christian Worldview*. Downers Grove, IL: InterVarsity Press, 2003, pg 478)

[7] (Aquinas, Thomas. *Summa Contra Gentiles*. Translated by Anton C. Pegis, James F. Anderson, Vernon J. Bourke, and Charles J. O'Neil. 5 vols. Notre Dame, IN: University of Notre Dame Press, 1975)

[8] (Moreland, J. P., and William Lane Craig. *Philosophical Foundations for a Christian Worldview.* Downers Grove, IL: InterVarsity Press, 2003, pg 477)

[9] (*Ibid*, pg 478)

[10] (*Ibid*, pg 480)

[11] (Craig, William Lane, and Quentin Smith. *Theism, Atheism, and Big Bang Cosmology*. Oxford: Clarendon Press, 1993, pg 120)

[12] (Wall, Aron C. "The Generalized Second Law Implies a Quantum Singularity Theorem." arXiv preprint arXiv:1010.5513, October 26, 2010, pg 38)

[13] (Penrose, Roger. *"Time-Asymmetry and Quantum Gravity."* In Quantum Gravity 2: A Second Oxford Symposium, edited by C. J. Isham, Roger Penrose, and D. W. Sciama, 244–272. Oxford: Clarendon Press, 1981, pg 249)

[14] (Paul Davies, *The Mind of God: The Scientific Basis for a Rational World*, New York: Simon & Schuster, 1992, 169, quoted in J. P. Moreland and William Lane Craig, *Philosophical Foundations for a Christian Worldview*, 2nd ed., Downers Grove, IL: IVP Academic, 2017, pg 496)

[15] (J.P. Moreland and William Lane Craig, *Philosophical Foundations for a Christian Worldview,* pg 499)

[16] (Craig, William Lane. *"The Scientific Kalam Cosmological Argument."* Reasonable Faith, 2015, pgs 18-21)

[17] (Bates, Clark R., and Timothy A. Stratton, eds. *Faith Examined: New Arguments for Persistent Questions, Essays in Honor of Dr. Frank Turek.* Eugene, OR: Wipf and Stock Publishers, 2023, pg 93)

Chapter 10
Final Remarks

Addressing Some Final Remarks And Things That Haven't Been Mentioned

Not every volume or book is able to cover every single objection raised against it. That goes for this book just as much as every other one, and I would rather honestly inform you where the hardest questions lie than go on in delusion, acting like I have all of the answers. Not every door has been closed, and many more have opened and their rooms and corridors to be explored. A right to be wrong unfortunately cuts both directions—it implies that one is free to remain unconvinced, yet it also means I am indebted to you to offer my best attempt at the strongest pushback and responses I know of, not just the ones that are easy to answer. So before you put down this book and carry on with your life, let's walk through the garden of objections that I didn't have room for in previous chapters, including several Christian answers to them—because within the body of Christ and house of God, even the most thoughtful finite minds disagree about how to solve further puzzles.

Given that God exists, as our best evidence and naturalistic models seem to imply, several objections may be raised in the minds of rather philosophically sharp readers. This final chapter responds to these remaining objections and the different answers offered throughout the Church's history and today. What are some objections raised to the arguments laid out in this book for the existence of God on cosmological grounds?

An Actual Infinite In The Physical World? A Second Option

In chapter two, I argued that an actually infinite succession of past events is metaphysically impossible; I followed several lines of reasoning, such as traversing an infinite succession, successive addition, and potential and actual infinities. These lines of reasoning flow as far back as Al-Ghazali all the way through William Lane Craig and into the present. Despite these reasons, and I must be honest with you, this is not a fully settled issue, as many still argue for an actual infinite. Many mathematicians and philosophers argue that Georg Cantor's set theory shows that an infinite set of objects or events is actually possible. They say that Hilbert's Hotel is not a contradiction, but simply a counterintuitive result from infinites, emphasizing the fact that counterintuitive does not necessarily mean "impossible."

The Craig Camp: The Impossibility Of A Genuinely Infinite Past

Now there are two main answers to this, offered by two thinkers separated by almost a millennium. William Lane Craig pushes back by distinguishing between mathematical existence and concrete existence. He shows that treating an infinite as an abstract object does not result in logical absurdities, and that's completely fine. But, as previously discussed, abstract objects are not the same thing as a series of physical past events. Craig affirms that you could possibly have an infinite set of numbers on a chalkboard, but you will not have an infinite series of past events behind the one that just happened now. Whether his distinction holds up is still being argued in philosophy journals today.[1]

It is worthwhile to specify exactly how the other side replies, rather than taking down a straw-manned version. Graham Oppy is probably the sharpest critic of Craig's argument. Oppy grants Craig's observation that Hilbert's Hotel would indeed be bizarre and logic-bending, but instead of denying it, he decides to essentially "bite the bullet" by saying that our sense of what's absurd is trained on finite collections only, and that an infinite hotel would indeed behave in strange ways without the strangeness resulting in a logical contradiction.[2] On this view, shuffling infinitely many guests into an infinite amount of full rooms is no logically incoherent, just foreign to our finite intuitions. He basically makes an argument from silence that an actual infinite can actually exist; we just lack the capacity to understand it due to our familiarity with finite things.

The Grim Reaper Paradox

Yet Oppy's "biting the bullet" and just accepting the absurdities despite their issues is not a valid argument, even though it defeats Hilbert's Hotel. Philosophers Robert Koons and Alexander Pruss have developed a newer and, in my opinion, tougher argument to raise against the affirmation of an actual infinite, which they named the "Grim Reaper Paradox."[3]

Imagine there is an infinite line of executioners stretching backward before the clock reads noon. Each one is assigned a specific time to check if you are alive—one assigned to check you at 10:00, one at 10:30, one at 11:00, one at 11:45, one at 11:50, one at 11:55, and one at 11:55:30. There is an infinite number of them assigned a different time between 10 am and noon to check on you with only one directive: if you are alive when they check, they should execute you right there. Here's where the paradox lies: which executioner is going to end up killing you? You cannot still be alive by noon, because one of the infinite executioners would have killed you. If executioner #456 killed you, then all the ones after him would have found you dead. But no matter which executioner you choose, there will always be another one before him that came first, therefore already killing you. Therefore, there is no "first" person who performs the killing.

You must be dead before noon, but there is literally no one executioner who can kill you before then, because there is always going to be another one before him! This situation doesn't just feel weird, leaving a bullet to be bitten; it produces a victim who is certainly dead by noon yet killed by no one particular person, which is a straightforward logical contradiction. Because this argument doesn't rely on any finite intuitions about objects called "hotels" at all, Oppy can't simply bite the bullet, as it is not available in the same way. One would have to actually find a genuine flaw in the logic, and not just offer a willingness to accept absurdities. That makes it, in my better judgment, one of the toughest versions of an argument against an actually infinite succession of past events in the universe. But there is another camp of thought that actually turns around and agrees with the skeptic here.

The Thomist Camp: First And Second Ways

Here's why I personally do not think the rest of the case collapses if you remain unpersuaded. Maybe you are just okay with affirming things that are not logically coherent; after all, we do not know everything about the universe, so who are we to state an actual infinite does not actually exist? We haven't actually reached a view of the "edge" of the universe yet. Thomas Aquinas, probably the most influential and important Christian philosopher in all history, actually agrees with the skeptic asking this question, at least in part. In his short work, On the Eternity of the World, he argues that reason alone cannot prove that the universe had a beginning in time.[4] He saw that contemporary theologians, like Bonaventure in chapter 3, were overreaching. For Aquinas, that the universe had a beginning is something we can only certainly know from revelation, and not philosophical proof (he never imagined we would achieve the technology to actually observe the heavens).

Yet, he still believed that he could demonstrate the existence of God through his Five Ways.[5] His first and second ways argue from causal series that exist "right now," not stretching through history. Something like a hand pushing a stick, pushing a stone: each part of the chain is only moving because a hand is moving it simultaneously. The stick and stone have the causal power to move on their own. His argument lies here: every member or part borrows its causal power from the one before it (like a ball at rest being hit by a ball moving), and this cannot regress forever. If the universe is full of mindless matter, and it's all in motion, then this chain of causation cannot regress forever without something at the base that has a causal power in its own right (the person with the hand) that is not derived from a precedent object or cause. This "unmoved mover," sustaining the whole chain of causation right now, is what he calls God. Aquinas' answer still stands if the universe is 6,000, 14 billion, or infinite years old: it does not require premise (2) of the Kalam Cosmological Argument at all. From my own perspective, Aquinas' argument sounds a lot like the BGV condition, where no matter how old the universe is (infinite or not), there must have been an initial cause, as nothing in the universe would surpass the recessional velocity of c, which is physically impossible.

I bring this up so that you can understand something crucial: the case for the existence of God does not solely rely on winning the actual-infinites debate. There is an entirely separate, ancient, and very logically developed path to the same conclusion without a cosmic beginning being required. Of course, Aquinas never imagined humans would gain the technology to look into the heavens and describe it with mathematical precision, given he lived in the 13th century. Fast forward about 700+

years, and men would finally begin to look into the skies just to discover that what the Christian has argued for centuries past is actually the case. So while our best current evidence suggests there was a beginning to nature, and even if future evidence contradicts this notion, God still created the universe. But our best evidence does imply a beginning, thus lending observational support for the God Hypothesis.

Of Course It Looks Fine-Tuned...

The next big objection one may have is to simply assert the anthropic principle as mentioned in Chapter 3. This is a different objection than the multiverse one from Chapter 5, as it states that we could only ever find ourselves in a fine-tuned universe that permits life because if the universe did not, there would be no observers around to… well, observe it. So why is anyone surprised to find themselves in a universe that permits life, when it's just the type of universe that would allow it in the first place?

Here’s the fatal flaw in this line of reasoning: it surely explains why we (life) observe a finely tuned universe, but it does nothing in explaining why the fine-tuning exists for us to observe. Imagine you are placed in front of a firing squad of twenty highly-trained marksmen. They all take their shot at you, yet you survive—every single shot missed your head. Under this argument's logic, you could reason “Well, if they hadn’t all missed their shots, I wouldn’t be here to see that they missed; therefore, my survival is not surprising whatsoever.” Yet that is a terrible way of conceptualizing your circumstances. Your chances of survival were still astonishingly improbable, and it still cries out for an explanation. Why did the marksmen miss? Because I am alive to see that I lived? Is that an adequate explanation?[6]

Why is the universe fine-tuned for the existence of life? Because life was permitted to observe it. Do you see how that fails to explain anything? Just because observation is a precondition for asking the question does not make the improbability of the event any more unremarkable (especially when the probabilities far exceed anything you could imagine). It just tells you where to look for an explanation for your question. The fact that we can only exist in a fine-tuned universe does not remove the overall mystery of why a life-permitting universe was produced out of the wider range of life-prohibiting ones. Something still selected for the outcome that we observe—either chance, necessity, or design (and we have already seen which ones best explain the evidence)

Must The Cause Be A Mind?

I already addressed libertarian free will and agent causation earlier in this book, so I won't waste your time repeating those sections. But there is a harder follow-up question to the idea of a timeless mind causing everything: "If God is timeless, how can He make a free choice at all—doesnt choosing something require a before and after, a moment of weighing options and then a change from a state of undecided to decided? And if God never changes (because He is timeless), wouldn't the universe's existence simply be inevitable?" This is a serious objection to the Mind-explanation, not a throwaway one, and I want to give it the space it deserves because Craig and Aquinas offer two different answers once again. And a conclusion to the change-causation problem may be found in the last paragraphs.

The Thomist Camp: Freedom Doesn't Require Succession

Aquinas' response begins by questioning the assumption buried in the objection: that freedom is exclusively a temporal process—weighing options, deliberating, and then switching from one state to another. This is how we experience freedom, because we are finite, embodied creatures within time who think discursively, in sequence from one topic or thought to another. Aquinas, while also observing this fact about human intellect, argues that this isn't what freedom is in essence. Freedom, he goes, most basically means an effect that is not necessitated by the nature of its cause. In other words, an effect that could have been otherwise, produced through volition rather than a blind automatic mechanism necessitated by required prior conditions (like heat necessarily radiates from boiling water whether it wants to or not).[7]

On his account, a single, eternal, and unified act of will is able to satisfy that definition without any succession at all. God would not have to "figure out" what to do in the same fashion as we do, moving from ignorance to decision. His single act of understanding and willing simply and eternally is what is; one that is free by virtue of its content not being forced on Him by His nature, like light is forced out of a flashlight when it's turned on. Perhaps an analogy would be helpful.

Imagine you begin to write a story. You begin by writing, in a single stroke, the opening line “Once upon a time in a land called Ooo, there was a boy named Finn and his yellow magical dog Jake.” The act of writing that first line happened once—no stages, no weighing options, and no deliberation being played out on the page itself. Yet the story you just set in motion has its own internal timeline and beginning, its own Chapter 1, its own succession of later events that are not dependent on you to continue writing in sync with the story's plot. The story you just wrote had its own temporal beginning; but your act of setting it in motion was not itself a temporal process, even though you freely chose to do so rather than an accident producing those words.

For Aquinas, this is exactly the relationship between God’s eternal act of will and the universe’s temporal beginning. Change and succession belong to the effect—the universe as it traverses forward through time from its first moment onward. Nothing within God directly changes; He does not undergo a shift from considering the universe to deciding to create it because His one eternal act already is the deciding, and it doesn’t need a before to count as free—it only needs to be necessitated. That satisfies the definition of freedom without requiring the passage of time at all. I think an easier way to state this is that, since God, being a mind transcendent to time, does not have temporal succession to decide, because God is a mind, libertarian freedom entails that He can start a chain of causation without any prior conditions being met (being necessitated from His nature), which is succession. It’s a little jarring, but this is the intellectual constipation we pay for trying to comprehend something we have no way of fully comprehending; all we can do is understand what is logically possible.

The Craig Camp: There Is A Change In Relationship Only

Craig doesn’t really follow Aquinas’ path. Craig holds that God is timeless “without” creation but becomes temporal “with” creation; the moment He stands in a real relationship to something that itself exists in time.[8] In order to defend this without saying God experienced a change, Craig leans on what philosophers call a Cambridge change, named after the ways properties may be gained or lost without anything intrinsic about the object or subject actually changing. Imagine my mother taking care of a baby Jason, and at that moment she is far taller than me. As the years go by, and her son grows up and gets taller himself, at some point she looks at me and realizes that I am now taller than her after all this time. Without my mother doing anything, her height never changed, and she is the same person as when I was born. Yet she has gained a new property: she is now shorter than her son, which wasn't true before. Nothing within my mother genuinely experienced change; what changed was her relationship to something else (me). In philosophical terms, she is shorter than me sans (insofar as) she relates to my height at 21 years old.

Craig argues God's transition from timeless to temporal is like this. God's intrinsic nature, knowledge, and will never change—He eternally wills for a universe to begin to exist should come to be. What changes is purely relational: once that universe exists, God now stands in a real relationship to a temporal thing, and standing in relationship to something temporal is sufficient enough to make God temporal in that (and only that) respect, without any intrinsic change in who God is or what He wills. God is temporal sans His relationship to the universe; yet He is timeless sans His existence without the universe. The freedom of His choice lies entirely in the eternal, unchanging content of God's will that a universe begins to exist at a first moment and not in the relational transition God undergoes.

I have given you both answers to this question on purpose, because I think it's more honest and frankly more persuasive. To show you that even the best Christian thinkers have wrestled very hard with this exact issue and arrived at two coherent, carefully reasoned positions rather than pretending there is a "one-for-all" answer. The human mind, after all, is finite. Whichever answer you find more compelling, the upshot for both remains the same. They both offer a free, personal cause that explains a temporally finite effect that emerges from a timeless and changeless being in such a way that no impersonal mechanistic cause ever could— An eternal mechanism with the right conditions in place would produce its effect forever; you cannot get a match that burns for five seconds from one that has burned for eternity. Only a mind can produce a beginning without itself requiring a beginning of its own.

The Problem Of Evil

This is an objection I haven't addressed at any length in this book, and I want to be upfront with you about exactly why: this volume is set out to answer one specific question, "Did the universe have a cause, and does the cause bear the marks of God?" I did not set out for the larger question of God's character, or why God permits suffering. These are real, weighty questions that prohibit a lot of people from accepting that God created the universe. But you, the reader, deserve a serious treatment of them, not a single paragraph at the end of a book about cosmology.

This problem is actually split into two smaller problems. The Logical Problem of Evil claims God's existence is strictly logically incompatible with the existence of any evil. Alvin Plantinga's Free Will Defense is widely accepted, even by those who reject theism, as having successfully answered this version of the problem. If libertarian free will is possible and valuable enough to be worth God permitting, then a world with free-willed creatures who sometimes choose evil is not a logical contradiction of God's goodness.[9] The harder version is the Evidential Problem of Evil, forwarded by folks like William Rowe: not that evil is logically incompatible with God, but the sheer scale and apparent pointlessness of some suffering makes God's actual existence very improbable.[10] That's the version worth listening to or reading Craig or Paul Copan on, if you want to see a case made for Theism's side of that issue.

I am sure it will come up in a future volume as we continue to investigate further into nature to see if God has left his marks. The apparent design and fringe supposed origins of biological life are the next step in this journey. But for now, we can say without a possible doubt that the cause of the universe, from our best evidence and arguments, was a transcendent personal intellect. Whether that cause is good, and how that goodness squares with a suffering world, is the subject for another volume — and one worth reading before you make up your mind either way.[11]

What About Newer Cosmological Models

I have already addressed this point elsewhere in this book, but it would be good for you to finish this book with it fresh in your mind. Since some of the research for this book was done, further models have been proposed that still attempt to avoid a cosmic beginning, such as certain bounce cosmologies and cyclic models. It is worth noting when you encounter one of these newer models: none of them are new in kind, and they all face the same physical, explanatory, evidential, and philosophical challenges as the Oscillating-Universe to Quantum Cosmology models covered in Chapters 3, 5, and 6. They are also all still subject to the BGV Theorem's requirements that any universe that is on average expanding (any expansion rate above 0) must have a past boundary of all objects' recessional velocities and the total absence of empirically confirmed physical universe-generating or universe-bouncing mechanisms.[12] If you are curious, I would keep your eyes on this field, as anything is possible. But with the prior arguments and evidence in place, we have a rather high confidence in the God Hypothesis.

One Last Topic: The Problem Of Divine-Change

One last issue may arise in someone who commits what is in this book to deeper thought. If God is timeless, and therefore unchanging (immutable), how could He choose to create a universe? How could God timelessly allow a universe to begin without experiencing change in Himself by making a decision? This is practically an extension to the section *"Must The Cause Be A Mind?"* section on page 208. Libertarian agency itself only goes so far, and this seems to raise an issue. Humans experience choice-making in a temporal succession. Going from thinking, to choosing, and then acting. Going from a state of non-choice, to one of choice and/or action. I want to walk through this topic a little bit—so please, would you mind walking this path with me? It may get technical and theological, but it's necessary to elaborate on this issue, especially the answer provided by Thomas Aquinas, which seems to raise this issue the most.

Plato did not believe in the tradition Greek pantheon of gods as literally true. He ultimately rejected stories told by poets like *Homer* because they depicted the gods as flawed, immoral, and capable of evil. They were essentially too flawed and human-like to be real transcendent "gods".[13] Instead he envisioned a perfectly rational divine order that was centered around goodness, logic, and moral order. He argues that the gods were completely good and were unchanging, could not lie, cause harm, or argue and fight with one another. In *the Republic*, Plato argues that Greek children shouldn't even be taught about Greek mythologies because it introduced them to immoral behaviors, and since the gods performed them, it offered justification for such behaviors.

Plato ultimately viewed divinity as a supreme abstract principle of goodness and logical order rather than a personal deity.[14] In his dialogue *Timaeus*, he proposes a rational God who ordered the universe from pre-existing matter using abstract ideal forms that he called *Demiurge*. This is not the same thing as the demiurge in ancient Gnostic mythology, as they would later adopt this concept themselves and change it quite a bit. Aristotle would join Plato's school in Athens in 367 BC at just seventeen years old to study his work for about twenty or so years. He would build off of Plato heavily, but would disagree with him about the nature of reality. Plato viewed true reality as existing in a higher abstract world of perfect/ideal forms—Aristotle argued that reality exist in the physical world and that forms cannot exist isolated from material objects. Plato also viewed the divine as a perfectly good demiurge that ordered matter into the universe—Aristotle argued for a Prime Mover, or Unmoved Mover from which Thomas Aquinas would expand upon in his first two ways, that was a purely conscious entity that sustains the universe's motion, but does not interact with it (Deism).

Aristotle's concept of an Unmoved Mover envisioned Himi as purely logical, an unchanging force that acts as the ultimate cause of all motion and change within the universe. His version of the demiurge is not a personal being who interacts with creation but rather is an entity of pure thought that could only contemplate perfection, thus not even thinking about human affairs. Aristotle's demiurge moved the universe as a sort of cosmic magnet. Just like how a beautiful object or idea draws or inspires a person to move towards it without the object or idea itself changing; all things in nature naturally move towards the perfection of this Unmoved mover. It does not push things in a literal sense but moves the universe by being the object of pure desire and love. He would apply this to the solar system and astronomical bodies, but that is not necessary here as observational, and mathematical developments would reveal a very different mechanism behind the universe's behavior.

Thomas Aquinas would adopt this Unmoved Mover concept and build heavily upon it in pair with Christian Theology. He does not use libertarian agency to solve the change-problem, and here I want to elaborate on libertarian agency's purpose. It is used in an analogous manner. We are using something within our direct familiar experience to get an idea of and extrapolate to articulate a cause for effects we want to explain. It is how we learn, by operating within our current frame, in order to expand its understanding of higher concepts. So, God, being a mind, would have freedom—just like humans do. But, as explained in the section this one expands, God's freedom is similar to ours, but far exceeds and transcends it entirely.

Aquinas avoids the problem of divine change by accepting Aristotle's rule that God must be unchangeable (or *immutability*, derived from His timelessness), and have no unfulfilled potential (pure actuality).[15] If God had strict libertarian agency, meaning He had to choose between universe A or B in a specific moment in time and in a specific temporal sequence. Making a choice like that implies moving from not acting to acting, which is a change which violates the core logic of the first and second ways of motion and efficient cause. Instead, he avoids the problem of change through a concept called an eternal, simple action.[16]

A Single Eternal Act

God does not make decisions over time, as He is outside of it. He wills everything that ever happens in the history of the universe in a single, eternal, and unchanging act of volition. Because God is pure act (*actus purus*), His mind does not switch from thinking about A, to choosing A. His choice, His knowledge, and His being are all the same thing.[17] This single act is different than Molinism's three logical moments, as they relay on different theological frameworks. Either option suffices, as neither of them inherently express a heresy, and because of the speculative nature of this level of thinking about God limits the certainty of a theory here.

Aquinas viewed God's knowledge, as a being of pure though and act, as being the cause of everything's sustained existence. His knowledge is what moves all things, including humans, to their ends. So how can humans have free-will when God's knowledge is what moves them? To this, Aquinas answers by distinguishing between a *Primary Cause,* and a *Secondary Cause*. God des not literally drive human will by his knowledge; but his knowledge sustains the human will's ability to choose. If God was not sustaining creation's existence, then human will would not exist, and thus not be able to choose—it is also free by its very nature. Therefore, God causes the will to exist, but the will is still free to operate after its initial sustained creation. God is the *Primary Cause*—He provides the raw existence, energy, and capacity for any action to happen (by sustaining existence and creating space, time, and energy). The human is the *Secondary Cause*, giving action and will its specific shape, direction, and moral character. God moves the will to choose (for example, time moves forward, allowing for temporal libertarian agency to occur), but the human mind makes the specific choice.

You may have noticed this already, but God also causes things to move *according to their natures*. So God causes, say, natural laws to operate necessarily in a regular manor; He also causes free creatures to operate contingently and freely (because free-will has a free nature). When God moves the human will, He moves from within it, illuminating the intellect and mind to see something as good (being made in His image) or the capacity to articulate something. We always think in terms of "good". Because the human mine is able to weigh different options as "good" or not, the will remains genuinely free to choose between them. And because God knows all contingent truths concerning your actions in any situation, and being outside of time, He eternally wills the existence of the universe's history in which you freely choose and make decisions within it.

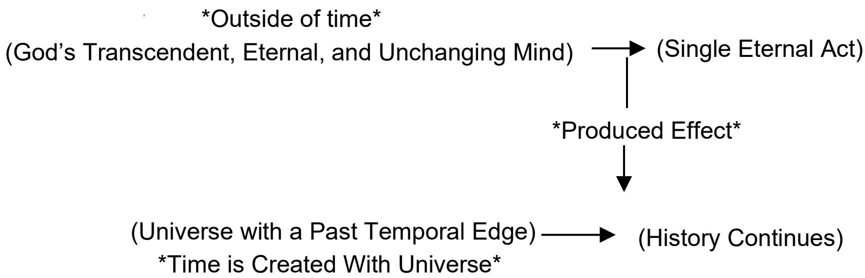
Going further, Aquinas distinguishes between a change in the cause, and a change in the effect. God's single, unmovable eternal will produces a universe full of temporal, changing things (which entails time within it). Humans have freedom in the sense that they can choose to cause things without being strictly limited by things outside of themselves. But we are limited in other senses externally, as to our environments and bodies. But God's freedom is not that way. Unlike human freedom, where options must be weighed, due to finite intellect, God is completely uncaused by anything outside of Himself. He is not restrained or determined by anything external to Himself. God chooses to create the universe freely out of love, but He does so eternally—He does not sit around waiting, thinking, and then changing His mind to create. But can Aquinas be harmonized with modern cosmology, mathematical theorems, and astronomical discoveries?

The Divine Mind Problem And A Temporal Beginning

Is Aquinas' view that the universe was an eternally willed act of God an outdated idea? Wouldn't God have created the universe an eternity ago because He has eternally willed it to be? Doesn't this run into the same issue as positing a prior material event that met the conditions to cause a universe for an infinite time before the Big Bang?

Harmonizing Aquinas with modern discoveries requires understanding a distinction he himself identifies: the difference between a temporal beginning (change) and a metaphysical sustaining of existence (creation). The Big Bang event was not what Aquinas meant by creation. He defined creation (from nothing, *ex nihilo*) as the complete, continuous bestowal of existence upon something. To him, even if the universe were infinite, or temporal, it would still require God to sustain its existence *right now*.[18] So, in a respect, discoveries like the BGV theorem and the Big Bang are "bonuses" for apologists and theologians, but are totally unnecessary for Aquinas' First and Second Ways. But how can an unchanging God trigger a beginning without divine change?

If the BGV theorem and Big Bang are correct, and time itself has an absolute beginning, how does an unchanging God trigger it without experiencing change Himself?



God simply wills the beginning eternally—He did not sit in time, wait, and then decide to explode the Big Bang. God transcends time entirely, and thus is outside of it.[19] He eternally wills a universe with a temporal edge. The effect produced changes, not the cause. The change, movement, and beginning all occur on the creaturely side of the divine creation decree. Time itself began at the Big Bang, but the divine command causing it is a sort of "anchor: of pure actuality outside of time entirely. Aquinas answers that,

> "God wills that some things should be now, and others afterwards... Hence it does not follow that His will is changed, but that He willed from eternity that the change in things should take place."[20]

The Universe has a real relationship to God, as He sustains its existence. But God only has a logical relationship to the universe with regard to temporality and change.[21] God, existing outside of time, can surely cause a temporal beginning to exist—and that is not a contradiction. There are multiple lines of reasoning to get to this point, some relying on the evidence in this book, and others purely on philosophical grounds or on revelation alone. I would like to close where I began: namely, that *you have a right to be wrong*. But I hope that after walking through not just my own arguments, but ones from the best minds and researchers and the strongest replies to them, you can see this isn't a case built on hiding the hard questions… but rather, facing them directly with the guidance of the Father, the work of the Son, and the comfort of the Holy Spirit. God bless you.

Chapter 10 Notes

[1] (William Lane Craig, *Reasonable Faith: Christian Truth and Apologetic*, 3rd ed. Wheaton, IL: Crossway, 2008, chap. 3)

[2] (Graham Oppy, *“Philosophical Perspectives on Infinity,”* Cambridge: Cambridge University Press, 2006, pgs 51–53; see also Oppy, *"Craig, Mackie, and the Kalam Cosmological Argument,"* Religious Studies 27, no. 2, 1991: pgs 189–97)

[3] (Robert C. Koons, *"A New Kalam Argument: Revenge of the Grim Reaper,"* *Noûs* 48, no. 2, 2014: pgs 256–67; Alexander Pruss, *"From the Grim Reaper Paradox to the Kalam Argument,"* Alexander Pruss's Blog, October 2, 2009, http://alexanderpruss.blogspot.com/2009/10/from-grim-reaper-paradox-to-kalaam.html)

[4] (Thomas Aquinas, *De Aeternitate Mundi*, 1270; also *Summa Theologica*, part I, question 46, articles 1–2)

[5] (Thomas Aquinas, *Summa Theologica*, part 1, question 2, article 3)

[6] (John Leslie, *“Universes”*, London: Routledge, 1989, pg 134; adopted in Craig, “Reasonable Faith”, 3rd ed., chap. 4)

[7] (Thomas Aquinas, *Summa Theologica*, part 1, question 19, articles 3–4, and question 10)

[8] (William Lane Craig, *“Time and Eternity: Exploring God's Relationship to Time,”* Wheaton, IL: Crossway, 2001,pg 233, and chaps. 9–10; see also William Lane Craig, *"God's Timelessness ‘sans’ Creation,"* Reasonable Faith, accessed July 2026, reasonablefaith.org)

[9] (Alvin Plantinga, *God, Freedom, and Evil*, Grand Rapids, MI: Eerdmans, 1974)

[10] (Moreland and Craig, *“Philosophical Foundations for a Christian Worldview”*, chap. on the problem of evil; William L. Rowe, *"The Problem*

of Evil and Some Varieties of Atheism," American Philosophical Quarterly 16, no. 4, 1979: pgs 335–41)

[11] (Paul Copan, *Is God a Moral Monster? Making Sense of the Old Testament God*)

[12] See chapter 3, nn. 40, 42, above (Borde, Guth, and Vilenkin, *"Inflationary Spacetimes Are Incomplete in Past Directions"*).

[13] (Plato, *The Republic*, books 2 & 3)

[14](*ibid*, books 7 & 8)

[15] (Aquinas, *Summa Theologica*, part 1, question 3)

[16] (*ibid*, question 19, article 7)

[17] (*ibid*, question 9, and question 3, articles 1, 2)

[18] (Aquinas, *Summa Contra Gentiles*, book 2, chapter 35)

[19] (*Ibid*)

[20] (Aquinas, *Summa Theologica*, part 1, question 19, article 7)

Creation Ex Nihilo

"In the beginning God created the heavens and the earth." (Genesis 1:1)

"Through him all things were made; without him nothing was made that has been made." (John 1:3)

"By faith we understand that the universe was formed at God's command, so that what is seen was not made out of what was visible." (Hebrews 11:3)

" For in him all things were created: things in heaven and on earth, visible and invisible, whether thrones or powers or rulers or authorities; all things have been created through him and for him." (Colossians 1:16)

"By faith we understand that the universe was formed at God's command, so that what is seen was not made out of what was visible." (Hebrews 11:3)

"This is what the Lord says— your Redeemer, who formed you in the womb: I am the Lord, the Maker of all things, who stretches out the heavens, who spreads out the earth by myself." (Isaiah 44:24)

"As it is written: 'I have made you a father of many nations.' He is our father in the sight of God, in whom he believed—the God who gives life to the dead and calls into being things that were not." (Romans 4:17)

"You are worthy, our Lord and God, to receive glory and honor and power, for you created all things, and by your will they were created and have their being." (Revelation 4:11)

Universe Expansion

"He sits enthroned above the circle of the earth, and its people are like grasshoppers. He stretches out the heavens like a canopy, and spreads them out like a tent to live in." (Isaiah 40:22)

“This is what the Lord says—your Redeemer, who formed you in the womb: I am the Lord, the Maker of all things, who stretches out the heavens, who spreads out the earth by myself" (Isaiah 44:24)

"It is I who made the earth and created mankind on it. My own hands stretched out the heavens; I marshaled their starry hosts." (Isaiah 45:12)

"But God made the earth by his power; he founded the world by his wisdom and stretched out the heavens by his understanding." (Jeremiah 10:12)

"He alone stretches out the heavens and treads on the waves of the sea." (Job 9:8)

"The Lord wraps himself in light as with a garment; he stretches out the heavens like a ten.t" (Psalm 104:2)

"My own hand laid the foundations of the earth, and my right hand spread out the heavens; when I summon them, they all stand up together." (Isaiah 48:13)

"A prophecy: The word of the Lord concerning Israel. The Lord, who stretches out the heavens, who lays the foundation of the earth, and who forms the human spirit within a person, declares:" (Zechariah 12:1)

The Design of Creation

" Paul, a servant of Christ Jesus, called to be an apostle and set apart for the gospel of God— the gospel he promised beforehand through his prophets in the Holy Scriptures regarding his Son, who as to his earthly life was a descendant of David, and who through the Spirit of holiness was appointed the Son of God in power by his resurrection from the dead: Jesus Christ our Lord.Through him we received grace and apostleship to call all the Gentiles to the obedience that comes from faith for his name’s sake.And you also are among those Gentiles who are called to belong to Jesus Christ. To all in Rome who are loved by God and called to be his holy people: Grace and peace to you from God our Father and from the Lord Jesus Christ. First, I thank my God through Jesus Christ for all of you, because your faith is being reported all over the world God, whom I serve in my spirit in preaching the gospel of his Son, is my witness how constantly I remember you in my prayers at all times; and I pray that now at last by God's will the way may be opened for me to come to you. I long to see you so that I may impart to you some spiritual gift to make you strong— that is, that you and I may be mutually encouraged by each other's faith. I do not want you to be unaware, brothers and sisters,[d] that I planned many times to come to you (but have been prevented from doing so until now) in order that I might have a harvest among you, just as I have had among the other Gentiles. I am obligated both to Greeks and non-Greeks, both to the wise and the foolish. That is why I am so eager to preach the gospel also to you who are in Rome. For I am not ashamed of the gospel, because it is the power of God that brings salvation to everyone who believes: first to the Jew, then to the Gentile. For in the gospel the righteousness of God is revealed—a righteousness that is by faith from first to last,[e] just as it is written: 'The righteous will live by faith.' The wrath of God is being revealed from heaven against all the godlessness and wickedness of people, who suppress the truth by their wickedness, since what may be known about God is plain to them, because God has made it plain to them. For since the creation of the world God's invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made, so that people are without excuse. For although they knew God, they neither glorified him as God nor gave thanks to him, but their thinking became futile and their foolish hearts were darkened. Although they claimed to be wise, they became fools and exchanged the glory of the immortal God for images made to look like a mortal human being and birds and animals and reptiles. Therefore God gave them over in the sinful desires of their hearts to sexual impurity for the degrading of their bodies with one another. They exchanged the truth about God for a lie, and worshiped and served created things rather than the Creator—who is forever praised. Amen. Because of this, God gave them over to shameful lusts. Even their women exchanged natural sexual relations for unnatural ones. In the same way the men also abandoned natural relations with women and were inflamed with lust for one another. Men committed shameful acts with other men, and received in themselves the due penalty for their error. Furthermore, just as they did not think it worthwhile to retain the knowledge of God, so God gave them over to a depraved mind, so that they do what ought not to be done. They have become filled with every kind of wickedness, evil, greed and depravity. They are full of envy, murder, strife, deceit and malice. They are gossips, slanderers, God-haters, insolent, arrogant and boastful; they invent ways of doing evil; they disobey their parents; they have no understanding, no fidelity, no love, no mercy. Although they know God’s righteous decree that those who do such things deserve death, they not only continue to do these very things but also approve of those who practice them." (Romans 1:1-32)

"For every house is built by someone, but God is the builder of everything." (Hebrews 3:4)

"Remember that you molded me like clay. Will you now turn me to dust again? Did you not pour me out like milk and curdle me like cheese, clothe me with skin and flesh and knit me together with bones and sinews? You gave me life and showed me kindness, and in your providence watched over my spirit." (Job 10:9-12)

"My own hand laid the foundations of the earth, and my right hand spread out the heavens; when I summon them, they all stand up together." (Isaiah 48:13)

"I praise you because I am fearfully and wonderfully made; your works are wonderful, I know that full well. My frame was not hidden from you when I was made in the secret place, when I was woven together in the depths of the earth." (Psalm 139:14-15)

"By faith we understand that the universe was formed at God’s command, so that what is seen was not made out of what was visible." (Hebrews 11:3)

"From him the whole body, joined and held together by every supporting ligament, grows and builds itself up in love, as each part does its work." (Ephesians 4:16)