PHYSICS-BASED INTELLIGENT DESIGN ARGUMENTS ARE BASED ON FALSE PHYSICS

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1. Introduction

It is my contention that at least some of the major physics-based arguments for the existence of God rely on false physical theories to support their key premises, and this makes those premises epistemically unwarranted. To the extent that the sole support for the premises is physics-based, we have no compelling reason to believe the premises, and hence no compelling reason to believe that the argument is sound or inductively strong.

My main focus will be on the kalam cosmological argument. I'll first consider the argument in its standard deductive formulation, and will show that appeals to physics to support the argument are flawed, because we don't have a potentially true fundamental theory of physics. I'll go on to present the kalam cosmological argument in a more novel inductive formulation, and will consider whether physics can be used to provide evidence that God exists. Next, I'll take up the fine-tuning argument; I'll argue that given our current knowledge of physics, we don't have strong reason to believe that the constants actually are fine-tuned. I will go on to contrast my critique of these arguments with objections I have to Gonzalez and Richards' "privileged planet" argument; while their argument is also physics-based, it is not open to the same critique. Their argument is flawed, but their appeals to physics are not flawed, and hence their argument can be used to show how to avoid my critique of the other physics-based arguments.

One terminological note: I'm considering these arguments to be "intelligent design" arguments, but I'd also be happy to consider them as arguments in natural theology. This is a terminological debate I don't want to get into (for discussion see Dembski 2001); I'll just stick with the "intelligent design" terminology for specificity.

As the final topic in this paper, I will point out that proponents of these physics-based arguments for the existence of God are not the only philosophers unwarrantedly appealing to false physics; there are popular arguments in metaphysics that suffer from

[1] I thank Alan Hájek for helpful discussion.

this same problem. But just because other people are doing it, it doesn't mean the proponents of these physics-based intelligent design arguments should too.

[Note to readers for the San Antonio conference: in fact, only the sections of the paper on the kalam cosmological argument are written. I thought about changing the title and introduction to reflect that, but I decided to leave it as is, so you can see where I'm going. I had told Jon that I wouldn't have that much to say but I was clearly wrong about that; I'm already over 6000 words with a lot more to go.]

2. The Kalam Cosmological Argument

The kalam cosmological argument is as follows:

Premise 1: The universe began to exist.

Premise 2: Everything that begins to exist has a cause of its existence.

Conclusion: Therefore the universe has a cause of its existence.

The argument goes on to establish that the cause of the universe's existence counts as God.

What I want to focus on is the first premise of the argument. There are two lines of defense that are standardly given, a philosophical defense and an empirical defense. The philosophical defense holds that it is impossible for a series of events to have been going on forever. I find this defense flawed, but to argue that is beyond the scope of this paper. I'll focus my discussion on the empirical defense. Here, philosophers like to cite the big bang hypothesis, as exemplified by a recent survey article by William Rowe:

> it must be acknowledged that the emergence of the Big Bang theory of the origin of the universe has given new weight to an argument for the existence of some sort of creator. (Rowe 2005, 115)

I do not hold that this claim must be acknowledged; I hold that it is completely reasonable for this claim to be rejected.

As a preliminary point, I prefer to refer to "the big bang hypothesis" rather than "the big bang theory". The big bang hypothesis holds that the universe, including space and time itself, came into existence a finite amount of time ago, and shortly after the universe came into existence it was in a state of large energy density, and the energy density in each region of the universe has overall been decreasing, due to the expansion of the universe (or, less tendentiously, due to the fact that at large scales most everything in the universe is getting further apart from most everything else). The theory in question is general relativity – general relativity is the best theory we have to describe the large-scale structure of spacetime. General relativity has an infinite number of models of spacetime, and in some of the models there is a big bang, while in others there isn't. Based on the empirical data we have about our universe, the models of general relativity that best describe our universe are models where there is a big bang.

Because there is frequent ignorance of this point, it's worth noting that the big bang hypothesis does not include the hypothesis that the universe started out very small, and has been expanding ever since. This is one possibility for how our universe has evolved, but another possibility is that the universe is spatially infinite, and has been spatially infinite ever since the big bang (assuming that the big bang hypothesis is true). In fact the latest empirical evidence suggests that the universe is spatially infinite – see Bennett et al. 2003 and Spergel et al. 2003 for details.[2]

I maintain that if the big bang hypothesis is true, then the first premise of the kalam cosmological argument is true. There is some controversy about this conditional, because some (e.g. Pitts 2007) have maintained that for something to begin to exist, there must be a first moment of its existence. But the big bang hypothesis is compatible with the universe being in existence a finite amount of time, without having a first moment of its existence. That is, it could be the case that the set of times at which the universe exists is open at the beginning. In other words, we could pick a coordinate system with the following result: the universe does not exist at time $t = 0$, but the universe exists at every time $t > 0$. I maintain that, if the Big Bang theory is true but the universe did not have a first moment of its existence, it nevertheless began to exist, because it has only been in existence a finite amount of time.

So if the big bang hypothesis is true, Premise 1 is true. This leads to the question: should we believe the big bang hypothesis?

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[2] For an easily accessible discussion, see http://map.gsfc.nasa.gov/m_mm.html.

William Lane Craig is a prominent defender of the kalam cosmological argument, and one piece of evidence he cites for the argument is the big bang hypothesis. In his 1979 book, *The Kalam Cosmological Argument*, he writes:

> the scientific evidence related to the expansion of the universe points to an absolute beginning of the universe about fifteen billion years ago. (Craig 1979, 130)

As part of his justification for this claim, he cites a paper by four astrophysicists, with J. Richard Gott as the lead author. Gott and his co-authors write:

> the universe began from a state of infinite density about one Hubble time ago [i.e., about 15 billion years 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 like asking what is north of the North Pole. (Gott et al. 1976, 65)

At first glance, this passage looks like it is supporting Craig's claim. But one has to be careful here. When physicists present a theory, they may be presenting it *as true*, or they may just be presenting it as a live option, putting it on the table for consideration. According to Bas van Fraassen's (1980) understanding of science, at least, physicists can *accept* a theory, and treat the theory as if it is true for the purposes of doing their science, without actually *believing* the theory.

In this vein, it's worth noting that Gott and his co-authors put an important caveat in their paper, a caveat that Craig doesn't quote. Gott and his co-authors write:

> That the universe began with a big bang is an inevitable conclusion *if* the known laws of physics are assumed to be correct and in some sense complete. It is conceivable, however, that there are laws of nature whose effects are negligible on the scale of the physics laboratory, or even on the scale of the solar system, but that might predominate in determining the behavior of the universe as a whole. (Gott et al. 1976, 65)

So this leads to the question: should we assume that the known laws of physics are correct and complete?

The answer is: we should not. There are currently two fundamental theories of physics on the table, general relativity and quantum theory. Both theories are strongly confirmed in their respective domains, but the problem is that the two theories contradict each other. Physicists are trying to come up with a new theory, a theory of quantum gravity, to replace both general relativity and quantum theory. So far, though, physicists have not been completely successful. The most promising candidate is string theory (or its possible replacement, M-theory), but this theory is not understood well enough to enable us to figure out what it says about whether the universe has a beginning. (And it may be that the theory fails to give a univocal answer; it may be that that the theory has multiple models consistent with all the data we have, where in one model the universe has a beginning while in another model it doesn't. For discussion of the idea that string theory has many models, see for example Susskind 2005.)

In sum, the big bang theory doesn't take into account quantum theory, and that gives us reason not to believe the big bang theory. In Craig's 1979 book, he doesn't seem aware of this potential problem regarding taking quantum effects into account, but by 1993, he shows more awareness of the potential problem. In 1993, Craig and Quentin Smith published a debate book, *Theism, Atheism, and Big Bang Cosmology*. The first chapter in the book consists of selections from Craig's 1979 book. At the end of the chapter Craig has a postscript, discussing our lack of knowledge of certain aspects of the big bang. He writes:

> During the 1980s, through the marriage of particle physics and cosmology, scientists have attempted to push back the frontiers of our knowledge of the early universe ever closer to the Big Bang. ... Prior to 10^{-12} sec, however, the physics becomes speculative. ... Prior to 10^{-35} sec the physics becomes extremely speculative and even unknown. (Craig 1993, 67-9)

I'll start with a couple preliminary points to elucidate what Craig is talking about here, and then I'll make my main critical point.

Preliminary point #1: When Craig talks about "Prior to 10^{-12} sec", he's talking about the time period between the big bang and 10^{-12} seconds after the big bang.

Preliminary point #2: Physicists tend to talk about stages in the development of the early universe, not in terms of the time period after the big bang, but in terms of the approximate amount of energy particles in the universe have at that time. So, 10^{-12} seconds corresponds to energies of 100 GeV (that is, 100 billion electron volts), while 10^{-35} seconds corresponds to energies of 10^{14} GeV.

Now, my main point: If one were to watch the history of the universe going backwards in time, one would see the energies increasing. Let me make the same point that Craig made about the physics getting speculative, but put in terms of energy. As the energy increases to 100 GeV, the physics becomes speculative – we're not really sure what happens at that point. As the energy increases to 10^{14} GeV (assuming it does increase to that point) the physics becomes extremely speculative, even unknown. In other words, we just don't know what happens once the energies get that high.

The way Craig puts the point, it sounds like we know that there's a big bang, and we know what happens in the history of the universe once 10^{-12} seconds have passed, but we don't know what happens between the big bang and 10^{-12} seconds after the big bang. But in fact our lack of knowledge is much more fundamental. Because the physics doesn't tell us what happens once we trace the history of the universe backwards in time to these high energies, we don't even know if there's a big bang at all.

So given that the physics is unknown, we ought to conclude that it's unknown whether there's a big bang, and hence (assuming that the philosophical defense of Premise 1 is flawed) we ought to conclude that it's unknown whether the universe began to exist. Hence, we are not warranted in believing that the cosmological argument is sound.

3. Objections

I'll now consider three objections to my line of reasoning in the previous section.

3.1. Isn't This Scientific Anti-Realism?

Let's step back for a moment, and think about other ways one might reject the physics-based defense of the first premise of the kalam cosmological argument. If one were a strong scientific anti-realist, in such a way that one didn't think that science delivered any substantive truths about the world, then one would have clear grounds for rejecting the physics-based line of reasoning – the evidence from physics would give one no reason to believe the big bang hypothesis. Suppose one were a more moderate scientific anti-realist, along the lines for example of van Fraassen's (1980) constructive empiricism. One would believe that the aim of science is truth about the *observable* aspects of the world. Since the beginning of the universe is presumably not an observable event, the aim of science would not include finding out whether the universe had a beginning. Note though that it would be a mistake to argue that the beginning of the universe is not an observable event simply because we couldn't exist then, because in fact we can observe events that occur before times that we exist. For example, we can now observe the cosmic microwave background radiation, which was emitted 300,000 years after the big bang (assuming the big bang hypothesis is true). The reason the beginning of the universe is not observable is both that we couldn't exist then (given the high amount of energy in each region of the universe), and that it's physically impossible for us to observe back that far – we can't see back any further than the cosmic microwave background radiation. So a moderate scientific anti-realist like van Fraassen would also hold that the physics-based defense of the first premise is unconvincing.

What I want to make clear is that my argument from the previous section does not rely on any sympathies I might have with scientific anti-realism. According to van Fraassen's characterization of scientific realism, at least, to be a scientific realist is to believe that the aim of science is truth. One can believe that the aim of science is truth, and still be skeptical of whether our current physical theories are delivering truth. In fact, given the current state of play in physics, one has good reason to doubt that general relativity is true, because it does not take into account quantum effects. Because of this, it's inappropriate to appeal to general relativity as providing the theoretical framework that allows us to predict that the evidence that our universe is expanding is evidence that the universe began to exist a finite amount of time ago. To put the point dramatically: my argument only works because physics is in crisis. If there were a worked-out consistent fundamental theory of physics, scientific realists could appeal to that theory to tell them whether the universe began to exist. But since there isn't, they can't.

3.2. Our Theories are Approximately True

Perhaps van Fraassen's characterization of scientific realism is too weak. Consider for example Ladyman and Ross's (2007, 68) characterization:

> we ought to believe that our best current scientific theories are approximately true, and that their central theoretical terms successfully refer to the unobservable entities they posit.

These scientific realists could say: maybe general relativity in all its details is false, but nevertheless we should expect general relativity to be *approximately* true. The realists could thus say that we should believe what general relativity tells us about the big bang. The realists could maintain that general relativity might get the details of what happens between the big bang and 10^{-12} seconds after the big bang wrong. Nevertheless such realists could maintain that the overall picture is approximately right – the universe did start a finite amount of time ago.

The notion of approximate truth is notoriously slippery – the question that always has to be asked is: in what respects, and to what degree, is the theory approximately true? Suppose that general relativity is right in suggesting that spacetime is curved, and that the curvature of spacetime is correlated with the distribution of matter in spacetime. This would be enough to make it reasonable to consider the theory to be approximately true. This could be the case even if general relativity makes incorrect predictions for what happens at large energy scales. As one traces the history of the universe backwards in time, toward larger and larger energy density, it could be that at sufficiently large energy density the universe undergoes a bounce, and energy density starts decreasing again. This scenario is compatible with the universe having been in existence forever – the cycle of the universe expanding and then contracting could have been going endlessly. If that were the case, general relativity could reasonably be considered to be approximately true, even though the big bang hypothesis is false.

This endless crunch/bounce model is not just pure philosophical speculation; at least some prominent physicists consider such a scenario to be a live option. Specifically, Paul Steinhardt and Neil Turok (2007) have proposed the *cyclic model*, where the expansion phase that the universe is in now will be followed by a contraction phase. At the end of the contraction phase the universe will undergo a "bounce", and will begin expanding again. Steinhardt and Turok still use the terminology of the "big bang", but for them the big bang is just the event of the bounce, where the universe starts expanding again. The cyclic model is compatible with the universe having been in existence forever.

For those who are familiar with the discredited oscillatory models of the 1920s, it's worth making clear that the cyclic model is not one of those models, but is instead based on up-to-date physics. It is arguably compatible with M-theory, and utilizes the branes (the multi-dimensional analogue to strings) that M-theory endorses. According to the cyclic model, there are ten dimensions of space, but six of those dimensions are compactified. We are living in one three-dimensional brane, and there is one other three-dimensional brane, which is at some distance from ours as measured in the fourth uncompactified spatial dimension. The branes oscillate back and forth relative to each other, and the big bang corresponds to the moment when these two branes get so close that they repel each other and bounce. There are many more details to the cyclic model, and it is detailed enough that it makes empirically verified quantitative predictions, but there's no need to into those details here. I've said enough to show that there is a respected theory under consideration by physicists which does not entail that the universe came into existence with a big bang.

One could legitimately hold that, according to the cyclic model, general relativity is approximately true. Indeed, many aspects of general relativity carry over to the cyclic model. But if the cyclic model is true, and the universe has been in existence forever, general relativity is not approximately true with respect to general relativity's suggestion that the universe came into existence at the big bang. This shows that general relativity can be approximately true, even if the big bang hypothesis is false. Thus, one can't appeal to the approximate truth of general relativity to establish that the universe came into existence a finite amount of time ago.

3.3. We Should Work With the Best Theories We Have

The third and final objection I want to consider goes as follows:

> Where else should we look for our guidance for our metaphysics, if not our best fundamental physical theory? Unless and until general relativity is replaced by a

> better theory, we should just assume that general relativity is true, for the purposes of doing metaphysics. It would be unreasonable to ask scientists and engineers to send rockets into space using a non-existent physical theory; the best they can do is to use the best fundamental physical theories we have. The same sort of reasoning holds for the metaphysician. Thus, in evaluating the first premise of the kalam cosmological argument, we should assume that the best theory we have regarding the beginning of the universe is true.

I'll point out two problems with this line of reasoning. The first problem is that someone reasoning this way will end up having contradictory beliefs. General relativity is not our only fundamental physical theory – quantum theory is also standardly considered by physicists to be a fundamental physical theory. (I'm using the term "quantum theory" so as to not take a stand on whether this theory is quantum mechanics or quantum field theory, or whether the theory includes the standard model of particle physics – different physicists might have different opinions here.) Thus, if we're going to assume, for the purposes of evaluating the kalam cosmological argument, that general relativity is true, we should also assume that quantum theory is true. But general relativity entails that the structure of spacetime is correlated with the distribution of matter (and hence, to use the technical terminology, spacetime is 'background-independent'), while quantum theory has a fixed ('background-dependent') spacetime. Hence, if one assumes that general relativity and quantum theory are true, one will end up believing that spacetime is background-independent and that spacetime is background-dependent, but these are contradictory beliefs. It would be arbitrary to assume that general relativity is true and not quantum theory, or vice versa, because they are standardly considered to be equally fundamental theories. (Or at least, one would need a worked-out argument to explain why it's legitimate to assume that general relativity is true but not quantum theory, and that's an argument that proponents of the kalam cosmological argument haven't given.) But if one assumes both are true, one ends up believing a contradiction.

Even setting this logical problem aside, there is another reason one wouldn't want to simply assume that general relativity is true for the purposes of doing metaphysics. The reason is that metaphysics isn't meant to be an elucidation of our best current scientific theories; metaphysics is meant to get at truth. In order to rely on our current best scientific theories in doing metaphysics, one would need to argue that these theories are true. As we've seen, given the state of current physics, it is unreasonable to simply assume that general relativity is true.

Moreover, if philosophers assume that general relativity is true, they won't be able to make sense of much of the work that's being done in contemporary theoretical physics. Why would physicists try to come up with a theory of quantum gravity that would supplant general relativity, if general relativity is true? Philosophers who took this approach would be viewed by physicists as naive.

But perhaps my focus on truth is misguided – perhaps it is wrong to construe metaphysics as search for truth. Perhaps metaphysics is simply out to elucidate the fundamental structure of the world, under the supposition that our best fundamental physical theories are true. This can be thought of as counterfactual metaphysics: what metaphysical claims would be true, were general relativity true? Assuming that there are no problems with the rest of the kalam cosmological argument, the argument can establish that it would be true that God exists, were general relativity true. This would be an interesting and important philosophical result, but we have to recognize what the limitations of the result are. It would be of the same importance as establishing that God would exist, were Cartesian physics true, or that God would exist, were Ptolemaic astronomy true. While these are philosophically interesting results, they don't get at reality – or at least, one would need an independent argument to show that they are getting at reality, even though the physical theory in question is false. Proponents of the kalam cosmological argument, historically at least, have tried to establish that God actually exists, not that God would exist were it the case that the latest scientific theories are true.

4. Bringing in Probabilities

The kalam cosmological argument is presented as a deductive argument, and so far I have been treating it as such. If we don't know that all the premises are true, then we aren't warranted in believing that the argument is sound. But what happens if we treat it instead as an inductive argument – one that leads to an increase in the probability assigned to the hypothesis that God exists?

Imagine an agent who believes that the kalam cosmological argument is valid, and believes that the second premise is true, but doesn't know whether the first premise is true – this agent isn't sure whether the universe began to exist. Also, suppose that this agent starts out not knowing any physics. Now, suppose that the agent becomes an expert in physics – her knowledge of physics matches the knowledge that top physicists have. Will this lead to an increase in the probability she assigns to the truth of the first premise, and hence, will this lead to an increase in the probability she assigns to the hypothesis that God exists?

My answer to these questions is: it depends. But seeing why that's the right answer will help us to better understand the inductive version of the kalam cosmological argument.

Let's first focus on the conclusion of the argument, the proposition that God exists. It could be that, before learning any physics, the agent already fully believes that God exists; she already assigns probability 1 to that proposition. As a result, learning the physics is not going to lead to an increase in the probability for that hypothesis.

Let's suppose then that, before learning any physics, the agent assigns an non-extremal probability, between 0 and 1, to the proposition that God exists – call that proposition G. For similar reasons, let's assume that the agent assigns a non-extremal probability to the hypothesis that the universe began to exist – call that proposition B. Note that the probability that the agent assigns to G, $P(G)$, is greater than or equal to the probability that the agent assigns to B, $P(B)$, since the agent fully believes that B, along with other propositions the agent fully believes, entails G.

Now, let E be the set of beliefs that expert physicists have. The key question we want to ask is: when the agent learns E, does this lead to an increase in the probability she assigns to G? In other words, is it the case that $P(G|E) > P(G)$?

The answer is: it depends on what agent we're discussing. I'll describe two sorts of agents, each of which is rational and has intuitively reasonable probability assignments, but where for one agent $P(G|E) > P(G)$, while for the other agent $P(G|E) < P(G)$.

First, imagine an agent, Alice, who is an atheist – she initially assigns a low probability to *G*. Alice starts out not knowing any physics, and she thinks it highly improbable that the universe began to exist. As a result, she initially does not find the kalam cosmological argument at all plausible, even though she believes the second premise, and believes that the argument is valid. Moreover, suppose that the kalam cosmological argument is the only reason she has for believing that the universe has a cause of its existence. But then, she learns physics, and learns that the hypothesis that the universe began to exist is a live option, an option taken seriously by expert physicists. This leads her to increase her probability assignment to the hypothesis that the universe began to exist, and hence to increase her probability assignment to the hypothesis that the universe has a cause of its existence. She believes that this cause would be God, and hence learning the physics *E* leads her to increase her probability assignment to *G*.

Now, imagine an agent, Bob, who is a believer – he initially assigns a high probability to *G*. Bob starts out not knowing any physics, and he thinks it highly probable that the universe began to exist. Moreover, the kalam cosmological argument provides the only reason that Bob believes in God. You can see how the story goes: when Bob learns physics, he learns that the hypothesis that the universe has been in existence forever is a live option, an option taken seriously by expert physicists. This leads him to decrease his probability for *B*, and hence to decrease his probability for *G*.

The lesson I draw is that the evidence from physics can, in conjunction with the kalam cosmological argument, lead to an increase in the probability that a rational and reasonable agent assigns to *G*; to this extent the inductive version of the kalam cosmological argument is effective. However, the same evidence and argument can lead to a decrease in the probability assigned to *G* for a different rational and reasonable agent; to this extent the argument is counterproductive (from a theistic perspective).

Is that all there is to say? Isn't there an objectively right answer as to whether the inductive kalam cosmological argument is successful? I have been implicitly utilizing a subjectivist interpretation of probability in this section, and while I think that is the right interpretation of probability to endorse, this is a controversial matter. Could a different interpretation of probability yield a more definitive answer as to whether the inductive kalam cosmological argument is successful?

I will argue that other interpretations either don't get off the ground, in the sense that they just aren't applicable to the inductive kalam cosmological argument, or the other interpretations will incorporate just as much subjectivity as the subjectivist interpretation – it's just that the subjectivity will come in deciding what the ostensibly objective probabilities are. A full discussion of this would require detailed examination of the various interpretations of probability; I'll just say enough to give the reader an idea of how my argument would go.

The frequency, propensity, and physical interpretations of probability are interpretations that just aren't applicable to the inductive kalam cosmological argument. The reason they aren't applicable is that they can't be reasonably used to determine a probability assignment to *G* or *B*.

On the frequency interpretation, a probability assignment is determined by the frequency with which an event occurs. But it doesn't seem to make sense to talk of the frequency with which God exists. The only way I can think of to make this prima facie plausible is to suppose that there exist multiple universes, where God exists in some universes but not in others. But even here it is not necessarily the case that a frequency approach makes sense. The most well-known account where there are multiple universes, only some of which have a God, is David's Lewis's (1986) modal realist account. But according to Lewis, there are an infinite number of universes with God, and an infinite number without, and as a result it's not clear what one could say about the frequency with which God exists in the universes. (One would need a measure over the space of possible worlds, but it's not clear where that measure would come from, or why we would be justified in treating that measure as a probability measure.)

The propensity interpretation suffers similar problems – it doesn't seem to make sense to talk of the propensity for God to exist, or the propensity for the universe to have a beginning. Also, the physical interpretation is a non-starter – there is no objectively indeterministic event that establishes whether God exists, or whether the universe has a beginning.

The classical and logical interpretations of probability are perhaps somewhat more promising than the three I've just considered. On these interpretations, probabilities are determined by symmetry considerations, including the principle of indifference. One could argue, for example, that since there are two possibilities for the universe, the universe having a beginning and the universe having been in existence forever, each possibility should receive equal probability, and hence $P(B) = 1/2$. But here the standard arguments against the principle of indifference come into play: one will get different probability assignments depending on how one chooses to partition the space of possibilities, and it's not clear that there's an objectively right way to partition the space. For example, we could partition the space of possibilities as follows: the universe began to exist; the universe has been in existence forever and will continue forever; the universe has been in existence forever but will end a finite time into the future. With this partition, $P(B) = 1/3$. But it can't be the case that both $P(B) = 1/2$ and $P(B) = 1/3$, so one would need an account of why one partition of the space is correct. It's not clear how there could be such an objectively correct account.

Finally, I want to consider the epistemic interpretation of probability. I am of the opinion that this interpretation doesn't make sense, but I'll suppose that it does make sense for the purposes of discussion. This interpretation holds that there is an objectively right probability assignment to a proposition, given the evidence that an agent or an epistemic community has. This, given the evidence that the community of physicists have accumulated (and any other relevant evidence), the proponent of the epistemic interpretation would say that there is an objectively right probability to assign to the proposition that the universe had a beginning. And similarly, they would say that given all the evidence we as an epistemic community has, there is an objectively right probability to assign to the proposition that God exists.

The problem here is that there is no agreement on what those objectively right probabilities are. An atheist and a theist are not going to agree on what the objectively right epistemic probability assignment to G is, even if they are both prima facie rational and share all the same evidence. Maybe there is an objectively right probability assignment, but given the lack of access to that assignment, we are left to deal with subjective opinions about what the objectively right probability assignment is, and hence we're in no different of a position than if we simply utilize the subjective interpretation to begin with. The point can also be made with the proposition that the universe began to exist – different physicists assign different probabilities to *B*, even if the physicists are equally knowledgeable about the results from physics.

It's worth noting that if the epistemic interpretation of probability is correct, or some other objective interpretation of probability is correct, then there is an objective fact of the matter regarding whether the kalam cosmological argument provides inductive evidence for the existence of God. My main point, in discussing these objective interpretations of probability, is that, at best, even if there are objective probabilities, we don't have epistemic access to what the objective probability assignments are. Thus, even if there is a fact of the matter regarding whether the inductive version of the kalam cosmological argument is successful, we don't know what that fact is. We are simply left with our subjective probabilistic reasoning, and thus, we are left with the conclusion I reached above: the evidence from physics can, in conjunction with the kalam cosmological argument, lead to an increase in the probability that a rational and reasonable agent assigns to *G*, but it can also lead to a decrease, depending on what opinions the agent starts with.

5. The Fine-Tuning Argument

6. The Privileged Planet Argument

7. Physics-Based Metaphysics

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