The Scientific Kalam Cosmological Argument
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SUMMARY

In this lecture at Georgia Tech Dr. Craig focuses on the scientific evidence for the premises of the kalam cosmological argument for a Personal Creator of the universe.

THE SCIENTIFIC KALAM COSMOLOGICAL ARGUMENT

What is the Kalam Cosmological Argument? The word “kalam” is an Arabic word that denotes medieval Islamic theology. Muslim theologians, when Islam swept over Egypt in North Africa, absorbed the Christian thought that had been in those areas, like in Alexandria, which was the center of Christian learning. They picked up these arguments for the creation of the world that Christians had been using against Greek materialists and other philosophers. They began to develop these arguments in highly sophisticated ways for the existence of God as the creator of the universe.

So let me appeal to one of the greatest of these medieval thinkers whose name was al-Ghazali, a medieval Muslim theologian from the 12th century who lived in Persia, or modern day Iran. He was concerned that the Muslim theologians of his day were being highly influenced by Greek philosophers. They denied the creation of the universe by God. Instead these philosophers held that the universe just flows necessarily out of the being of God and is therefore eternal and beginningless and, in fact, just as necessary as God is. The world is a sort emanation out of the being of God.

After thoroughly studying the writings of these philosophers, al-Ghazali wrote a withering critique of their views in a book entitled The Incoherence of the Philosophers. This is a fascinating book, which I think repays reading today – it is just a very stimulating book! In this book, he argues that the idea of a beginningless universe is absurd. He argues that the universe must have had a beginning, and since nothing comes into being without a cause, there must be a transcendent creator of the universe. Al-Ghazali frames the argument very simply; here is a quotation from him, “Every being which begins has a cause for its beginning. Now the world is a being which begins. Therefore, it possesses a cause for its beginning.” [1] We can summarize al-Ghazali’s argument by means of three simple steps:

1. Whatever begins to exist has a cause.
2. The universe began to exist.

3. Therefore, the universe has a cause.

This little argument is so marvelously simple that anybody can memorize it and share it with another person. It just consists of those three short steps.

Notice that it is also a logically airtight argument. If the two premises are true, then the conclusion follows necessarily. Anybody who wants to deny the conclusion that the universe has a cause of its beginning has to deny one of the two premises. He has to say that either premise 1 or premise 2 is false, and so the whole question comes down to that – are these premises more plausibly true than false?

What we want to do is examine each of the premises in turn.

PREMISE 1

The first premise is that whatever begins to exist has a cause. I think that this premise is virtually undeniable for any sincere seeker after truth. For something to come into being without any causal conditions of any sort would be to come into being from nothing. That is surely impossible. Let me give three reasons in support of this first premise.

First, *something cannot come from nothing*. To claim that something can come into being from nothing is worse than magic, when you think about it. When a magician pulls a rabbit out of a hat, at least you’ve got the magician—not to speak of the hat! But if you deny premise 1, you have got to say that the whole universe just appeared at some moment in the finite past for no reason whatsoever. But I do not think that any sane person sincerely believes that things, say, a horse or an Eskimo village, can just pop into being out of nothing without a cause.

Very many times, skeptics will respond to this point by saying that in physics, subatomic particles, virtual particles as they are called, come into being from nothing. And, therefore, in subatomic physics, you do get something from nothing: these virtual particles pop into being from nothing. Or certain theories of the origin of the universe are sometime described in popular magazines as getting something from nothing. Very often the universe will be described as the proverbial “free lunch.” Milton Friedman, the economist, says, “There ain’t no free lunch.” Sometimes people will say that the universe is the exception to the proverb “There ain’t no free lunch” because the universe came into being from nothing. E.G., Hawking; Krauss.

I think that this response represents a deliberate abuse of science, to be frank. The theories in
question have to do with particles’ originating as fluctuations of the energy in the vacuum. And you need to understand that in physics, the vacuum is not what the layman means by a vacuum, namely, nothing. In physics, the vacuum is a sea of fluctuating energy, a sea of violent activity, having a physical structure and governed by physical laws. Similarly, in these models of the universe, the universe comes into being out of the vacuum; it doesn’t come into being from nothing. The vacuum is definitely something, which is this sea of fluctuating energy. And to tell lay people that in this case something comes from nothing is simply a distortion of these theories and, as I say, an abuse of science by those who appeal to them.

David Albert explains,

ever since the scientific revolution of the 17th century, what physics has given us in the way of candidates for the fundamental laws of nature have as a general rule simply taken it for granted that 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.

The fundamental physical laws that Krauss is talking about in “A Universe From Nothing” — the laws of relativistic quantum field theories — are no exception to this. The particular, eternally persisting, elementary physical stuff of the world, according to the standard presentations of relativistic quantum field theories, consists (unsurprisingly) of relativistic quantum fields. 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.

there is, as it happens, an interesting difference between relativistic quantum field theories and every previous serious candidate for a fundamental physical theory of the world. Every previous such theory counted material particles among the concrete, fundamental, eternally persisting elementary physical stuff of the world — and relativistic quantum field
theories, interestingly and emphatically and unprecedentedly, do not. According to relativistic quantum field theories, particles are to be understood, rather, as specific arrangements of the fields. Certain arrangements of the fields, for instance, correspond to there being 14 particles in the universe, . . . and certain other arrangements correspond to there being no particles at all. And those last arrangements are referred to, in the jargon of quantum field theories, for obvious reasons, as "vacuum" states.

Krauss seems to be thinking that these vacuum states amount to the relativistic-quantum-field-theoretical version of there not being any physical stuff at all. . . . But that's just not right. 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. [2]

There is, by the way, a lesson that is very, very important in this, namely, you have got to be very leery of articles in popular magazines and shows on television purporting to describe current scientific theories. In order to communicate these highly technical theories to laymen, the authors of these articles and television shows inevitably have to appeal to metaphors which are highly misleading and inaccurate. This is a case in point, where it is said that contemporary physics shows that something can come from nothing. They are using the word "nothing" in an inaccurate sense, philosophically. The quantum vacuum is not nothing. So be very careful and skeptical on what you hear on these popular programs and in these popular articles.

Nothing, or nothingness, is not just empty space. "Nothing" is a term of universal negation; it means "not anything." Should not be reified. Eg., "I had nothing for lunch today." You can see how silly it is when popularizers say things like nothingness is unstable to quantum fluctuations or the universe tunneled into being out of nothing. They are using these words in a philosophically inaccurate and misleading way. Nothingness is the absence of being – the absence of anything –
and as such has no properties and therefore cannot be unstable to fluctuations or produce universes or anything of this sort.

When I first published my work on the Kalam Cosmological Argument as a result of my study at the University of Birmingham in England, I figured that atheists would attack the second premise of the argument (“The universe began to exist”) because that seemed to me clearly a more controversial premise. I never dreamed that atheists would go after this first premise. It seemed to me that to attack the first premise would simply expose one as a person who isn’t really sincere about finding out the truth about reality but is just looking for an academic refutation of the argument – just looking for any sort of loophole to try to escape the conclusion. You can imagine my surprise, then, in finding atheists denying premise 1 in order to avoid the conclusion to the argument! For example, my friend and colleague Quentin Smith, who is a philosopher at the University of Western Michigan, responded to this argument by saying that the universe came from nothing, by nothing, and for nothing – sort of a good close to a Gettysburg Address of atheism! But it seems to me this is simply the faith of an atheist. 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?

My second point is: if something can come into being from nothing, if that is possible, then it becomes inexplicable why anything and everything doesn’t come into being from nothing. Think about it. Why don’t bicycles and Beethoven and root beer pop into being uncaused from nothing? Why is it only universes that can spring into being from nothing? What makes nothingness so discriminatory? There can’t be anything about nothingness that favors universes because nothingness has no properties. Nothing can constrain nothingness either because there isn’t anything to be constrained. I think this point is a very persuasive one, namely, it becomes utterly inexplicable why just anything and everything doesn’t just pop into being out of nothing, if this can happen.

I have heard atheists respond to this argument in the following way. “Well, premise 1 is true of everything in the universe, but it is not true of the universe.” Premise 1 isn’t just a physical law of nature, like the law of gravity, which only applies in the universe. Rather, it is a metaphysical principle which applies to being as being – it applies to being as such. Therefore, it governs all of
reality, all of being. And it would be arbitrary to say that the principle does not apply to the origin of the universe – that the universe can somehow spring into being without a cause. You cannot dismiss the causal principle like a cab once you have arrived at your desired destination.

At this point the atheist is likely to retort, “All right, if everything has a cause, then what is God’s cause?” And, I must say, I am surprised at the self-congratulatory attitude that accompanies this question many times on student’s lips. They imagine that they have said something really profound here and really offered a knock down argument, when in fact all they have done is misunderstand the first premise. Premise 1 does not say everything has a cause. It says whatever begins to exist has a cause. Everything that comes into being has a cause. But something that is eternal would not need a cause because it never came into being.

And notice this isn’t special pleading for God. This is what the atheist has always said about the universe, right? The universe is eternal and uncaused and therefore there is no cause of the universe existing. So this isn’t special pleading for God, this is exactly what the atheist has typically said about the universe, or about matter and energy. But the problem is, as we will see, we now have strong evidence that the universe is not eternal in the past, but that the universe did have a beginning. And so the atheist is backed into the corner of having to say that the universe just sprang into being uncaused out of nothing, which, I think, is absurd.

The third point in support of this first premise is that common experience and scientific evidence confirm the truth of premise 1. Premise 1 is constantly verified and never falsified. So it is hard to understand how any atheist, who is committed to modern science, could deny, in the light of the evidence, that premise 1 is more plausibly true than false. Even if it is not certain, surely the evidence makes it more plausibly true than false. It is never falsified, it is always verified, and that gives us good inductive grounds for accepting this premise.

In my opinion, the first premise of the Kalam Cosmological Argument is clearly true, and if the price of denying the argument’s conclusion is to deny premise 1, then I think that atheism is philosophically bankrupt.

PREMISE 2

If we agree that whatever begins to exist has a cause, what evidence is there to support the crucial second step in the argument, that the universe began to exist? We’ll examine both deductive, philosophical arguments and inductive, scientific arguments in support of (2). Here we shall examine only the scientific evidence.
Scientific Arguments: The Expansion of the Universe

Now some people find philosophical arguments dubious or difficult to follow; they prefer empirical evidence. So I now turn to an examination remarkable scientific confirmations of the conclusion already reached by philosophical argument alone. Before I do so, however, I want to note in passing that the sort of philosophical problems with the infinity of the past which we have discussed are now being recognized in scientific papers by leading cosmologists and philosophers of science. [3] For example, Ellis, Kirchner, and Stoeger ask, “Can there be an infinite set of really existing universes? We suggest that, on the basis of well-known philosophical arguments, the answer is No.” [4] Similarly, noting that an actual infinite is not constructible and therefore not actualizable, they assert, “This is precisely why a realised past infinity in time is not considered possible from this standpoint—since it involves an infinite set of completed events or moments.” [5] These misgivings represent endorsements of both of the kalam arguments which I defended above. Ellis and his colleagues conclude, “The arguments against an infinite past time are strong—it's simply not constructible in terms of events or instants of time, besides being conceptually indefinite.” [6]

The physical evidence for the beginning of the universe comes from what is undoubtedly one of the most exciting and rapidly developing fields of science today: astronomy and astrophysics. Prior to the 1920s, scientists had always assumed that the universe was stationary and eternal. Tremors of the impending earthquake that would topple this traditional cosmology were first felt in 1917, when Albert Einstein made a cosmological application of his newly discovered gravitational theory, the General Theory of Relativity (GR). To his chagrin, Einstein found that GR would not permit an eternal, static model of the universe unless he fudged the equations in order to offset the gravitational effect of matter. 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. By taking this feature of Einstein’s model seriously, the Russian mathematician Alexander Friedman and the Belgian astronomer Georges Lemaître were able to formulate independently in the 1920s solutions to his equations which predicted an expanding universe.

The monumental significance of the Friedman-Lemaître model lay in its historization of the universe. As one commentator has remarked, up to this time the idea of the expansion of the universe “was absolutely beyond comprehension. Throughout all of human history the universe was regarded as fixed and immutable and the idea that it might actually be changing was
inconceivable." [7] But if the Friedman-Lemaître model were correct, the universe could no longer be adequately treated as a static entity existing, in effect, timelessly. Rather the universe has a history, and time will not be matter of indifference for our investigation of the cosmos.

In 1929 the American astronomer Edwin Hubble showed that the light from distant galaxies is systematically shifted toward the red end of the spectrum. This red-shift was taken to be a Doppler effect indicating that the light sources were receding in the line of sight. Incredibly, what Hubble had discovered was the expansion of the universe predicted by Friedman and Lemaître on the basis of Einstein's GR. It was a veritable turning point in the history of science. “Of all the great predictions that science has ever made over the centuries,” exclaims John Wheeler, “was there ever one greater than this, to predict, and predict correctly, and predict against all expectation a phenomenon so fantastic as the expansion of the universe?” [8]

The Standard Model

According to the Friedman-Lemaître model, as time proceeds, the distances separating the galaxies become greater. It's important to appreciate that as a GR-based theory, the model does not describe the expansion of the material content of the universe into a pre-existing, empty space, but rather the expansion of space itself. The galaxies are conceived to be at rest with respect to space but to recede progressively from one another as space itself expands or stretches, just as buttons glued to the surface of a balloon will recede from one another as the balloon inflates. As the universe expands, it becomes less and less dense. This has the astonishing implication that as one reverses the expansion and extrapolates back in time, the universe becomes progressively denser until one arrives at a state of infinite density at some point in the finite past. This state represents a singularity at which space-time curvature, along with temperature, pressure, and density, becomes infinite. It therefore constitutes an edge or boundary to space-time itself. P. C. W. Davies comments,

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. [9]
The term “Big Bang,” originally a derisive expression coined by Fred Hoyle to characterize the beginning of the universe predicted by the Friedman-Lemaître model, is thus potentially misleading, since the expansion cannot be visualized from the outside (there being no “outside,” just as there is no “before” with respect to the Big Bang). [10]

The standard Big Bang model, as the Friedman-Lemaître model came to be called, thus describes a universe which is not eternal in the past, but which came into being a finite time ago. Moreover, — and this deserves underscoring — the origin it posits is an absolute origin out of nothing. For not only all matter and energy, but space and time themselves come into being at the initial cosmological singularity. As physicists John Barrow and Frank Tipler emphasize, “At this singularity, space and time came into existence; literally nothing existed before the singularity, so, if the Universe originated at such a singularity, we would truly have a creation ex nihilo.” [11] Thus, we may graphically represent space-time as a cone (Fig. 2).

Fig. 2: Conical Representation of Standard Model Space-Time. Space and time begin at the initial cosmological singularity, before which literally nothing exists.

On such a model the universe originates ex nihilo in the sense that at the initial singularity it is true that There is no earlier space-time point or it is false that Something existed prior to the singularity.

Now such a conclusion is profoundly disturbing for anyone who ponders it. For the question cannot be suppressed: Why did the universe come into being? Sir Arthur Eddington, contemplating the beginning of the universe, opined that the expansion of the universe was so preposterous and incredible that “I feel almost an indignation that anyone should believe in it — except myself.” [12] He finally felt forced to conclude, “The beginning seems to present insuperable difficulties
unless we agree to look on it as frankly supernatural.” [13] The problem of the origin of the universe, in the words of one astrophysical team, thus “involves a certain metaphysical aspect which may be either appealing or revolting.” [14]

EXCEPTIONS TO SINGULARITY THEOREMS

Five possible exceptions to the Hawking-Penrose singularity theorems conveniently distinguish four classes of non-standard models which provide possible alternatives to the standard Big Bang model. The H-P theorem also has the obvious, but implicit, condition that GR is fundamental; that is, it is a complete as well as correct description of conditions within our universe.

![Diagram of 5 Exception Conditions to Hawking-Penrose Theorem]

**Fig. 1: Model classes based on exceptions to the H-P singularity theorems.**

The first option (closed time loops) has been the subject of some exploration in cosmological circles. The next two—eternal inflation and quantum gravity—represent areas of fertile cosmological investigation which merit our attention. The last two exception conditions are not expected to be part of ‘reasonable’ physical models of the universe. Hence, our discussion will
revolve around the first three options.

I. Closed Timelike Curves

A first, exotic exception to the Hawking-Penrose theorems is the possible existence of closed, timelike curves. Permitted by Einstein’s GR, closed, timelike curves represent an observer tracing out a circular path through space and time.

J. Richard Gott and Li-Xin Li have proposed a model according to which the early universe is a closed time loop that occasionally gives ‘birth’ to a universe like ours (Fig. 4). Most cosmological models assert that the past terminates at a boundary a finite time ago. One then wishes to explain what exists at that boundary. Gott and Li believe, instead, that there is a closed timelike curve (CTC) at this boundary.

Fig. 4: A Gott-Li Universe: The region of closed timelike curves exists at the bottom of the diagram. The four branches to the top of the diagram can be thought of as inflationary bubbles undergoing a De Sitter-like expansion.

Philosophically problematic. Here our interest is in the model’s physical viability. The primary physical problem confronting CTC models in general is their violation of the so-called Chronology Protection Conjecture.
Gott and Li indicate that “the region of CTCs . . . should be in a pure vacuum state containing no real particles or Hawking radiation and no bubbles” (Gott and Li 1998, p. 39). This is so because this stray radiation would destroy the CTC. The reason for this curious feature of a CTC model was discussed by Stephen Hawking in (Hawking 1992), where he formally suggested a ‘Chronology Protection Conjecture’. His theory was that a time machine (CTC) would have characteristics that were so unstable that it would quickly destroy itself. Hence nature conspires to prevent time machines.

After the publication of Gott and Li’s paper, William Hiscock developed a defense of the CPC that still appears to stand (Hiscock 2000). First, Hiscock argues that the Gott-Li choice of initial condition is highly fine-tuned. In fact, Gott-Li’s scenario is just about as unlikely as is possible without ruling it out summarily. Second, Hiscock argues that the Gott-Li vacuum is not stable, given more realistic physical force fields. CTC physics is interesting, and while some theorists still pursue it, it occupies only a small minority of ongoing cosmological investigation. While it is true that no one has been able definitively to rule out CTCs, the evidentiary burden lies upon those defending the viability of such spacetimes and models predicated upon their reality.

II. Eternal Inflation

A more serious exception to the Hawking-Penrose singularity theorems is afforded by inflationary theory. Although the Friedmann-Lemaître model had a great deal of evidential support, there were, nonetheless, observational anomalies which suggested that there was more to the story. There were also theoretical reasons to think that the description was not quite complete. These difficulties, especially the horizon, flatness, and cosmic relic problems, prompted theorists to propose a modification of the standard Big Bang picture called “inflation.” Guth’s solution to these three problems was to postulate a period of exponential expansion very early in the history of the universe.

Inflation was a remarkable fix to a set of serious anomalies; but it also had one more feature in store. The Hawking-Penrose singularity theorems had as one of their requirements that gravity is always attractive—just as it is for ordinary matter. But the most likely physical candidate that could account for an inflationary event was a type of energy similar to the original cosmological constant that Einstein had proposed (Einstein 1917). This bizarre type of energy would act like repulsive gravity. This led to a philosophically desired outcome. If this “repulsive gravity” was present in the early universe and could dominate attractive gravity, then the possibility arises that the Hawking-
Penrose singularity theorems did not apply to the real universe. Perhaps the universe is past eternal after all.

The 1980s and '90s witnessed a proliferation of inflationary models that theoretically allowed for a projection into an eternal past (Linde 2005). The inflationary phase mentioned above was not viewed in these models as an isolated event. Theorists began to describe the exotic energy that produces inflation as a field that pervades otherwise empty space. A key assumption was that the density of the energy throughout space never changes, so that it resembles Einstein’s cosmological constant. It does not depend on space or time, that is, it is constant. In that case, as space expands, more energy must continually be produced in order to maintain a constant energy density (where this energy comes from is still a matter of controversy). Space ‘clones’ itself. Occasionally, parts of this rapidly expanding space decay (convert) into the type of “empty” space that we live in. This space has a much lower energy density, so there is now a great deal of excess energy that pervades our new “bubble”. This excess energy is thought to convert into the normal matter that we see around us. The Big Bang is just a regional event within a larger multiverse. There are different kinds of ‘empty space’ which feature different values of the cosmological constant (different colored bubbles). The larger the constant, the faster the universe expands. Our universe decayed from one of these ‘false vacuum’ regions.

But what happens to the original space, part of which decayed to form our universe? It is still there, continuing to expand at enormous speed. Since it (usually) has a cosmological constant larger than the new bubble, its growth outpaces that of the new bubble. Since the false vacuum expands faster than it decays, inflation is eternal into the future. New bubbles of low energy vacuum will continue to decay out of the expanding space.

Theorists wondered whether this process could be infinitely extended into the past. Interestingly, Guth himself, along with collaborators Alexander Vilenkin and Arvind Borde, has likely closed the door on that possibility. In 2003, Borde, Guth, and Vilenkin published an updated singularity theorem far grander in scope than the Hawking-Penrose theorems. They explain,

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 $H_{av} > 0$ holds along these past-directed geodesics (Borde, Guth, and Vilenkin 2003, p. 3) [15]

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. This assumption should certainly be satisfied in the inflating false vacuum. The conclusion is that past-eternal inflation without a beginning is impossible (Vilenkin 2006, p. 175).

The Borde-Vilenkin-Guth singularity theorem is now widely accepted within the physics community. As of this writing, it has gone largely unchallenged. [16]

Some current cosmological speculation is based upon attempts to craft models based upon possible exceptions to the Borde-Guth-Vilenkin condition that the universe has on average been in a state of cosmic expansion. In his article Jim provides the following chart of possibilities:

The first case involves an infinite contraction prior to the singularity, followed by our current expansion. The second case postulates an unstable initial state followed by an inflationary
expansion. The third case imagines a contraction followed by a super-expansion fueled by ‘dark’ energy, with the universe breaking into a multiverse. The fourth case postulates two mirror-image, inflationary expansions, where the arrows of time point away from the cosmological singularity. 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.

III. QUANTUM GRAVITY

The third alternative to the Hawking-Penrose theorems that has been vigorously pursued is Quantum Gravity models. Jim provides the following chart of such models:

The first class of models postulates an eternal vacuum space in which our universe originates via a quantum fluctuation. It was found that these models could not avoid the beginning of the vacuum space itself and so implied the absolute beginning of spacetime. These models did not outlive the early 1980s.

The second class, string theoretical models, have been all the rage lately. They are based upon an
alternative to the standard model of particle physics which construes the building blocks of matter to be, not pointlike particles, but one dimensional strings of energy. Jim discusses three types of string cosmological models:

The first of these string cosmologies, Ekpyrotic cyclic models, is subject to the Borde-Guth-Vilenkin theorem and so is admitted to involve a beginning of the universe. The second group, Pre-Big Bang models, cannot be extended into the infinite past if they are taken to be realistic descriptions of the universe. The third group, the string landscape models, feature the popular multiverse scenario. They are also subject to the Borde-Guth-Vilenkin theorem and so imply a beginning of the universe. Thus, string cosmological models do not serve to avert the prediction of the standard model that the universe began to exist.

The third class of Quantum Gravity models, Loop Quantum Gravity theories, features versions of a cyclical universe, expanding and contracting. These models do not require an eternal past, and trying to extend them to past infinity is hard to square with the Second Law of Thermodynamics
and seems to be ruled out by the accumulation of dark energy, which would in time bring an end to the cycling behavior.

Finally, fourth, the Semi-classical Quantum Gravity models include the famous Hartle-Hawking model and Vilenkin’s own theory:

These models feature an absolute beginning of the universe, even if the universe does not come into being at a singular point. Thus, Quantum Gravity models no more avoid the universe’s beginning than do purported Eternal Inflationary models.

In sum, the prediction of the standard model that the universe began to exist remains today as secure as ever—indeed, more secure, in light of the Borde-Guth-Vilenkin theorem and that prediction’s corroboration by the repeated and often imaginative attempts to falsify it. Our survey shows that contemporary cosmology is quite supportive of the second premise of the kalam cosmological argument. Further, this conclusion is not reached through ferreting out elaborate and unique failure conditions for scores of individual models. Rather, the repeated application of simple
principles seems effective in ruling out a beginningless model.

They are:

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<tr>
<th>Model average expansion history</th>
<th>Condition requiring a beginning</th>
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<td>1) Expanding models</td>
<td>singularity theorems</td>
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<td>2) Asymptotically static models</td>
<td>metastability</td>
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<tr>
<td>3) Cyclic models</td>
<td>Second Law of Thermodynamics</td>
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<tr>
<td>4) Contracting models</td>
<td>acausal fine-tuning</td>
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Vilenkin is blunt about the implications: “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.” [17] Earlier this year in Cambridge at a conference celebrating the 70th birthday of Stephen Hawking, Vilenkin delivered a paper which surveys current cosmology with respect to the question “Did the Universe Have a Beginning?” He argued that “none of these scenarios can actually be past-eternal.” [18] He concluded, “All the evidence we have says that the universe had a beginning.” [19] Now that’s a remarkable statement. Vilenkin does not say merely that the evidence for a beginning outweighs the evidence against a beginning. Rather he says that all the evidence we have says that the universe has a beginning. Thus, the person who believes that the universe began to exist remains solidly and comfortably within mainstream science.

The Cause of the Universe

Properties of the First Cause

From the two premisses it follows logically that the universe has a cause. This is a staggering conclusion, for it implies that the universe was brought into existence by a transcendent reality.

Conceptual analysis of what it is to be a cause of the universe enables us to recover a number of striking properties which this ultramundane cause must possess and which are of theological significance. For example, the cause must be uncaused, since, as we have seen, an infinite regress of causes is impossible. One could, of course, arbitrarily posit a plurality of causes in some sense prior to the origin of the universe, but ultimately, if the philosophical kalam arguments are
sound, this causal chain must terminate in a cause which is absolutely first and uncaused. There being no reason to perpetuate the series of events beyond the origin of the universe, Ockham’s Razor, which enjoins us not to posit causes beyond necessity, strikes such further causes in favor of an immediate First Cause of the origin of the universe. The same principle dictates that we are warranted in ignoring the possibility of a plurality of uncaused causes in favor of assuming the unicity of the First Cause.

This First Cause must also be beginningless, since by contraposition of premiss (1.0) whatever is uncaused does not begin to exist. Moreover, this cause must be changeless, since, once more, an infinite temporal regress of changes cannot exist. We should not be warranted, however, in inferring the immutability of the First Cause, since immutability is a modal property, and from the Cause’s changelessness we cannot infer that it is incapable of change. But we can know that the First Cause is changeless, at least insofar as it exists sans the universe. From the changelessness of the First Cause, its immateriality follows. For whatever is material involves incessant change on at least the molecular and atomic levels, but the uncaused First Cause exists in a state of absolute changelessness. Given some relational theory of time, the Uncaused Cause must therefore also be timeless, at least sans the universe, since in the utter absence of events time would not exist. 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. Given that time had a beginning, the cause of the beginning of time must be timeless. [20] It follows that this Cause must also be spaceless, since it is both immaterial and timeless and no spatial entity can be both immaterial and timeless. If an entity is immaterial, it could exist in space only in virtue of being related to material things in space; but then it could not be timeless, since it undergoes extrinsic change in its relations to material things. Hence, the uncaused First Cause must transcend both time and space and be the cause of their origination. Such a being must be, moreover, enormously powerful, since it brought the entirety of physical reality, including all matter and energy and space-time itself, into being without any material cause.

Finally, and most remarkably, such a transcendent cause is plausibly taken to be personal. Three reasons can be given for this conclusion. First, as Richard Swinburne (1991, pp. 32-48) points out, there are two types of causal explanation: scientific explanations in terms of laws and initial
conditions and personal explanations in terms of agents and their volitions. For example, in answer to the question, “Why is the kettle boiling?” we might be told, “The heat of the flame is being conducted via the copper bottom of the kettle to the water, increasing the kinetic energy of the water molecules, such that they vibrate so violently that they break the surface tension of the water and are thrown off in the form of steam.” Or alternatively, we might be told, “I put it on to make a cup of tea. Would you like some?” The first provides a scientific explanation, the second a personal explanation. Each is a perfectly legitimate form of explanation; indeed, in certain contexts it would be wholly inappropriate to give one rather than the other. Now a first state of the universe cannot have a scientific explanation, since there is nothing before it, and therefore it cannot be accounted for in terms of laws operating on initial conditions. It can only be accounted for in terms of an agent and his volitions, a personal explanation.

Second, the personhood of the First Cause is already powerfully suggested by the properties which have been deduced by means of our conceptual analysis. For there appear to be only two candidates which can be described as immaterial, beginningless, uncaused, timeless, and spaceless beings: 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. No other candidates which could be suitably described as immaterial, beginningless, uncaused, timeless, and spaceless beings come to mind. Nor has anyone else, to our knowledge, suggested any other such candidates. But no sort of abstract object can be the cause of the origin of the universe, for abstract objects are not involved in causal relations. Even if they were, since they are not agents, they cannot volitionally exercise a causal power to do anything. If they were causes, they would be so, not as agents, but as mindless events or states. But they cannot be event-causes, since they do not exist in time and space. Even if we allow that some abstract objects exist in time (for example, propositions which change their truth-value in virtue of the tense of the sentences which express them), still, in view of their abstract nature, it remains utterly mysterious how they could be causally related to concrete objects so as to bring about events, including the origin of the universe. Nor can they be state-causes of states involving concrete objects, for the same reason, not to mention the fact that in the case at hand we are not talking about state-state causation (that
is, the causal dependence of one state on another), but what would amount to state-event causation (namely, the universe’s coming into being because of the state of some abstract object(s)), which seems impossible. Thus, the cause of the universe must be an unembodied mind.

Third, this same conclusion is also implied by the fact that only personal, free agency can account for the origin of a first temporal effect from a 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?

One might say that the cause came to exist or changed in some way just prior to the first event. But then the cause’s beginning or changing would be the first event, and we must ask all over again for its cause. And this cannot go on forever, for we know that a beginningless series of events cannot exist. There must be an absolutely first event, before which there was no change, no previous event. We know that this first event must have been caused. The question is: How can a first event come to exist if the cause of that event exists changelessly and eternally? Why isn’t the effect co-eternal with its cause?

The best way out of this dilemma is agent causation, whereby the agent freely brings about some event in the absence of prior determining conditions. Because the agent is free, he can initiate new effects by freely bringing about conditions which were not previously present. For example, a man sitting changelessly from eternity could freely will to stand up; thus, a temporal effect arises from an eternally existing agent. Similarly, a finite time ago a Creator endowed with free will could have freely brought the world into being at that moment. In this way, the Creator could exist changelessly and eternally but choose to create the world in time. By “choose” one need not mean that the Creator changes his mind about the decision to create, but that he freely and eternally intends to create a world with a beginning. By exercising his causal power, he therefore brings it about that a world with a beginning comes to exist. So the cause is eternal, but the effect is not. In
this way, then, it is possible for the temporal universe to have come to exist from an eternal cause: through the free will of a personal Creator.

A conceptual analysis of what properties must be possessed by an ultra-mundane First Cause thus enables us to recover a striking number of the traditional divine attributes. An analysis of what it is to be cause of the universe reveals that

4.0. If the universe has a cause, then an uncaused, personal Creator of the universe exists, who sans the universe is beginningless, changeless, immaterial, timeless, spaceless, and enormously powerful.

From (3.0) and (4.0), it follows that

5.0. Therefore, an uncaused, personal Creator of the universe exists, who sans the universe is beginningless, changeless, immaterial, timeless, spaceless, and enormously powerful.

This, as Thomas Aquinas was wont to remark, is what everybody means by “God.”

Objections

Certain thinkers have objected to the intelligibility of this conclusion. For example, Adolf Grünbaum has marshaled a whole troop of objections against inferring God as the Creator of the universe (Grünbaum 1990b). As these are very typical, a brief review of his objections should be quite helpful.

Grünbaum’s objections fall into three groups. Group I seeks to cast doubt upon the concept of “cause” in the argument: (1) When we say that everything has a cause, we use the word “cause” to mean something that transforms previously existing materials from one state to another. But when we infer that the universe has a cause, we must mean by “cause” something that creates its effect out of nothing. Since these two meanings of “cause” are not the same, the argument is guilty of equivocation and is thus invalid. (2) It does not follow from the necessity of there being a cause that the cause of the universe is a conscious agent. (3) It is logically fallacious to infer that there is a single conscious agent who created the universe.

But these objections do not seem to present any insuperable difficulties: (1) The univocal concept of “cause” employed throughout the argument is the concept of something which brings about or produces its effects. [21] Whether this production involves transformation of already existing materials or creation out of nothing is an incidental question. Thus, the charge of equivocation is groundless. (2) The personhood of the cause does not follow from the two premisses of the
cosmological argument proper, but rather from a conceptual analysis of the notion of a first cause of the beginning of the universe, as we have seen. (3) The inference to a single cause of the origin of the universe seems justified in light of the principle, commonly accepted in science, that one should not multiply causes beyond necessity. One is justified in inferring only causes such as are necessary to explain the effect in question; positing any more would be gratuitous.

The objections of Group II relate the notion of causality to the temporal series of events: (1) Causality is logically compatible with an infinite, beginningless series of events. (2) If everything has a cause of its existence, then the cause of the universe must also have a cause of its existence.

Both of these objections, however, seem to be based on misunderstandings. (1) It is not the concept of causality which is incompatible with an infinite series of past events. Rather the incompatibility, as we have seen, is between the notion of an actually infinite number of things and the series of past events. The fact that causality has nothing to do with it may be seen by reflecting on the fact that the philosophical arguments for the beginning of the universe would work even if the events were all spontaneous, causally unconnected events. (2) The argument does not presuppose that everything has a cause. Rather the operative causal principle is that whatever begins to exist has a cause. Something that exists eternally and, hence, without a beginning would not need to have a cause. This is not special pleading for God, since the atheist has always maintained the same thing about the universe: it is beginningless and uncaused.

Group III objections are aimed at the alleged claim that creation from nothing surpasses all understanding: (1) If creation out of nothing is incomprehensible, then it is irrational to believe in such a doctrine. (2) An incomprehensible doctrine cannot explain anything.

But with regard to (1), creation from nothing is not incomprehensible in Grünbaum’s sense. By “incomprehensible” Grünbaum appears to mean “unintelligible” or “meaningless.” But the statement that a finite time ago a transcendent cause brought the universe into being out of nothing is clearly a meaningful statement, not mere gibberish, as is evident from the very fact that we are debating it. We may not understand how the cause brought the universe into being out of nothing, but such efficient causation without material causation is not unprecedented, as we have seen, and it is even more incomprehensible, in this sense, how the universe could have popped into being out of nothing without any cause, material or efficient. One cannot avert the necessity of a cause by positing an absurdity. (2) The doctrine, being an intelligible statement, obviously does
constitute a purported explanation of the origin of the universe. It may be a metaphysical rather than a scientific explanation, but it is no less an explanation for that.

Grünbbaum has one final objection against inferring a cause of the origin of the universe: the cause of the Big Bang can be neither after the Big Bang (since backward causation is impossible) nor before the Big Bang (since time begins at or after the Big Bang). Therefore, the universe’s beginning to exist cannot have a cause (Grünbbaum 1990a; Grünbbaum 1991; cf. Craig 1994a). But this argument pretty clearly confronts us with a false dilemma. For why could not God’s creating the universe be simultaneous (or coincident) with the Big Bang? God may be conceived to exist timelessly (or in an undifferentiated time) without the universe and in time from the moment of creation. Perhaps an analogy from physical cosmology will be illuminating. The initial Big Bang singularity is not considered to be part of physical time, but to constitute a boundary to time. Nevertheless, it is causally connected to the universe. In an analogous way, we could say that God’s timeless eternity is, as it were, a boundary of time which is causally, but not temporally, prior to the origin of the universe. It seems, therefore, that it is not only coherent but also plausible in light of the kalam cosmological argument that God existing changelessly alone without creation is timeless and that He enters time at the moment of creation in virtue of His causal relation to the temporal universe. The time of the first event would be not only the first time at which the universe exists, but also, technically, the first time at which God exists, since sans the universe God exists timelessly. The moment of creation is, as it were, the moment at which God enters time. His act of creation is thus simultaneous with the origination of the universe.

Conclusion

The first premiss of the kalam cosmological argument is obviously more plausibly true than its contradictory. Similarly, in light of both philosophical argument and scientific evidence, its second premiss, though more controversial, is again more plausibly true than its negation. The conclusion of the argument involves no demonstrable incoherence and, when subjected to conceptual analysis, is rich in theological implications. On the basis of the kalam cosmological argument it is therefore plausible that an uncaused, personal Creator of the universe exists, who sans the universe is beginningless, changeless, immaterial, timeless, spaceless, and enormously powerful.

Footnotes


[5] Ibid.

[6] Ibid.


[10] As Gott, Gunn, Schramm, and Tinsley write,

[11] “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” (J. Richard Gott III, James E. Gunn, David N. Schramm, and Beatrice M. Tinsley, “Will the Universe Expand Forever?” *Scientific American* [March 1976], p. 65).


Ibid., p. 178.


[16] $H_{av}$ refers to the average value of the Hubble constant throughout history.

[17] Andrei Linde has offered a critique, suggesting that BVG imply that all the individual parts of the universe have a beginning, but perhaps the WHOLE does not. This seems misconstrued, however, since BVG are *not* claiming that each past inextendible geodesic is related to a *regional* singularity. Rather, they claim that Linde’s universe description contains an internal contradiction. As we look backwards along the geodesic, it *must* extend to the infinite past if the universe is to be past eternal. But it does not (for the observer co-moving with the expansion). Rather, past inextendible geodesics are the ‘symptom’, not the ‘disease.’ As Robert Wald says (Wald 1984, p. 216), “Unfortunately, the singularity theorems give virtually no information about the nature of the singularities of which they prove existence.” So we don’t know the nature of the singularity that the BVG theorem indicates; we know only that Linde’s description of an infinite past is in error.


[19] Audrey Mithani and Alexander Vilenkin, “Did the universe have a beginning?” ArXiv 1204.4658v1 [hep-th] 20 April 2012. *Cf.* his statement “There are no models at this time that provide a satisfactory model for a universe without a beginning” (A. Vilenkin, “Did the Universe Have a Beginning?” lecture at Cambridge University, 2012). Specifically, Vilenkin closed the door on three models attempting to avert the implication of his theorem: eternal inflation, a cyclic universe, and an “emergent” universe which exists for eternity as a static seed before expanding.


[21] This needs some qualification, since the *kalam* argument strictly demonstrates only that metric time had a beginning. Perhaps the cause exists changelessly in an undifferentiated time in which temporal intervals cannot be distinguished. On this view God existed literally before creation but there was no moment, say, one hour or one million years before creation.

[22] That is to say, an efficient cause. Alternatively, we could leave the question of material causation open by taking “cause” to mean either an efficient or a material cause. Then our conceptual analysis of what it is to be a cause of the universe will eliminate the alternative that the cause is a material cause, leaving us with an ultramundane efficient cause.