

THE KALAM COSMOLOGICAL ARGUMENT: CRITIQUING A RECENT DEFENCE

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Abstract

In the late 1970s the big bang model of cosmology was widely accepted and interpreted as implying the universe had a beginning. At the end of that decade William Lane Craig revived an argument for God known as the Kalam Cosmological Argument (KCA) based on this scientific consensus. Furthermore, he linked the big bang to the supposed biblical concept of creation *ex nihilo* found in Genesis. I shall critique Craig's position as expressed in a more recent update and argue that contemporary cosmology no longer understands the big bang as the ultimate beginning, seriously undermining the KCA. I will further contend that book of Genesis should not be understood as describing creation *ex nihilo* anyway.

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'In the beginning God created the heavens and the Earth' (Genesis 1:1). This opening line of the Bible is, according to Christian philosopher William Lane Craig, a clear statement of the doctrine of creation *ex nihilo* (creation from

nothing). A doctrine that Craig claims has been confirmed by modern science. Here I offer a critique of a recent defence of this position.¹

Creation *ex nihilo*: Is it in Genesis?

Let us first examine if the Hebrew really does talk of creation *ex nihilo*. The word for heavens is Hashimiyam, which could just as easily be translated as 'the sky'. We know this because it is used in many other contexts to refer to the realm where birds fly, for example in Genesis 1:20 and Deuteronomy 4:17. A problem here is that modern readers will think of 'The Heavens' as representing the wider cosmos of galaxies and larger structures. But there is no reason to think the ancient Hebrews had any such notions. Our next word of concern is Eretz, which should perhaps mean 'Land' rather than Earth; for example, in Genesis 21:21 the word is used to describe 'the land of Egypt'. One could perhaps better translate Genesis 1:1 then as 'In the Beginning God created the land and the sky.' This makes the Genesis account far more local than Craig would have us believe.

The Hebrew word for create is 'Bara', which according to Strong's Hebrew concordance means 'to fashion by cutting', implying the existence of pre-existing material. Furthermore, Genesis describes God moving over the face of the water before even saying 'let there be light', indicating that water is primordial and therefore undermining the notion of creation *ex nihilo*.

God also separates this water with a firmament. The Hebrew word used is Raqia, which according to Strong's concordance was 'regarded by Hebrews as solid, and supporting "waters" above it . . . It is derived from the root *raqqē* (רַקַּע), meaning "to beat or spread out thinly", e.g., the process of making a dish by hammering thin a lump of metal.' According to the Jewish encyclopaedia,

The Hebrews regarded the Earth as a plain or a hill figured like a hemisphere, swimming on water. Over this is arched the solid vault of heaven. To this vault are fastened the lights, the stars. So slight is this elevation that birds may rise to it and fly along its expanse.²

This is of course remarkably similar to the cosmology of the Sumerians, who believed in primordial waters separated into An (the Heavenly waters) and Ki (the Earthly waters) divided by the Raqia which stands between them.

Genesis also described the sun and stars and the moon being created on the fourth day after the creation of flowering plants.

Genesis then has no mention of creation *ex nihilo* but instead presents a scientifically inaccurate creation myth that bears remarkable similarity to those of surrounding cultures.

The fact that many Christian philosophers believed in creation *ex nihilo* does not imply that Hebrew authors did. Creation *ex nihilo* was only made official church doctrine in ad 1215.³

Big Bang Cosmology

According to Craig the assumption that the universe was static and eternal became the dominant view among intellectuals from Newton until the twentieth century. In this period Christianity was still the dominant view of natural philosophers. But if the Bible preaches a past finite beginning to the world, how were all these intellectuals Christian? A simple explanation is that they were following a long tradition that assumes Genesis refers to creation *ex materia* (from something).

We are next told by Craig that a clue to creation *ex nihilo* came in the form of Olber's Paradox, which claims that if there were infinitely many stars and their light had an infinite time to reach us then that light should fill the sky preventing the darkness of night. However, the universe might be infinitely old but not infinitely large. If it is expanding, the light from infinitely old stars may never reach us. So Olber's Paradox only tells us the universe is not all three of the following: infinitely old, infinitely large and static.

Craig goes on to describe the revolution of twentieth-century physics and how Einstein's theory was used to show that the universe is expanding from a singularity: a point of infinite density, pressure and curvature. He goes on to quote Barrow and Tipler as saying that if there is a beginning from a singularity, we have a de facto creation *ex nihilo*. However, Barrow himself says that if there was such an infinite density it would be an 'actual infinity'.⁴ As Craig has consistently argued that actual infinities cannot exist, his appeal to the existence of a singularity is plausibly a contradiction. Moreover, at the singularity the universe still has dimensionality; it still has mass and curvature. To claim that it is synonymous with creation *ex nihilo* then is an equivocation on the word 'nothing'.

Contemporary cosmologists do not recognize the singularity as marking anything more than simply a breakdown of our current theories. Or more precisely, they show that the space-time that obeys the condition of the theorem cannot be extended to past infinity. But that does not mean there isn't another region of space-time that doesn't obey the condition of the theorem.

It is worth giving some historical background. Early versions of these singularity theorems had the unrealistic assumption that the universe was perfectly symmetrical. In the 1960s Penrose and Hawking showed that the singularity is still present even when this unrealistic assumption is relaxed, but there are still assumptions in the Penrose Hawking theorems. One is that gravity is always attractive. But the theory of cosmic inflation violates this assumption (as does the observed acceleration of the expansion). Inflation posits that the universe underwent an extremely rapid period of exponential expansion. It is thought to solve many problems with big bang cosmology; NASA has claimed to have experimental evidence backing inflation and it is now mainstream cosmology.⁵

Inflation is unstable, though, and when its energy decays it creates a hot soup of particles; we can think of this moment as the big bang. Alan Guth, the creator of inflationary cosmology, has described it as a 'prequel to the big bang'.⁶ In the early 1980s scientists wondered about the patch of space where inflation has not yet ended (it will not decay everywhere at once due to quantum uncertainty). They realized that the remaining patch of inflating space would exponentially expand creating more regions where there is then another local decay and another big bang and so on ad infinitum. Inflation, once it begins, according to Guth, can never end and may create an infinity of bubble universes.⁷ If inflation is eternal into the future, can it be eternal into the past? This is the question the famous Borde Guth/Vilenkin (BGV) paper addresses. It concludes that inflation cannot be eternal into the past and big bang theists have jumped on this as proof of the beginning of the universe. However, it is important to note that the beginning envisioned by Borde Guth and Vilenkin is essentially a beginning to inflation, as Guth said:

What we basically managed to achieve is proving a theorem which says that any expanding region of space that has some minimum expansion rate can only go back so far and not infinitely far. That means inflation must have had a beginning; it doesn't really say that the universe had a beginning.⁸

The beginning of an eternally inflating space-time envisaged is completely removed from any empirical confirmation. So, Craig's appeal to big bang cosmology and the BGV theorem seems to be inconsistent: they are not really describing the same phenomenon. While Alex Vilenkin in the past claimed that the theorem proves a beginning to the universe, his position now seems more in line with Guth's, stating: 'The theorem proves that inflation must have a beginning, right, the universe as a whole, it doesn't, and the theorem doesn't say that.'⁹

Essentially then, the theorem says that there is a boundary to the region of space-time that obeys its conditions. What are these conditions? One is that the universe is on average expanding. But there is no reason to suppose that this has to always be the case. Guth favours a model where there are two regions of space-time, one expanding and the other contracting. The arrow of time points forward in both regions. Such models are known as Janus Universes and other cosmologists have also put forward variations on the idea.¹⁰ Craig claims that since the arrow of time reverses at the bounce there is no sense in which the other region is in our past and so there is still a beginning. While these models do perhaps have a thermodynamic beginning, they do not have a geometric beginning. In other words, if we draw the path of a particle it can be extended to past infinity. There are no moments in the entire evolution where there is nothing. So, there is no creation *ex nihilo*. Don Page, a well-known theoretical cosmologist who is also an Evangelical Christian, wrote an open letter to Craig saying:

At times well away from the bounce, there is a strong arrow of time, so that in those regions *if* one defines the direction of time as the direction in which entropy increases, it is rather as if there are two expanding universes both coming out from the bounce. But it is erroneous to say that the bounce is a true beginning of time, since the structure of space-time there (at least if there is an approximately classical space-time there) has time like curves going from a proper time of minus infinity through the bounce.¹¹

It is also hard to see how Craig can make his descriptions of these issues consistent with his own views of time as he has denied that time's arrow can be defined using thermodynamics.¹²

The standard view of time in cosmology is that there is no absolute 'now', rather time is observer dependent. Craig rejects this and appeals to an absolute time that ticks away independent of how we measure it. But in order to square this with modern physics, he has to appeal to a Neo-Lorentzian interpretation of relativity. According to Craig this implies a violation of the symmetries of special relativity giving us a testable prediction: the speed of light can be surpassed. When faster-than-light neutrinos were thought to have been measured, Craig announced this as a possible triumph of his Lorentzian view.¹³ Unfortunately for Craig, the observations were spurious and retracted. But if we return now to the BGV theorem we will see a problem.

Here is how Vilenkin described the logic of the theorem:

Suppose, for example, that [a] space traveler has just zoomed by the earth at the speed of 100,000 kilometers per second and is now headed toward a distant galaxy, about a billion light years away. [Because of the expansion of the universe as a whole], that galaxy is moving away from us at a speed of 20,000 kilometers per second, so when the space traveler catches up with it, the observers there will see him moving at 80,000 kilometers per second. [As the universe continues to expand, the relative velocity of the space traveler will get smaller and smaller into the future.] If the velocity of the space traveler relative to the spectators gets smaller and smaller into the future, then it follows that his velocity should get larger and larger as we follow his history into the past. In the limit, his velocity should get arbitrarily close to the speed of light [the maximum velocity attainable by mass energy in the universe].¹⁴

As the speed of light cannot be surpassed this is thought to ensure the beginning of the inflating region of space-time. But as we have seen, Craig's commitments have led him to abandon the symmetries of relativity upon which the BGV is based. And so it seems there is a conflict between Craig's reliance on the BGV theorem and his interpretation of relativity.

In 1979, when Craig introduced his Kalam argument, the mainstream view of cosmology was that the generality of the Penrose/Hawking theorem implied that there really was a beginning of time. But the consensus now is that a quantum theory of gravity is needed to understand the big bang. As Stephen

Hawking said, 'the real lesson of the singularity theorems is therefore that we need to combine the general theory of relativity with quantum theory in order to understand the origin of the universe'. A former President of the Society of General Relativity, Abhay Ashtekar, insists that defining the big bang as an expansion is entirely valid, but clarifies: 'on the other hand there is another definition of big bang which would be an absolute beginning and which the curvature of space-time, matter density becomes infinite. Most cosmologists would not agree that there was such a big bang.'¹⁵

In response Craig claims that any quantum gravity era would still have a beginning, quoting Anthony Aguirre and John Kehayias, who state that 'it is very difficult to devise a system – especially a quantum one – that does nothing “forever” and then evolves'.¹⁶ The astute observer will note that Aguirre has long argued that the universe may be eternal into the past and he claims that the BGV theorem does not even prove a beginning to inflation.¹⁷ Others, such as Yasunori Nomura and Leonard Susskind, have argued the same thing.¹⁸ So why the apparent change of mind? The answer is that Aguirre and Kehayias were only critiquing a particular past eternal model known as 'The Emergent Universe'. But that says nothing about other models. Many models of quantum gravity imply a past contracting universe which violates the BGV theorem.

One model of the universe that has been thoroughly studied is Loop Quantum Cosmology (LQC), with thousands of papers published examining its implications.¹⁹ Here one has two classical space-times joined by a quantum bridge giving an hour-glass structure but with no reversal of the arrow of time. So even if Craig is right that Janus Universes have a beginning and the quantum gravity era is not past eternal, it will have no bearing on the possibility of LQC being past eternal.

Lastly, Craig claims that a new theorem by Aron Wall closes the door on quantum cosmology by giving an eternal past. This theorem builds on an earlier work by Penrose which assumes that space is infinitely large. Yet Craig tells us that actual infinities cannot exist. But what if the theorem can be maintained without this assumption? Does that give us proof that quantum gravity cannot avoid the singularity? It does not. The author merely states that 'the results *may hold* in full quantum gravity',²⁰ but of course they may not. When Sean Carroll posted that he thought they would not, Wall responded: 'this is quantum gravity, so none of us really know what we're talking about!'²¹ And this really underlies the view from cosmology today. Without a well-verified theory of quantum gravity we cannot meaningfully describe the origin of our expanding universe and so we are in no position to say that cosmology implies a beginning to the universe.

The Second Law

The second law of thermodynamics roughly states that disorder grows with time. If the universe was past eternal, argues Craig, then we should be in the maximum state of disorder, which we clearly are not. There are two problems with this view; firstly, it assumes that the maximum possible entropy is a finite number. But as Guth states, we don't really know if the maximum possible entropy for the universe is finite or infinite, so let's assume that it is infinite. Then, no matter what entropy the universe started with, the entropy would have been low compared to its maximum. That is all that is needed to explain why the entropy has been rising ever since . . . An interesting feature of this picture is that the universe need not have a beginning.²²

The second problem is that it assumes the entropy is unaffected by the unusual conditions as the universe moves from a pre-big bang universe to a post-big bang one. Many cosmologists have argued that in fact the entropy could essentially be reset as one crosses through the transition.²³ This would render the second law argument moot.

Boltzmann Brains

In order for the universe to have an infinite maximum for the amount of entropy as envisioned by Guth one needs a model that allows for this. Guth is probably thinking of eternal inflation and its many bubble universes. According to Craig though, we cannot be living in such a multiverse because it is more likely that we would be freak observers (known as Boltzmann Brains) who just popped into existence rather than having evolved from a big bang. However, in eternal inflation all observers are infinite in quantity. There is no way to say which is more common without a counting procedure known as a measure. Cosmologists have found measures which imply that normal observers outnumber Boltzmann Brains. Craig complains that these are 'non-standard measures'. But as Don Page said after the Carroll/Craig debate, 'Bill, you referred to using some "non-standard" probabilities, as if there is just one standard. But there isn't. As Sean noted, there are models giving high probabilities for Boltzmann brain observations (which I think count strongly against such models) and other models giving low probabilities.'²⁴

A Past Finite Universe?

Even if the universe was created *ex nihilo* there are naturalistic accounts of this which have been popularized by Lawrence Krauss. But Craig argues that this 'nothing' is simply the quantum vacuum, which of course isn't really nothing. However, in his book, Krauss describes Alex Vilenkin's proposal that if space-time is treated quantum mechanically, it might spontaneously fluctuate into existence from a state where there is no space-time.²⁵ And so this is not a model of a universe from a vacuum but a genuine model of creation *ex nihilo*. Or at least as close to it, as God creating the universe *ex nihilo* is. The harsh language levelled at Krauss is not given to Vilenkin, which

is unsurprising as Craig often uses quotes from Vilenkin to bolster his case. Craig describes Vilenkin's model as a 'different proposal'. But it is not as if Krauss has one model and Vilenkin another. Krauss is describing Vilenkin's work.

Vilenkin's model relies on an interesting feature of physics that implies that the negative energy of gravity in a closed universe necessarily balances the positive energy of matter. So, in this scenario, as Vilenkin says, 'there is nothing to prevent such a universe from being spontaneously created out of nothing'. Craig's objection is to say that the fact that nothing prevents it happening does not mean it will happen. But if there is no finite time constraint and a finite possibility for something to happen then this is exactly what will happen. Craig's objection that God could just as easily spontaneously appear ignores the fact that there simply may be no finite probability for God to appear and in order for God to stick around, he would have to have zero net energy and a closed geometry.

We do not know the total energy of the universe; if it is not zero, then Vilenkin's model will be in serious trouble. But according to the Quantum Eternity theorem²⁶ the universe must have existed for an infinite amount of time in the past as long as the net energy of the universe has a non-zero form. So it seems we have two possibilities, both appealing to the naturalist. If the universe has zero net energy it may have been spontaneously created. If it does not, then it should have existed forever.

Conclusion

To conclude, we have a wealth of evidence that there was some sort of big bang event, but we have no evidence that this event marks the beginning of time. No observations confirm there was a singularity. And the existence of a singularity is disputed by the vast majority of cosmologists. Even if there was a singularity it is doubtful that this represents a case of true creation *ex nihilo*. And even if the universe was created *ex nihilo*, as Vilenkin proposes, this may not be incompatible with naturalism. Moreover, Genesis does not even describe creation *ex nihilo*. Instead it describes a creation where water is primordial, there is a solid dome of heaven and the stars are created after plants. In no scenario currently being explored by cosmologists is that an accurate description of our origins.

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