§ 4. Excursus on Natural Theology
Lecture 12
Defending The Premises of the *Kalam* Cosmological Argument

In our lesson we've been looking at the first scientific confirmation of the second premise of the *kalam* cosmological argument that the universe began to exist. That confirmation comes from the expansion of the universe. We saw last time that based upon the physical evidence space and time can be represented geometrically as a cone which shrinks as one goes back in time until one reaches an absolute beginning of the universe. The standard Big Bang model predicts a beginning of the universe. Although the standard model will need to be modified in various ways, especially to accommodate a quantum gravity theory to explain the earliest split-second of the universe, nevertheless a prediction of the standard model of a beginning of the universe has now stood for nearly one hundred years and remains the most probable account for the origin of the universe.

I concluded last time by saying, in a sense, the history of 20th century cosmology can be seen as a series of failed attempts to avoid the absolute beginning of the universe predicted by the standard model. We've seen theories like the steady state model, oscillating models, vacuum fluctuation models, eternal inflationary models, and so on and so forth come and go. Any model that doesn't involve an absolute beginning of the universe has shown to be untenable in some way. So when someone like Sean Carroll in our debate on the evidence of cosmology for the existence of the universe simply gives a list of beginningless models of the universe, that says nothing about the tenability of those models. Models are a dime-a-dozen. The question is: are these tenable? The fact is that Jim Sinclair in our article in the *Blackwell Companion to Natural Theology* had already discussed most of the models in that list and shown why they were either empirically untenable or in fact did not avoid the absolute beginning of the universe.

In 2012 Alexander Vilenkin, a prominent cosmologist at Tufts University, at a conference at Cambridge University held in celebration of Stephen Hawking's 70th birthday surveyed the models of contemporary cosmology and concluded, "There are no models at this time that provide a satisfactory model for a universe without a beginning."

Meanwhile, a series of remarkable singularity theorems has increasingly tightened the loop around empirically tenable models by showing that under more and more generalized conditions, a beginning is inevitable. For example, in 1970 Hawking and Penrose formulated the singularity theorems which bear their name which show that any universe governed by the equations of General Relativity must shrink down to an initial singularity. In 2003 three prominent cosmologists, Arvind Borde, Alan Guth, and Alexander Vilenkin, were able to prove a theorem to the effect that any universe which is, on average, in a state of cosmic expansion over its history cannot be infinite in the past but must have a beginning. That goes for expanding multiverse scenarios, as well. In 2012 Vilenkin showed that models which do not meet this single condition of the Borde-Guth-Vilenkin theorem nevertheless fail for other reasons to avert the beginning of the universe.[1] He concluded, "None of these scenarios can actually be past eternal."[2] "All the evidence we have says that the universe had a beginning."[3]

That is a remarkable statement. It would be important if Vilenkin said the evidence for a beginning of the universe outweighs the evidence against a beginning of the universe. But he didn't say that. He said *all* the evidence we have says that the universe had a beginning. I am not aware of any evidence that the universe is past eternal. There is simply nothing on that side of the scale. The evidence for the beginning of the universe, while not rendering this certain, I think certainly justifies Vilenkin's conclusion that the universe probably did begin to exist.

The Borde-Guth-Vilenkin theorem proves that under a single very general condition classical space-time must shrink down to a boundary at some point in the past. *[Dr. Craig draws a diagram on the whiteboard]* Let this [*pointing to diagram]* be classical space-time where you don't take into account quantum effects. Now either there was something on the other side of that boundary or not. If not, then that boundary simply was the beginning of the universe. If there was something on the other side of that boundary, that will be the quantum gravity regime described by the yet-to-be-discovered quantum theory of gravity. In that case, that will be the beginning of the universe. So the Borde-Guth-Vilenkin theorem shows either that classical space-time began with this past boundary or else, if there was a quantum gravity regime, that regime is the beginning of the universe.

Vilenkin's confidence in this fact, even though we don't have yet a quantum theory of gravity, is based upon the fact that a quantum regime like this is radically unstable, or as scientists would say it is metastable. That is to say it cannot endure for very long. Certainly it would be impossible for such a metastable condition to endure for infinite time doing nothing and then suddenly begin to expand about 13.7 billion years ago. Even though we may not have a description of this earliest phase of the universe, we can be confident that if such a quantum regime does exist that it was the beginning of the universe.

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1 5:00

2 Audrey Mithani and Alexander Vilenkin, "Did the universe have a beginning?" arXiv:1204.4658v1 [hep-th] 20 Apr 2012, p. 5. For an accessible video, see see http://www.youtube.com/watch?v=NXCQelhKJ7A (accessed February 23, 2014), where Vilenkin concludes, "there are no models at this time that provide a satisfactory model for a universe without a beginning."

3 A. Vilenkin, cited in "Why physicists can't avoid a creation event," by Lisa Grossman, New Scientist (January 11, 2012).

The prominent cosmologist Charles Misner once put it this way to me. He said, *It is as though there were a tiny window shade drawn across the first split-second of the universe, and we don't know what went on behind that shade. But what we do know is that the universe doesn't come out on the other side.* So whether the universe began in the quantum regime or with classical space-time, the universe began to exist.

Of course, scientific results are always provisional. Science doesn't deal in certainties. It deals in probabilities. We can fully expect that new theories will be proposed, trying to avoid the universe's beginning. These proposals are to be welcomed and tested. But nevertheless I think it's pretty clear which way the evidence points. Today the proponent of the *kalam* cosmological argument stands comfortably within the scientific mainstream in holding that the universe began to exist.

On Friday, Chris Shannon, the former executive director of Reasonable Faith, sent me a link to an article by Alexander Vilenkin written just one month ago for the online scientific magazine *Inference* entitled "Did the Universe Have a Beginning?"[4] This is from October 23, 2015. In it Vilenkin interacts with the *kalam* cosmological argument. I want to read to you from this article. He says,

> Richard Dawkins, Lawrence Krauss and Victor Stenger have argued that modern science leaves no room for the existence of God. A series of science–religion debates has been staged, with atheists like Dawkins, Daniel Dennett, and Krauss debating theists like William Lane Craig. Both sides have appealed to the BGV theorem, both sides appealing to me—of all people!—for a better understanding.

Vilenkin is himself an agnostic.[5] He doesn't believe in God. He is rather bemused that he should become the authority for these arguments. He goes on to say,

> The cosmological argument for the existence of God consists of two parts. The first is straightforward:
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> 1. Everything that begins to exist has a cause;
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> 2. The universe began to exist;
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> 3. Therefore, the universe has a cause.
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> The second part affirms that the cause must be God.
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> I would now like to take issue with the first part of the argument.

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4 See http://inference-review.com/article/the-beginning-of-the-universe (accessed November 22, 2015).

5 10:13

He is going to reject one of those two premises in the *kalam* cosmological argument. But he doesn't reject the second premise that the universe began to exist. Quite the contrary, he affirms this. In the article he says this:

> We have no viable models of an eternal universe. The BGV theorem gives us reason to believe that such models simply cannot be constructed.

This is the strongest statement yet I have read from Vilenkin. Not only does he say we have no viable models today for a beginningless universe, he says that on the basis of his theorem we have reason to believe that such models simply cannot be constructed.

How does Vilenkin then respond as an agnostic to the *kalam* argument? He chooses to reject the first premise – that everything that begins to exist has a cause. He maintains that the universe just popped into being uncaused out of nothing. What justification does he have for such a remarkable hypothesis? Well, he says, in a closed universe (that is, one that is finite in volume), the positive energy and the negative energy in such a universe balance each other out so that the net energy is zero. There is the same amount of positive energy as negative energy so the net energy is zero, and therefore if the universe pops into being uncaused out of nothing the conservation laws of matter and energy are not violated. Therefore the universe can simply come into being uncaused from nothing.

I have to say that I find this difficult to take seriously. Vilenkin assumes that if something doesn't violate the laws of nature then it is metaphysically possible. But there is no reason to adopt such an assumption. Just because something wouldn't violate a natural law doesn't mean that it is metaphysically possible. Just because coming into being uncaused out of nothing wouldn't violate the conservation laws doesn't mean that it is metaphysically possible that something can come into being from nothing. It is easy to think of examples of things that are metaphysically impossible that don't violate the laws of nature. For example, moral truths of some sorts are metaphysically necessary, and therefore it is impossible that it would be good to torture a little child for fun. But doing so wouldn't violate any of nature's laws, would it? That is perfectly consistent with the laws of nature. But I think it is plausible that it is metaphysically impossible that it would be good to torture a little child for fun. That is an ethical truth rather than a scientific or natural truth. Well, what might be another example? How about the statement that no event precedes itself – no event comes before itself. That, I think, is metaphysically necessary. It is impossible that an event precede itself. But no natural law would be violated in such a thing. In fact, what this would be would be if time is circular. If time is circular then event E both precedes and succeeds itself – it comes after itself, it comes before itself. There is no natural law violated in cyclical time. Indeed, scientists will often talk about closed time-like loops. But given the objectivity of temporal becoming, the nature of time, it seems to me that a circular time is metaphysically impossible.[6] So to say that something doesn't violate a law of nature doesn't imply that that thing is metaphysically possible, and coming into being out of nothing would certainly seem to be something that is metaphysically impossible regardless of the conservation laws of matter and energy.

In fact, when you think about it, the situation that Vilenkin imagines just seems positively misguided. It is like saying that if your financial assets and your financial debits exactly balance each other out then your net worth is zero and therefore there is no cause of your financial condition. Clearly, that would be a mistake. Christopher Isham, who is Great Britain's leading quantum cosmologist, in his article “Cosmos and Creation” points out that even if the positive and negative energy balance each other out so that the net energy is zero, he says there still needs to be “ontic seeding” to create the positive energy and negative energy in the first place! So, in fact, even if you have the exact balance of positive and negative energy that wouldn't eliminate the need for a cause of the origin of the universe.

START DISCUSSION

Student: Can I ask for a very basic definition of “metaphysical?”

Dr. Craig: Good question, because the metaphysical section in Barnes and Noble is typically going to be your New Age books and other kook things! Metaphysics is that branch of philosophy which investigates questions concerning ultimate reality. What is real? For example, is materialism true? Is everything that exists material or are their minds or spirits in addition to material things? What is the nature of time and space? Questions about mathematical objects. Are there abstract objects like numbers and sets and functions and propositions? Those are metaphysical questions. “Meta” is a Greek prefix meaning “above” or “beyond.” So metaphysics is that which is beyond physics. Physics describes the physical world in which we live governed by the laws of nature. Metaphysics would be philosophical reflection upon the nature of reality that goes beyond just physics. Is that helpful?

Student: Yes. To take that one step further – then metaphysical is not necessarily theological?

Dr. Craig: No, by no means. For example, a metaphysician who is a materialist would say all that exists is space-time and its contents and there are no spiritual entities. This is a neutral term. It is just a field of philosophy that investigates the nature of reality. Good question.

6 15:01

Student: Do you ever meet people who hold to the "universe never began to exist" but then say you shouldn't hold to dogmas, you should just believe whatever the evidence supports.

Dr. Craig: Certainly that is true. What I say is, why don't you follow the evidence where it leads with regard to the second premise: the universe began to exist. Notice that this premise is theologically neutral. It says nothing about God. It is a scientific statement that can be found in any textbook on astronomy and astrophysics. If Vilenkin is right, we have very powerful evidence for the truth of that premise. My question is: why won't you follow the evidence where it leads? The answer, I think, to that question in some cases is that they see the theologically significant conclusion that this is going to lead to once you couple the second premise with the first premise. I want them to follow the evidence where it leads in this regard.

Student: How does this relate to the no-boundary model?

Dr. Craig: The no-boundary model is an attempt to peek behind the shade and see what lies back there. On the Hartle-Hawking model the idea is that if you peek behind the shade you find that the universe, or space-time, does not go back to a sharp point or singularity at which it begins, but rather the beginning of space-time is rounded off rather like a badminton birdie instead of a cone.[7] This then would say that the beginning point of the universe – the south pole here in this hemisphere *[Dr. Craig points to the rounded edge of the "badminton birdie" on the diagram on the whiteboard]* – is like any other point on the surface. If you go to the north pole or the south pole you wouldn't notice anything different. You would just go right through it. It is like any other point. If successful, the Hartle-Hawking model removes the shade and allows us to describe the universe all the way back to its beginning. That is a beginning that occurs in the finite past. It is supportive of the second premise of the cosmological argument.

Student: As a CPA, I liked your analogy of balance sheets. A balance sheet is a picture of two points in time, but it also contains the equity section which contains the profit and loss which explains how you got from one point in time to another.

Dr. Craig: In this case, there isn't a separation in time. The positive and negative energy both exist right now. But it is like someone whose assets and debits balance each other out so he has a net worth of zero. But it would be, as you know, foolish to say therefore there is no cause of his financial situation.

Student: If you say that there is no boundary on the one end it seems to me you also have to explain the boundary on the leading edge, you'd have a boundary on the edge of expansion, too. I think you'd have to explain that as well.

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Dr. Craig: No, not in the technical sense in which boundary is being used here. The south pole is not a boundary point in the sense that in a cone you have this boundary point. Neither should you think of these edges here as boundaries. It isn't as though you would go to the edge of space and then fall off and that there would be an edge there. On these models if they are finite (if they are closed, as I mentioned before) then three dimensional space would be the analog to the two dimensional surface of a sphere like the Earth. The Earth has no boundary. If you start in one place and keep going, you never come and fall off the edge anywhere. You are going to come back to where you started off again. There is no edge or boundary in that sense to the surface of the Earth. Yet, its volume is finite. It has a finite area. Don't think of these models as representing boundaries in the relevant sense.

Student: I wasn't thinking of boundary on, let's say, the sphere in the expansion. I was projecting out from the singularity – the outward boundary – beyond the edge if you are thinking about the blown balloon.

Dr. Craig: Again, I am going to kind of repeat myself. Imagine that this sphere is shrinking as you go back in the past and as you go forward in the future it is getting bigger. There still isn't any boundary to the sphere. It is at all times finite but either growing or shrinking. But you shouldn't think that this sphere is embedded in some higher dimension. That is the key. It is not as though there is something outside of it. This is the analog to three dimensional space. Even though we can't visualize something like that, nevertheless mathematically it is perfectly consistent to describe it. It is not embedded in a higher dimension.

Student: One thing I don't understand about the expansion is . . . particles and universes, all these have space within them as well. Why is it that the galaxies are receding from each other? They, too, seem to be expanding. All our measurement devices it seems they should be expanding, too. I am not quite getting that.

Dr. Craig: There are forces in nature like gravitation that hold things together.[8] So even though space is expanding it doesn't mean this table is expanding or your body is expanding. There are electromagnetic and gravitational forces that keep these things together. As a result, as space expands they become increasingly isolated from each other, and therefore recede from each other even though they are at rest in space. The galaxies are at rest, but they hold together because of gravity. As space expands they recede from each other even though they are at rest because this sphere itself is getting bigger and bigger.

Student: What is the cause of this space expansion?

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Dr. Craig: That is a question that is unknown in the standard model. But the attempt to have an inflationary model of the universe that I briefly mentioned would be an attempt to explain that. If there was very early on in the early history of the universe this period of super rapid, or inflationary, expansion, what you have there is what is called a false vacuum. In it gravity becomes a repulsive force rather than an attractive force. It would be this repulsive gravity in a sense that would cause the universe to expand.

Student: If I am understanding correctly, even though it has the badminton shaped bottom on the cone, as long as that is not open, as long as that is a closed surface, then that means that time had to have started at a certain point?

Dr. Craig: Let's be careful. What I point out is that Hawking makes the unjustified assumption that having a beginning entails having a beginning point. That is not true. I gave the example of something that is at rest and has a last instant at which it is at rest, and then it begins to move. There is no first instant of motion in such a case because any instant of motion that you pick is preceded by another instant at which it is already in motion. So even though there would be a last instant of rest, there would be no first instant of motion – no beginning point at which it starts to move. But nevertheless it is clear that that motion had a beginning and was finite. The model doesn't need to have a beginning point in order to have a beginning. Time has a beginning just in case for any interval of time that you pick (a second, an hour, a year) if there are only a finite number of prior such equal intervals then time has a beginning whether or not there is a beginning point.

In his most recent book *The Grand Design*, co-authored with Leonard Mlodinow, Hawking does call the south pole in this model the beginning point of time and the universe. He himself validates the interpretation that that would be the beginning point of time and the universe. But it wouldn't be a singularity. It wouldn't be a singular point as in the standard model – that is to say, a point at which quantities become infinite like infinite temperature, infinite density, infinite pressure. This would be an ordinary point like any other point on that hemisphere, and yet it would be the earliest point, Hawking says in *The Grand Design*.

Student: If we were looking at a pool table and *[inaudible]* . . .

Dr. Craig: Right. The cue ball when struck would have obviously a cause and it wouldn't have an infinite path to take, would it? Yet there need not be a first instant of motion of the cue ball. It could just go back to that limit. Zero would be like a limit at which it is at rest. Then it would begin to move. But it doesn't have to have a beginning point. These are ancient paradoxes that Greek philosophers like Zeno talked about in the ancient world as to whether or not there are paradoxes of starting and stopping. Some of them argued on the same assumption as Hawking that because beginning requires a beginning point and there isn't any beginning point that therefore motion is impossible.[9] Motion is an illusion, Zeno thought. That conclusion is obviously absurd.

Student: So instead of the pool ball being shot by somebody, it explodes from where it is at rest and sends all the others outward.

Dr. Craig: I think we would say that its beginning obviously requires a cause and therefore there was some pool player that struck the cue ball and caused it to move. My only point that I am making here is that "beginning to move" doesn't mean it has a beginning point or instant of its motion.

END DISCUSSION

I think you can see why I was so excited about this article from Vilenkin that appeared last month and his interaction with this argument.[10]

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10 Total Running Time: 31:43 ()