Further reading

William Lane Craig (2001) *The Cosmological Argument from Plato to Leibniz*. Eugene, OR: Wipf and Stock. (Analyzes the cosmological arguments of thirteen major proponents, including significant Jewish and Islamic thinkers.)

Brian Davies (1992) *The Thought of Thomas Aquinas*. Oxford: Oxford University Press. (A helpful treatment of Aquinas's thought, including the Five Ways.)

Gottfried W. Leibniz ([1714] 1898/1951 reprint) "Monadology," in *The Monadology and Other Philosophical Writings*. Trans. Robert Latta. Oxford: Oxford University Press. (Contains Leibniz's "sufficient reasons" version of the cosmological argument.)

Plato (*c.* 360 BC] 1988) *Laws*. Chicago, IL: University of Chicago Press. (Contains one of the earliest versions of the cosmological argument—see specifically Stephanus pagination numbers 893–6.)

William Rowe (1975) *The Cosmological Argument*. Princeton, NJ: Princeton University Press. (A critical study of versions of the cosmological argument.)

Chapter 18

William Lane Craig

THE *KALAM* COSMOLOGICAL ARGUMENT

William Lane Craig is Research Professor of Philosophy at Talbot School of Theology. He is a leading proponent of the *kalam* cosmological argument for the existence of God, which he defends in this selection. Professor Craig formulates the argument in three simple steps: (1) whatever begins to exist has a cause; (2) the universe began to exist; and (3) therefore, the universe has a cause. He examines each of these steps in turn.

Craig spends little time arguing for the first premise—that whatever begins to exist must have a cause—primarily since it is a seemingly obvious truth deeply rooted in human experience. While we may have the ability to imagine something coming into existence out of nothing, he notes that it is highly implausible that this should happen.

In order to defend the second premise of the argument, Craig utilizes arguments and evidences from physics and metaphysics. According to the first argument for this premise, it seems metaphysically impossible for an actually infinite number of things to exist. If the universe never had a beginning, however, there would be an actually infinite number of events in time. Since this is not possible, the universe must have had a beginning. Craig provides a second argument which, unlike the first, does not deny that an actually infinite number of things can exist. Rather, it denies that a collection of an actually infinite number of things can be formed by adding one thing after another. If the universe never had a beginning, however, the series of events in time would be such a collection. Since, he argues, this is metaphysically impossible, the universe must have a finite past and thus must have a beginning. The conclusion of these two arguments is also corroborated by modern physics, including the expansion and thermodynamic properties of the universe.

Further examination of the argument's conclusion—that the universe has a cause—leads Craig to conclude that this cause is an uncaused, personal agent—one who is immaterial, timeless, spaceless, and an enormously powerful creator. This is none other than God.

In my opinion the version of the cosmological argument which is most likely to be a sound and persuasive proof for the existence of God is the *kalam* cosmological argument based on the impossibility of an infinite temporal regress of events.* The argument may be formulated in three simple steps:

1. Whatever begins to exist has a cause.
2. The universe began to exist.
3. Therefore, the universe has a cause.

The point of the argument is to demonstrate the existence of a first cause which transcends and creates the entire realm of finite reality. Having reached that conclusion, one may then inquire into the nature of this first cause and assess its significance for theism.

Whatever begins to exist has a cause

The first premise is rooted in the metaphysical principle that 'something cannot come out of nothing' and is so intuitively obvious that I think scarcely anyone could sincerely believe it to be false. I therefore think it somewhat unwise to argue in favour of it, for any proof of the principle is likely to be less obvious than the principle itself, and, as Aristotle remarked, one ought not to try to prove the obvious via the less obvious. The proposition that 'Out of nothing, nothing comes' seems to me to be a sort of metaphysical first principle whose truth impresses itself upon us. In any case, the first premise, even if taken as a mere inductive generalization, seems as secure as any truth rooted in experience.

It is therefore not a little surprising to find atheists attempting to defeat the argument by attacking the first premise. For example, the late J. L. Mackie turned his main guns on this first premise, writing, 'there is *a priori* no good reason why a sheer origination of things, not determined by anything, should be unacceptable, whereas the existence of a god [*sic*] with the power to create something out of nothing is acceptable.'[1] Indeed, he believed that *creatio ex nihilo* raises problems: (1) if God began to exist at a point in time, then this is as great a puzzle as the beginning of the universe; (2) if God existed for infinite time, then the same arguments would apply to His existence as would apply to the infinite duration of the universe; and (3) if it be said that God is timeless, then this, says Mackie, is a complete mystery.

Now notice that Mackie never denies, much less refutes, the principle that whatever begins to exist has a cause. Rather, he simply demands what good reason there is *a priori* to accept it. He writes, 'As Hume pointed out, we can certainly conceive an uncaused beginning-to-be of an object; if what we can thus conceive is nevertheless in some way impossible, this still requires to be shown.'[2] But, as many philosophers have noted, imaginability is in no way a reliable guide to metaphysical possibility. Just because I can imagine in my mind's eye an object, say a horse, coming into existence from nothing, that in no way suggests that a horse really could come into existence that way. The fact that there is no formal contradiction in 'a horse's popping into being out of nothing' does not defeat the claim of the defender of the *kalam* argument that such a thing is metaphysically impossible. Does anyone in his right mind believe that, say, a raging tiger could suddenly come into existence uncaused, out of nothing, in this room right now? The same applies to the universe: if there were absolutely nothing prior to the existence of the universe—no God, no space, no time—how could the universe possibly have come to exist?

In fact, Mackie's appeal to Hume at this point is counter-productive. For Hume himself clearly believed the causal principle. In 1754 he wrote to John Stewart,

> But allow me to tell you that I never asserted so absurd a Proposition as *that anything might arise without a cause*: I only maintain'd, that our Certainty of the Falsehood of that Proposition proceeded neither from Intuition nor Demonstration, but from another source.[3]

Even Mackie, in response to the claim of atheist scientist Peter Atkins that the universe came into being out of nothing by sheer chance, demurred: 'I myself find it hard to accept the notion of self-creation *from nothing*, even *given* unrestricted chance. And how *can* this be given, if there really is nothing?'[4] Moreover, Mackie concedes, 'Still this [causal] principle has some plausibility, in that it is constantly confirmed in our experience (and also used, reasonably, in interpreting our experience).'[5] So, leaving *a priori* intuitions aside, why not at least accept the truth of the causal principle as plausible and reasonable—at the very least more so than its denial?

The answer is that in this particular case the theism implied by affirming the principle is, in Mackie's thinking, even more unintelligible than the denial of the principle. It makes more sense to believe that the universe came into being uncaused out of nothing than to believe that God created the universe out of nothing.

But is this really the case? Consider the three alternatives Mackie raises concerning *creatio ex nihilo*. Certainly, the proponent of the *kalam* argument would not hold (1) that God began to exist or (2) that God has existed for an infinite number of, say, hours, or any other unit of time. But what is wrong with (3), that God is, without creation, timeless? I would argue that God exists timelessly without creation and temporally since creation. This may be 'mysterious' in the sense of 'wonderful' or 'awe-inspiring,' but it is not, so far as I can see, unintelligible; and Mackie gives us no reason to think that it is. Moreover, there is also an alternative which Mackie failed to consider: (4) prior to creation God existed in an undifferentiated time in which hours, days and so forth simply do not exist. Because this time is undifferentiated, it is not incompatible with the *kalam* argument based on the impossibility of an infinite temporal regress of events. It seems to me, therefore, that Mackie is entirely unjustified in rejecting the first step of the argument as not being intuitively obvious, plausible and reasonable.

The universe began to exist

If we agree that whatever begins to exist has a cause, what evidence is there to support the crucial second premise, that 'the universe began to exist'? This premise may be supported by both deductive and inductive arguments from metaphysics and physics.

1. Argument from the impossibility of an actually infinite number of things

This argument can also be formulated in three steps:

1. An actually infinite number of things cannot exist.
2. A beginningless series of events in time entails an actually infinite number of things.
3. Therefore, a beginningless series of events in time cannot exist.

Since the universe is not distinct from the temporal series of past events, the demonstration that the series of temporal events had a beginning implies that the universe began to exist. Let us examine more closely each of the argument's two premises.

1. *An actually infinite number of things cannot exist.* In order to understand this first premise, we need to differentiate clearly between an actual infinite and a potential infinite. A potential infinite is a collection that is increasing toward infinity as a limit but never gets there. Such a collection is really indefinite, not infinite. For example, any finite distance can be subdivided into potentially infinitely many parts. One can keep on dividing parts in half forever, but one will never arrive at an actual 'infinitieth' division or come up with an actually infinite number of parts. By contrast, an actual infinite is not growing toward infinity; it is infinite, it is 'complete'. A collection is actually infinite just in case a proper part of the collection can be put into a one-to-one correspondence with the whole collection, so that the proper part has the same number of members as the whole (Principle of Correspondence). This notion of infinity is employed in set theory to designate sets that have an infinite number of members, such as {1, 2, 3, . . .}. The argument, then, is not that a potentially infinite number of things cannot exist, but that an actually infinite number of things cannot exist. For if an actually infinite number of things could exist, this would spawn all sorts of absurdities.

Perhaps the best way to bring this home is by means of an illustration. Let me use one of my favorites, Hilbert's Hotel, a product of the mind of the great German mathematician David Hilbert.[6] Let us imagine a hotel with a finite number of rooms. Suppose, furthermore, that all the rooms are full. When a new guest arrives asking for a room, the proprietor apologizes, 'Sorry, all the rooms are full,' and the new guest is turned away. But now let us imagine a hotel with an infinite number of rooms and suppose once more that 'all the rooms are full.' There is not a single vacant room throughout the entire infinite hotel. Now suppose a new guest shows up, asking for a room. 'But of course!' says the proprietor, and he immediately shifts the person in room #1 into room #2, the person in room #2 into room #3, the person in room #3 into room #4, and so on, out to infinity. As a result of these room changes, room #1 now becomes vacant and the new guest gratefully checks in. But remember, before he arrived, all the rooms were full! Equally curious, according to the mathematicians, there are now no more persons in the hotel than there were before: the number is just infinite. But how can this be? The proprietor just added the new guest's name to the register and gave him his keys—how can there not be one more person in the hotel than before?

But the situation becomes even stranger. For suppose an infinity of new guests show up at the desk, each asking for a room. 'Of course, of course!' says the proprietor,

and he proceeds to shift the person in room #1 into room #2, the person in room #2 into room #4, the person in room #3 into room #6, and so on out to infinity, always putting each former occupant into the room number twice his own. Because any natural number multiplied by two always equals an even number, all the guests wind up in even-numbered rooms. As a result, all the odd-numbered rooms become vacant, and the infinity of new guests is easily accommodated. And yet, before they came, all the rooms were full! And again, strangely enough, the number of guests in the hotel is the same after the infinity of new guests check in as before, even though there were as many new guests as old guests. In fact, the proprietor could repeat this process *infinitely many times*, and yet there would never be one single person more in the hotel than before.

But Hilbert's Hotel is even stranger than the German mathematician made it out to be. For suppose some of the guests start to check out. Suppose the guest in room #1 departs. Is there not now one less person in the hotel? Not according to the mathematicians—but just ask Housekeeping! Suppose the guests in rooms ##1, 3, 5 . . . check out. In this case an infinite number of people have left the hotel, but according to the mathematicians, there are no fewer people in the hotel—but don't talk to those people in Housekeeping! In fact, we could have every other guest check out of the hotel and repeat this process infinitely many times, and yet there would never be any fewer people in the hotel.

Now suppose the proprietor does not like having a half-empty hotel (it looks bad for business). No matter! By shifting occupants as before, but in reverse order, he transforms his half-vacant hotel into one that is jammed to the gills. One might think that by these maneuvers the proprietor could always keep this strange hotel fully occupied. But one would be wrong. For suppose that the persons in rooms ##4, 5, 6 . . . checked out. At a single stroke the hotel would be virtually emptied, the guest register reduced to but three names, and the infinite converted to finitude. And yet it would remain true that the *same* number of guests checked out this time as when the guests in rooms ##1, 3, 5 . . . checked out! Can anyone believe that such a hotel could exist in reality?

Hilbert's Hotel is absurd. Since nothing hangs on the illustration's involving a hotel, the above sorts of absurdities show in general that it is impossible for an actually infinite number of things to exist.[7] There is simply no way to avoid these absurdities once we admit the possibility of the existence of an actual infinite. Students sometimes react to such absurdities as Hilbert's Hotel by saying that we really do not understand the nature of infinity and, hence, these absurdities result. But this attitude is simply mistaken. Infinite set theory is a highly-developed and well-understood branch of mathematics, so that these absurdities can be seen to result precisely because we do understand the notion of a collection with an actually infinite number of members.

These considerations also show how superficial Mackie's response to this premise is.[8] He thinks that the absurdities are resolved by noting that for infinite groups the axiom that 'the whole is greater than its part' does not hold, as it does for finite groups. But far from being the solution, this is precisely the problem. Because in infinite set theory this axiom is denied, one gets all sorts of absurdities, like Hilbert's Hotel, when one tries to translate that theory into reality. Mackie's response does nothing to prove that the envisioned situations are not absurd, but only reiterates, in effect, that if an actual infinite were to exist and the Principle of Correspondence were valid with respect to it, then the relevant situations would result, which is not in dispute. Moreover, the contradictions that result when guests check out of the hotel are not even

prima facie resolved by Mackie's analysis. (In trans-finite arithmetic, inverse operations of subtraction and division are prohibited because they lead to contradictions; but in reality, one cannot stop people from checking out of the hotel if they want to!) Hence, it is plausible that an actually infinite number of things cannot exist.[9]

2. *A beginningless series of events in time entails an actually infinite number of things.* This second premise seems pretty obvious. If the universe never began to exist, then prior to the present event there have existed an actually infinite number of previous events. Thus, a beginningless series of events in time entails an actually infinite number of things, namely, events.

3. *Therefore a beginningless series of events in time cannot exist.* If the above two premises are true, then the conclusion follows logically. The series of past events must be finite and have a beginning. Since, as I said, the universe is not distinct from the series of events, the universe therefore began to exist.

2. Argument from the impossibility of forming an actually infinite collection of things by successive addition

This argument is distinct from the foregoing argument, for it does not deny that an actually infinite number of things can exist. It denies that a collection containing an actually infinite number of things can be formed by adding one member after another. This argument, too, can be formulated in three steps:

1. The series of events in time is a collection formed by successive addition.
2. A collection formed by successive addition cannot be actually infinite.
3. Therefore, the series of events in time cannot be actually infinite.

Let us take a closer look at each of the three premises.

1. *The series of events in time is a collection formed by successive addition.* This seems rather obvious. The past did not spring into being whole and entire but was formed sequentially, one event occurring after another. Notice, too, that the direction of this formation is 'forward' in the sense that the collection of events grows with time. Although we sometimes speak of an 'infinite temporal regress' of events, in reality an infinite past would be an 'infinite temporal progress' of events with no beginning and its end in the present.

2. *A collection formed by successive addition cannot be actually infinite.* This is the crucial step. Sometimes this is called the impossibility of counting to infinity or the impossibility of traversing the infinite. This impossibility has nothing to do with the amount of time available: no matter how much time one has at one's disposal, an actual infinite cannot be so formed. For no matter how many numbers one counts or how many steps one takes, one can always add or take one more before arriving at infinity.

Now someone might say that while an infinite collection cannot be formed by beginning at a point and adding members, nevertheless an infinite collection could be formed by never beginning but ending at a point, that is to say, ending at a point after having added one member after another from eternity. But this method seems even more unbelievable than the first method. If one cannot count *to* infinity, how can one count down *from* infinity? If one cannot traverse the infinite by moving in one direction, how can one traverse it by moving in the opposite direction?

Indeed, the idea of a beginningless temporal series of events ending in the present seems absurd. To give just one illustration: consider Tristram Shandy, who, in the novel by Sterne, writes his autobiography so slowly that it takes him a whole year to record the events of a single day. According to Bertrand Russell, if Tristram Shandy were immortal, then the entire book could be completed, since by the Principle of Correspondence to each day there would correspond one year, and both are infinite.[10] Russell's assertion is wholly untenable, however, since the future is in reality a potential infinite only. Though he write for ever, Tristram Shandy would only get farther and farther behind, so that instead of finishing his autobiography he would progressively approach a state in which he would be infinitely far behind. But he would never reach such a state because the years and, hence, the days of his life would always be finite in number, though indefinitely increasing.

But let us turn the story about: suppose Tristram Shandy has been writing from eternity past at the rate of one day per year. Should not Tristram Shandy now be infinitely far behind? For if he has lived for an infinite number of years, Tristram Shandy has recorded an equally infinite number of past days. Given the thoroughness of his autobiography, these days are all consecutive days. At any point in the past or present, therefore, Tristram Shandy has recorded a beginningless, infinite series of consecutive days. But now the question inevitably arises: Which days are these? Where in the temporal series of events are the days recorded by Tristram Shandy at any given point? The answer can only be that *they are days infinitely distant from the present*. For there is no day on which Tristram Shandy is writing which is finitely distant from the last recorded day. This may be seen through an incisive analysis of the Tristram Shandy paradox given by Robin Small.[11] He points out that if Tristram Shandy has been writing for one year's time, then the most recent day he could have recorded is one year ago. But if he has been writing two years, then that same day could not have been recorded by him. For since his intention is to record consecutive days of his life, the most recent day he could have recorded is the day immediately after a day at least two years ago. This is because it takes a year to record a day, so that to record two days he must have two years. Similarly, if he has been writing three years, then the most recent day recorded could be no more recent than three years and two days ago. In other words, the longer he has written the further behind he has fallen. In fact, the recession into the past of the most recent recordable day can be plotted according to the formula (present date $- n$ years of writing)$+ n - 1$ days. But what happens if Tristram Shandy has, *ex hypothesi*, been writing for an infinite number of years? The most recent day of his autobiography recedes to infinity, that is to say, to a day infinitely distant from the present. Nowhere in the past at a finite distance from the present can we find a recorded day, for by now Tristram Shandy is infinitely far behind. The beginningless, infinite series of days which he has recorded are days which lie at an infinite temporal distance from the present. But there is no way to traverse the temporal interval from an infinitely distant event to the present, or, more technically, for an event which was once present to recede to an infinite temporal distance. Since the task of writing one's autobiography at the rate of one

year per day seems obviously coherent, what follows from the Tristram Shandy story is that an infinite series of past events is absurd.

But now a deeper absurdity bursts into view. For even if every recorded past event lies at only a finite distance from the present, still, if the series of past events is actually infinite, we may ask, why did Tristram Shandy not finish his autobiography yesterday or the day before, since by then an infinite series of events had already elapsed? No matter how far along the series of past events one regresses, Tristram Shandy would have already completed his autobiography. Therefore, at no point in the infinite series of past events could he be finishing the book. We could never look over Tristram Shandy's shoulder to see if he were now writing the last page. For at any point an actually infinite sequence of events would have transpired and the book would have already been completed. Thus, at no time in eternity will we find Tristram Shandy writing, which is absurd, since we supposed him to be writing from eternity. And at no point will he finish the book, which is equally absurd, because for the book to be completed he must at some point have finished.

These illustrations reveal the absurdities involved in trying to form an actually infinite collection of things by successive addition. Hence, set theory has been purged of all temporal concepts; as Russell says, 'classes which are infinite are given all at once by the defining properties of their members, so that there is no question of "completion" or of "successive synthesis".'[12] The only way an actual infinite could come to exist in the real world would be by being created all at once, simply in a moment. It would be a hopeless undertaking to try to form it by adding one member after another.

Mackie's objections to this premise are off the target.[13] He thinks that the argument illicitly assumes an infinitely distant starting point in the past and then pronounces it impossible to travel from that point to today. If we take the notion of infinity 'seriously,' he says, we must say that in the infinite past there would be no starting point whatever, not even an infinitely distant one. Yet from any given point in the past, there is only a finite distance to the present.

Now I know of no proponent of the *kalam* argument who assumed that there was an infinitely distant starting point in the past. On the contrary, the beginningless character of the series of past events only serves to underscore the difficulty of its formation by successive addition. The fact that there is no beginning at all, not even an infinitely distant one, makes the problem worse, not better. It is thus not the proponent of the *kalam* argument who fails to take infinity seriously. To say the infinite past could have been formed by adding one member after another is like saying someone has just succeeded in writing down all the negative numbers, ending at –1. And, we may ask, how is Mackie's point that from any given moment in the past there is only a finite distance to the present even relevant to the issue? The defender of the *kalam* argument could agree to this without batting an eye. For the issue is how the whole series can be formed, not a finite portion of it. Does Mackie think that because every finite segment of the series can be formed by successive addition, the whole infinite series can be so formed? That is as logically fallacious as saying that because every part of an elephant is light in weight, the whole elephant is light in weight. Mackie's point is therefore irrelevant. It seems that this premise of the argument remains undefeated by his objections.

3. *Therefore, the series of events in time cannot be actually infinite.* Given the truth of the premises, the conclusion logically follows. If the universe did not begin to exist a finite time ago, then the present moment would never arrive. But obviously it has arrived. Therefore, we know that the universe is finite in the past and began to exist.

3. Argument based on the isotropic expansion of the universe

In 1917, Albert Einstein made a cosmological application of his newly discovered gravitational theory, the General Theory of Relativity (GTR). In so doing he assumed that the universe is homogeneous and isotropic and that it exists in a steady state, with a constant mean mass density and a constant curvature of space. To his chagrin, however, he found that GTR would not permit such a model of the universe unless he introduced into his gravitational field equations a certain 'fudge factor' in order to counterbalance the gravitational effect of matter and so ensure a static universe. Unfortunately, Einstein's static universe was balanced on a razor's edge, and the least perturbation 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 the field 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.'[14] 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 a matter of indifference for our investigation of the cosmos.

In 1929 the astronomer Edwin Hubble showed that the red shift in the optical spectra of light from distant galaxies was a common feature of all measured galaxies and was proportional to their distance from us. This red shift was taken to be a Doppler effect indicative of the recessional motion of the light source in the line of sight. Incredibly, what Hubble had discovered was the isotropic expansion of the universe predicted by Friedman and Lemaître on the basis of Einstein's GTR. 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?'[15]

According to the Friedman-Lemaître model, as time proceeds, the distances separating galactic masses become greater. It is important to understand that as a GTR-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 ideal particles of the cosmological fluid constituted by the matter and energy of the universe 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 would 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.[16] 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.[17]

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).

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 Barrow and 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*.'[18] 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, in the words of one astrophysical team, 'The problem of the origin [of the universe] involves a certain metaphysical aspect which may be either appealing or revolting.'[19] Revolted by the stark metaphysical alternatives presented to us by an absolute beginning of the universe, certain theorists have been understandably eager to subvert the Standard Model and restore an eternal universe. The history of twentieth-century cosmology has been the history of the repeated falsification of such non-standard theories and the corroboration of the Big Bang theory. It has been the overwhelming verdict of the scientific community that none of these alternative theories is superior to the Big Bang theory. Again and again models aimed at averting the prediction of the Standard Model of an absolute beginning of the universe have been shown either to be untenable or to fail to avert the beginning after all. For example, some theories, like the Oscillating Universe (which expands and re-contracts forever) or the Chaotic Inflationary Universe (which continually spawns new universes), do have a potentially infinite future but turn out to have only a finite past.[20] Vacuum Fluctuation Universe theories (which postulate an eternal vacuum out of which our universe is born) cannot explain why, if the vacuum was eternal, we do not observe an infinitely old universe.[21] The Quantum Gravity Universe theory propounded by James Hartle and Stephen Hawking, if interpreted realistically, still involves an absolute origin of the universe even if the universe does not begin in a so-called singularity, as it does in the Standard Big Bang theory.[22]

Hawking sums up the situation: 'Almost everyone now believes that the universe, and time itself, had a beginning at the Big Bang.'[23]

4. Argument based on thermodynamic properties of the universe

If this were not enough, there is a second inductive argument for the beginning of the universe based on the evidence of thermodynamics. According to the Second Law of Thermodynamics, processes taking place in a closed system always tend toward a state of equilibrium. For example, if we had a bottle containing a sealed vacuum, and we introduced into it some molecules of gas, the gas would spread itself out evenly throughout the bottle. It would be virtually impossible for the molecules to retreat, for example, into one corner of the bottle and remain. This is why, when we walk into a room, the air in the room never separates suddenly into oxygen at one end and nitrogen at the other. It is also why, when we step into the bath, we may be confident that it will be an even temperature instead of frozen solid at one end and boiling at the other. It is clear that life would not be possible in a world in which the Second Law of Thermodynamics did not operate.

Now our interest in the law is what happens when it is applied to the universe as a whole. The universe is, on a naturalistic view, a gigantic closed system, since it is everything there is and there is nothing outside it. What this seems to imply then is that, given enough time, the universe and all its processes will run down, and the entire universe will come to equilibrium. This is known as the heat death of the universe. Once the universe reaches this state, no further change is possible. The universe is dead.

There are two possible types of heat death for the universe. If the universe will eventually re-contract, it will die a 'hot' death. Beatrice Tinsley describes such a state:

> If the average density of matter in the universe is great enough, the mutual gravitational attraction between bodies will eventually slow the expansion to a halt. The universe will then contract and collapse into a hot fireball. There is no known physical mechanism that could reverse a catastrophic big crunch. Apparently, if the universe becomes dense enough, it is in for a hot death.[24]

If the universe is fated to re-contraction, then as it contracts the stars gain energy, causing them to burn more rapidly so that they finally explode or evaporate. As everything in the universe grows closer together, the black holes begin to gobble up everything around them, and eventually begin themselves to coalesce. In time, 'All the black holes finally coalesce into one large black hole that is coextensive with the universe,'[25] from which the universe will never re-emerge.

But suppose, as is more likely, that the universe will expand forever. Tinsley describes the fate of this universe:

> If the universe has a low density, its death will be cold. It will expand forever at a slower and slower rate. Galaxies will turn all of their gas into stars, and the stars will burn out. Our own sun will become a cold, dead remnant, floating among the corpses of other stars in an increasingly isolated Milky Way.[26]

At 10^{30} years the universe will consist of 90 percent dead stars, 9 percent supermassive black holes formed by the collapse of galaxies, and 1 percent atomic matter, mainly hydrogen. Elementary particle physics suggests that thereafter protons will decay into electrons and positrons, so that space will be filled with a rarefied gas so thin that the distance between an electron and a positron will be about the size of the present galaxy. At 10^{100} years, some scientists believe that the black holes themselves will dissipate by a strange effect predicted by quantum mechanics. The mass and energy associated with a black hole so warp space that they are said to create a 'tunnel' or 'worm-hole' through which the mass and energy are ejected in another region of space. As the mass of a black hole decreases, its energy loss accelerates, so that it is eventually dissipated into radiation and elementary particles. Eventually all black holes will completely evaporate and all the matter in the ever expanding universe will be reduced to a thin gas of elementary particles and radiation. The entire universe will be in its final state, from which no change will occur.

Very recent discoveries provide strong evidence that there is effectually a positive cosmological constant which causes the cosmic expansion to accelerate rather than decelerate. Paradoxically, since the volume of space increases exponentially, allowing greater room for more entropy production, the universe actually grows further and further from an equilibrium state as time proceeds. But the acceleration only hastens the cosmos's disintegration into increasingly isolated patches no longer causally connected with similarly marooned remnants of the expanding universe. Thus, the same pointed question raised by classical physics persists: why, if the universe has existed forever, are we not now in a cold, dark, dilute, and lifeless state?

Some theorists have tried to escape this conclusion by adopting an oscillating model of the universe which never reaches a final state of equilibrium. But wholly apart from the physical and observational difficulties confronting such a model, the thermodynamic properties of this model imply the very beginning of the universe that its proponents sought to avoid. For entropy increases from cycle to cycle in such a model, which has the effect of generating larger and longer oscillations with each successive cycle. As one scientific team explains,

> The effect of entropy production will be to enlarge the cosmic scale, from cycle to cycle . . . Thus, looking back in time, each cycle generated less entropy, had a smaller cycle time, and had a smaller cycle expansion factor than the cycle that followed it.[27]

Thus, as one traces the oscillations back in time, they become progressively smaller until one reaches a first and smallest oscillation. Zeldovich and Novikov therefore conclude, 'The multicycle model has an infinite future, but only a finite past.'[28] In fact, astronomer Joseph Silk estimates on the basis of current entropy levels that the universe cannot have gone through more than 100 previous oscillations.[29]

. . .

So whether one adopts a re-contracting model, an ever-expanding model, or an oscillating model, thermodynamics implies that the universe had a beginning. According to P. C. W. Davies, the universe must have been created a finite time ago and is in the process of winding down. Prior to the creation, says Davies, the universe simply did not exist. Therefore, he concludes, even though we may not like it, we must say that the universe's energy was somehow simply 'put in' at the creation as an initial condition.[30]

So we have two inductive arguments that the universe began to exist. First, the expansion of the universe implies that the universe had a beginning. Second, thermodynamics shows the universe began to exist. Therefore, on the basis of both philosophical argument and scientific evidence, I think we are justified in accepting our second premise, that the universe began to exist.

The universe has a cause

From the first premise—that 'whatever begins to exist has a cause'—and the second premise—that 'the universe began to exist'—it follows logically that 'the universe has a cause.' This conclusion ought to stagger us, to fill us with awe, for it means that the universe was brought into existence by something which is greater than and beyond it.

But what is the nature of this first cause of the universe? A conceptual analysis of what properties must be possessed by such an ultra-mundane cause 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. 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) and (4), it follows that

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

As the cause of space and time, this entity must transcend space and time and therefore exist atemporally and non-spatially, at least *sans* the universe. This transcendent cause must therefore be changeless and immaterial, since timelessness entails changelessness, and changelessness implies immateriality. Such a cause must be beginningless and uncaused, at least in the sense of lacking any antecedent causal conditions. Ockham's Razor will shave away further causes, since we should not multiply causes beyond necessity. This entity must be unimaginably powerful, since it created the universe out of nothing.

Finally, and most strikingly, such a transcendent cause is plausibly to be regarded as personal. As Swinburne 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.[31] A first state of the universe cannot have a scientific explanation, since there is nothing before it, and therefore it can be accounted for only in terms of a personal explanation. Moreover, the personhood of the cause of the universe is implied by its timelessness and immateriality, since the only entities we know of which can possess such properties are either minds or abstract objects, and abstract objects do not stand in causal relations. Therefore the transcendent cause of the origin

of the universe must be of the order of mind. This same conclusion is also implied by the origin of a temporal effect from a timeless cause. For if the cause of the universe were an impersonal set of necessary and sufficient conditions, it could not exist without its effect. The only way for the cause to be timeless and changeless but for its effect to originate *de novo* a finite time ago is for the cause to be a personal agent who freely chooses to bring about an effect without antecedent determining conditions. This type of causation is called 'agent causation,' and because the agent is free he can initiate new effects by freely bringing about conditions which were not previously present. A finite time ago a Creator endowed with free will could have acted to bring the world into being at that moment. In this way, God 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 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. Thus, we are brought, not merely to a transcendent cause of the universe, but to its personal Creator.

These purely philosophical arguments for the personhood of the cause of the origin of the universe receive powerful scientific confirmation from the observed fine-tuning of the universe, which bespeaks intelligent design. Without wanting to go into a discussion of the teleological argument, let me simply say that the incredibly complex and delicately balanced nexus of initial conditions necessary for intelligent life seems to be most plausibly explained if that nexus is the product of intelligent design, that is to say, if the cause of the beginning of the universe is a personal Creator. The scientific evidence thus serves to underscore the conclusion to which philosophical argument has led us. So we have both good philosophical and scientific reasons for regarding the cause of the universe as an uncaused, beginningless, timeless, spaceless, immaterial, changeless, powerful, personal Creator.

Now certain thinkers have objected to the intelligibility of this conclusion. For example, Adolf Grünbaum has marshalled a whole troop of objections against inferring a Creator of the universe.[37] 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 for a cause of the universe.

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. 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 cosmological argument proper, but from an analysis of the notion of a first cause of the beginning of the universe, confirmed by Anthropic considerations.
3 The inference to a single cause of the origin of the universe seems justified in the 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. Since the universe is a single effect originating in the Big Bang event, we have no grounds for inferring a plurality of causes.

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. 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 non-connected 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. The difference between these two hypotheses is that the atheistic view has been shown to be untenable.

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 these objections are also unsuccessful:

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 then it is even more incomprehensible, in this sense, how the universe could have popped into being out of nothing without any cause, material or productive. One cannot avert the necessity of 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 personal rather than a scientific explanation, but it is no less an explanation for that.

Grünbaum 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.[33] But this argument pretty clearly confronts us with a false dilemma. For why could God's creating the universe not be simultaneous (or coincident) with the Big Bang? On the view I've defended, God may be conceived to be timeless or relatively timeless without creation and in time at and subsequent to the first moment of creation. None of Grünbaum's objections, therefore, seems to undermine the credibility of the *kalam* cosmological argument for a personal Creator of the universe.

Thus, we have been brought to the remarkable conclusion that an uncaused, personal Creator of the universe exists, who *sans* the universe is beginningless, changeless, immaterial, timeless, spaceless and enormously powerful. And this, as Thomas Aquinas laconically remarked, is what everyone means by 'God.'[34]

Notes

* [This version of the essay has been slightly modified by William Lane Craig.]

1 J. L. Mackie, *The Miracle of Theism* (Oxford: Clarendon Press, 1982), p. 94.
2 Mackie, *Theism*, p. 89.
3 David Hume, *The Letters of David Hume*, 2 vols, ed. J. Y. T. Greig (Oxford: Clarendon Press, 1932), 1:187.
4 J. L. Mackie, critical notice of *The Creation*, by Peter Atkins, *Times Literary Supplement* (5 February 1982), p. 126.
5 Mackie, *Theism*, p. 89.
6 The story of Hilbert's Hotel is related in George Gamow, *One, Two, Three, Infinity* (London: Macmillan, 1946), p. 17.
7 What is the logical structure of the argument here? The proponent of the argument has two options open to him. On the one hand, he could argue that if an actual infinite were to exist, then the Principle of Correspondence would be valid with respect to it and that if an actual infinite were to exist and the Principle of Correspondence were to be valid with respect to it, then the various counter-intuitive situations would result. Therefore, if an actual infinite were to exist, the various counter-intuitive situations would result. ($A \rightarrow B$; $A \& B \rightarrow C$; $\therefore A \rightarrow C$). But because these are absurd and so really impossible, it follows that the existence of an actual infinite is impossible ($\neg\Diamond C$; $\therefore \neg\Diamond A$).

On the other hand, the proponent of the argument might call into question the premise that if an actual infinite were to exist, then the Principle of Correspondence would be valid with respect to it. There is no reason to think that the principle is universally valid. It is merely a convention adopted in infinite set theory. Now, necessarily, if an actual infinite were to exist, then either the Principle of Correspondence or Euclid's maxim that 'The whole is greater than its part' would apply to it. ($\lfloor A \rightarrow B \vee C \rfloor$). But since the application of either of these two principles to an actual infinite results in counter-intuitive absurdities, it is plausible that if the existence of an actual infinite were possible, then if an actual infinite were to exist, neither of these two principles would be valid with respect to it. ($\Diamond A \rightarrow \neg\lfloor A \rightarrow B \vee C \rfloor$). It therefore follows that the existence of an actual infinite is impossible, since the counterfactual that 'If an actual infinite were to exist, then neither principle would be valid with respect to it' is necessarily false ($\therefore \neg\Diamond A$).

8 Mackie, *Theism*, p. 93.
9 Students frequently ask if God, therefore, cannot be infinite. The question is based on a misunderstanding. When we speak of the infinity of God, we are not using the word in a mathematical sense to refer to an aggregate of an infinite number of finite parts. God's infinity is, as it were, qualitative, not quantitative. It means that God is metaphysically necessary, morally perfect, omnipotent, omniscient, eternal, etc.
10 Bertrand Russell, *The Principles of Mathematics*, 2nd edn (London: Allen & Unwin, 1937), pp. 358–9.
11 Robin Small, 'Tristram Shandy's Last Page,' *British Journal for the Philosophy of Science*, 37 (1986), pp. 214–15.
12 Bertrand Russell, *Our Knowledge of the External World*, 2nd edn (New York: W. W. Norton, 1929), p. 170.
13 Mackie, *Theism*, p. 93.
14 Gregory L. Naber, *Spacetime and Singularities: An Introduction* (Cambridge: Cambridge University Press, 1988), pp. 126–7.
15 John A. Wheeler, 'Beyond the Hole,' in *Some Strangeness in the Proportion*, ed. Harry Woolf (Reading, MA: Addison-Wesley, 1980), p. 354.
16 This is not to say that the density measurement takes on the value of a trans-finite cardinal number. Rather, the density is the mass divided by volume, and, since division by zero is impossible, the density of the universe at the initial cosmological singularity is said to be 'infinite' in this sense.
17 P. C. W. Davies, 'Spacetime Singularities in Cosmology,' in J. T. Fraser (ed.), *The Study of Time III* (New York: Springer Verlag, 1978), pp. 78–9.
18 John Barrow and Frank Tipler, *The Anthropic Cosmological Principle* (Oxford: Clarendon Press, 1986), p. 442.
19 Hubert Reeves, Jean Audouze, William A. Fowler and David N. Schramm, 'On the Origin of Light Elements,' *Astrophysical Journal*, 179 (1973), p. 912.
20 See I. D. Novikov and Ya. B. Zeldovich, 'Physical Processes near Cosmological Singularities', *Annual Review of Astronomy and Astrophysics*, 11 (1973), pp. 401–2; A. Borde and A. Vilenkin, 'Eternal Inflation and the Initial Singularity', *Physical Review Letters*, 72 (1994), pp. 3305, 3307.
21 Christopher Isham, 'Creation of the Universe as a Quantum Process' in R. J. Russell, W. R. Stoeger and G. V. Coyne (eds), *Physics, Philosophy and Theology: A Common Quest for Understanding* (Vatican City: Vatican Observatory, 1988), pp. 385–7.
22 See John D. Barrow, *Theories of Everything* (Oxford: Clarendon Press, 1991), pp. 67–8.
23 Stephen Hawking and Roger Penrose, *The Nature of Space and Time*, The Isaac Newton Institute Series of Lectures (Princeton, NJ: Princeton University Press, 1996), p. 20.

24 Beatrice Tinsley, 'From Big Bang to Eternity?' *Natural History Magazine* (October 1975), p. 103.
25 Duane Dicus et al., 'The Future of the Universe', *Scientific American* (March 1983), p. 99.
26 Tinsley, 'Big Bang', p. 105.
27 Duane Dicus et al., 'Effects of Proton Decay on the Cosmological Future', *Astrophysical Journal*, 252 (1982), pp. 1, 8.
28 Novikov and Zeldovich, 'Physical Processes near Cosmological Singularities,' pp. 401–2.
29 Joseph Silk, *The Big Bang*, 2nd edn (San Francisco: W. H. Freeman, 1989), pp. 311–12.
30 P. C. W. Davies, *The Physics of Time Asymmetry* (London: Surrey University Press, 1974), p. 104.
31 Richard Swinburne, *The Existence of God*, rev. edn (Oxford: Clarendon Press, 1991), pp. 32–48.
32 Adolf Grünbaum, 'The Pseudo-Problem of Creation in Physical Cosmology', in John Leslie (ed.), *Physical Cosmology and Philosophy*, Philosophical Topics (New York: Macmillan, 1990), pp. 92–112.
33 Adolf Grünbaum, 'Pseudo-Creation of the Big Bang', *Nature*, 344 (1990), p. 85.
34 Thomas Aquinas, *Summa Theologiae* 1a. 2.3.

Questions for reflection

1 Do you believe it is rational to hold the view that something could begin to exist without a cause? Explain.
2 Professor Craig uses two philosophical arguments to argue for the premise that the universe began to exist. Do you find either of them persuasive? Why or why not?
3 Is Craig being inconsistent in utilizing an argument against belief in the existence of an actual infinite to demonstrate God's existence? Isn't God infinite?
4 Why does Craig believe that the conclusion of the *kalam* argument leads one to a personal God rather than, say, an impersonal cause? Explain.
5 Explain why Craig claims that Hilbert's Hotel is metaphysically absurd, and how this absurdity supports his argument for the universe having a beginning. Do you agree with his conclusion? Why or why not?

Further reading

William Lane Craig (2000) *The Kalam Cosmological Argument*. Eugene, OR: Wipf and Stock. (A historical overview and defense of the *kalam* argument.)
William Lane Craig (2001) *The Cosmological Argument from Plato to Leibniz*. Eugene, OR: Wipf and Stock. (Analyzes the cosmological arguments of thirteen major proponents.)
William Lane Craig and Quentin Smith (1993) *Theism, Atheism, and Big Bang Cosmology*. Oxford: Clarendon Press. (A sustained debate on whether Big Bang cosmology supports theism or atheism.)
Nicholas Everitt (2004) *The Non-Existence of God*. London: Routledge. (Critically assesses traditional and recent arguments about God's existence.)
Leadership University. http://www.leaderu.com. (A website dedicated to theology and the integration of faith and learning; contains many academic papers on arguments for the existence of God.)
J. L. Mackie (1982) *The Miracle of Theism: Arguments for and against the Existence of God*. Oxford: Clarendon Press. (Atheist philosopher Mackie examines many of the arguments about God's existence; a contemporary classic.)

Chapter 19

J. L. Mackie

A CRITIQUE OF COSMOLOGICAL ARGUMENTS

J. L. Mackie (1917–81) was Reader in Philosophy at Oxford University and Fellow of University College, Oxford. He was one of the leading atheist philosophers of the twentieth century. In this selection, he criticizes various forms of the cosmological argument. First, he examines an argument commonly referred to as the "argument from sufficient reason," propounded by philosopher Gottfried Wilhelm Leibniz. The argument is based on the principle of sufficient reason in which nothing contingent occurs without a reason or explanation for why it occurs rather than not. Mackie focuses on two criticisms of the argument which are summed up in the following questions: "How do we know that everything must have a sufficient reason?" and "How can there be a necessary being, one that contains its own sufficient reason?" Unable to find sound answers for these questions, he rejects this form of the cosmological argument.

Mackie next examines arguments in which the claim is made that there cannot be an indefinite regress of causes—they must terminate in a first, uncaused cause (i.e., God). He notes especially Thomas Aquinas's Third Way argument and maintains that it includes the implicit assumption that anything whose essence does not involve existence must depend for its existence on something else; only God's essence involves existence, so everything owes its existence to him. Mackie sees no reason for accepting this assumption; it could just be that some kind of matter exists which does not depend on something else, even if its essence does not involve its existence.

The third form of the cosmological argument Mackie considers is the *kalam* cosmological argument, whose most ardent defender in recent decades is William Lane Craig. According to this argument, the universe (i.e., time, space, matter, and energy) must have a cause outside of itself; namely, a divine cause. One significant aspect of this argument is that the universe must have a cause since its history could not extend back into the infinite past. Mackie responds by claiming that it seems impossible to disprove, a priori, the possibility of an infinite past time. Furthermore, if time has a beginning, and God created it, then he must exist outside of it. This is sheer mystery, he argues, and neither a priori reasoning nor scientific evidence can provide a solution to it.