The Existence of God and the Beginning of the Universe

William Lane Craig
Used by permission of San Bernardino: Here's Life, 1979, 107 pp.

SUMMARY

The *kalam* cosmological argument, by showing that the universe began to exist, demonstrates that the world is not a necessary being and, therefore, not self-explanatory with respect to its existence. Two philosophical arguments and two scientific confirmations are presented in support of the beginning of the universe. Since whatever begins to exist has a cause, there must exist a transcendent cause of the universe.

THE EXISTENCE OF GOD AND THE BEGINNING OF THE UNIVERSE

Introduction

"The first question which should rightly be asked," wrote G.W.F. Leibniz, is " *Why is there something rather than nothing*?" [1] This question does seem to possess a profound existential force, which has been felt by some of mankind's greatest thinkers. According to Aristotle, philosophy begins with a sense of wonder about the world, and the most profound question a man can ask concerns the origin of the universe. [2] In his biography of Ludwig Wittgenstein, Norman Malcolm reports that Wittgenstein said that he sometimes had a certain experience which could best be described by saying that "when I have it, *I wonder at the existence of the world*. I am then inclined to use such phrases as 'How extraordinary that anything should exist!'"[3] Similarly, one contemporary philosopher remarks, ". . . My mind often seems to reel under the immense significance this question has for me. That anything exists at all does seem to me a matter for the deepest awe." [4]

Why *does* something exist instead of nothing? Leibniz answered this question by arguing that something exists rather than nothing because a necessary being exists which carries within itself its reason for existence and is the sufficient reason for the existence of all contingent being. [5]

Although Leibniz (followed by certain contemporary philosophers) regarded the non- existence of a necessary being as logically impossible, a more modest explication of necessity of existence in terms of what he calls "factual necessity" has been given by John Hick: a necessary being is an eternal, uncaused, indestructible, and incorruptible being. [6] Leibniz, of course, identified the necessary being as God. His critics, however, disputed this identification, contending that the material universe could itself be assigned the status of a necessary being. "Why," queried David Hume, "may not the material universe be the necessary existent Being, according to this pretended explanation of necessity?" [7] Typically, this has been precisely the position of the atheist. Atheists have not felt compelled to embrace the view that the universe came into being out of nothing for no reason at all; rather they regard the universe itself as a sort of factually necessary being: the universe is eternal, uncaused, indestructible, and incorruptible. As Russell neatly put it, " . . . The universe is just there, and that's all." [8]

Does Leibniz's argument therefore leave us in a rational impasse, or might there not be some further resources available for untangling the riddle of the existence of the world? It seems to me that there are. It will be remembered that an essential property of a necessary being is eternality. If then it could be made plausible that the universe began to exist and is not therefore eternal, one would to that extent at least have shown the superiority of theism as a rational world view.

Now there is one form of the cosmological argument, much neglected today but of great historical importance, that aims precisely at the demonstration that the universe had a beginning in time. [9] Originating in the efforts of Christian theologians to refute the Greek doctrine of the eternity of matter, this argument was developed into sophisticated formulations by medieval Islamic and Jewish theologians, who in turn passed it back to the Latin West. The argument thus has a broad inter-sectarian appeal, having been defended by Muslims, Jews, and Christians both Catholic and Protestant.

This argument, which I have called the kalam cosmological argument, can be exhibited as follows:

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

2.1 Argument based on the impossibility of an actual infinite.

2.11 An actual infinite cannot exist.
2.12 An infinite temporal regress of events is an actual infinite.
2.13 Therefore, an infinite temporal regress of events cannot exist.

2.2 Argument based on the impossibility of the formation of an actual infinite by successive addition.

2.21 A collection formed by successive addition cannot be actually infinite.
2.22 The temporal series of past events is a collection formed by successive addition.
2.23 Therefore, the temporal series of past events cannot be actually infinite.

3. Therefore, the universe has a cause of its existence.

Let us examine this argument more closely.

Defense of the Kalam Cosmological Argument

Second Premiss

Clearly, the crucial premiss in this argument is (2), and two independent arguments are offered in support of it. Let us therefore turn first to an examination of the supporting arguments.

First Supporting Argument

In order to understand (2.1), we need to understand the difference between a potential infinite and an actual infinite. Crudely put, a potential infinite is a collection which is increasing toward infinity as a limit, but never gets there. Such a collection is really indefinite, not infinite. The sign of this sort of infinity, which is used in calculus, is ¥. An actual infinite is a collection in which the number of members really *is* infinite. The collection is not growing toward infinity; it is infinite, it is "complete." The sign of this sort of infinity, which is used in set theory to designate sets which have an infinite number of members, such as {1, 2, 3, . . .}, is À0. Now (2.11) maintains, 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 home the truth of (2.11) 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. 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." 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 the desk, 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. 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 gave 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 the woman who makes the beds! Suppose the guests in room numbers 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 less people in the hotel-but don't talk to that laundry woman! 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 less people in the hotel. But suppose instead the persons in room number 4, 5, 6, . . . checked out. At a single stroke the hotel would be virtually emptied, the guest register reduced to 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 room numbers 1, 3, 5, . . . checked out. Can anyone sincerely believe that such a hotel could exist in reality? These sorts of absurdities illustrate the impossibility of the existence of an actually infinite number of things.

That takes us to (2.12). The truth of this premiss seems fairly obvious. If the universe never began to exist, then prior to the present event there have existed an actually infinite number of previous events. Hence, a beginningless series of events in time entails the existence of an actually infinite number of things, namely, past events.

Given the truth of (2.11) and (2.12), the conclusion (2.13) logically follows. The series of past events must be finite and have a beginning. But since the universe is not distinct from the series of events, it follows that the universe began to exist.

At this point, we might find it profitable to consider several objections that might be raised against the argument. First let us consider objections to (2.11). Wallace Matson objects that the premiss must mean that an actually infinite number of things is *logically* impossible; but it is easy to show that such a collection is logically possible. For example, the series of negative numbers {. . . -3, -2, -1} is an actually infinite collection with no first member. [10] Matson's error here lies in thinking that (2.11) means to assert the *logical* impossibility of an actually infinite number of things. What the premiss expresses is the real or factual impossibility of an actual infinite. To illustrate the difference between real and logical possibility: there is no logical impossibility in something's coming to exist without a cause, but such a circumstance may well be really or metaphysically impossible. In the same way, (2.11) asserts that the absurdities entailed in the real existence of an actual infinite show that such an existence is metaphysically impossible. Hence, one could grant that in the conceptual realm of mathematics one can, given certain conventions and axioms, speak consistently about infinite sets of numbers, but this in no way implies that an actually infinite number of things is really possible. One might also note that the mathematical school of intuitionism denies that even the number series is actually infinite (they take it to be potentially infinite only), so that appeal to number series as examples of actual infinites is a moot procedure.

The late J.L. Mackie also objected to (2.11), claiming that the absurdities are resolved by noting that for infinite groups the axiom "the whole is greater than its part" does not hold, as it does for finite groups. [11] Similarly, Quentin Smith comments that once we understand that an infinite set has a proper subset which has the same number of members as the set itself, the purportedly absurd situations become "perfectly believable." [12] But to my mind, it is precisely this feature of infinite set theory which, when translated into the realm of the real, yields results which are perfectly incredible, for example, Hilbert's Hotel. Moreover, not all the absurdities stem from infinite set theory's denial of Euclid's axiom: the absurdities illustrated by guests checking out of the hotel stem from the self-contradictory results when the inverse operations of subtraction or division are performed using transfinite numbers. Here the case against an actually infinite collection of things becomes decisive.

Finally one might note the objection of Sorabji, who maintains that illustrations such as Hilbert's Hotel involve no absurdity. In order to understand what is wrong with the *kalam* argument, he asks us to envision two parallel columns beginning at the same point and stretching away into the infinite distance, one the column of past years and the other the column of past days. The sense in which the column of past days is no larger than the column of past years, says Sorabji, is that the column of days will not "stick out" beyond the far end of the other column, since neither column has a far end. Now in the case of Hilbert's Hotel there is the temptation to think that some unfortunate resident at the far end will drop off into space. But there is no far end: the line of residents will not stick out beyond the far end of the line of rooms. Once this is seen, the outcome is just an explicable-even if a surprising and exhilarating-truth about infinity. [13] Now Sorabji is certainly correct, as we have seen, that Hilbert's Hotel illustrates an explicable truth about the nature of the actual infinite. If an actually infinite number of things could exist, a Hilbert's Hotel would be possible. But Sorabji seems to fail to understand the heart of the paradox: I, for one, experience no temptation to think of people dropping off the far end of the hotel, for there is none, but I do have difficulty believing that a hotel in which all the rooms are occupied can accommodate more guests. Of course, the line of guests will not stick out beyond the line of rooms, but if all of those infinite rooms *already* have guests in them, then can moving those guests about really create empty rooms? Sorabji's own illustration of the columns of past years and days I find not a little disquieting: if we divide the columns into foot-long segments and mark one column as the years and the other as the days, then one column is as long as the other and yet for every foot-length segment in the column of years, 365 segments of equal length are found in the column of days! These paradoxical results can be avoided only if such actually infinite collections can exist only in the imagination, not in reality. In any case, the Hilbert's Hotel illustration is not exhausted by dealing only with the addition of new guests, for the subtraction of guests results in absurdities even more intractable. Sorabji's analysis says nothing to resolve these. Hence, it seems to me that the objections to premiss (2.11) are less plausible than the premiss itself.

With regard to (2.12), the most frequent objection is that the past ought to be regarded as a potential infinite only, not an actual infinite. This was Aquinas's position versus Bonaventure, and the contemporary philosopher Charles Hartshorne seems to side with Thomas on this issue. [14] Such a position is, however, untenable. The future is potentially infinite, since it does not exist; but the past is actual in a way the future is not, as evidenced by the fact that we have traces of the past in the present, but no traces of the future. Hence, if the series of past events never began to exist, there must have been an actually infinite number of past events.

The objections to either premiss therefore seem to be less compelling than the premisses themselves. Together they imply that the universe began to exist. Hence, I conclude that this argument furnishes good grounds for accepting the truth of premiss (2) that the universe began to exist.

Second Supporting Argument

The second argument (2.2) for the beginning of the universe is based on the impossibility of forming an actual infinite by successive addition. This argument is distinct from the first in that it does not deny the possibility of the existence of an actual infinite, but the possibility of its being *formed* by successive addition.

Premiss (2.21) is the crucial step in the argument. One cannot form an actually infinite collection of things by successively adding one member after another. Since one can always add one more before arriving at infinity, it is impossible to reach actual infinity. Sometimes this is called the impossibility of "counting to infinity" or "traversing the infinite." It is important to understand that this impossibility has nothing to do with the amount of time available: it belongs to the nature of infinity that it cannot be so formed.

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 simply moving in the opposite direction?

Indeed, the idea of a beginningness series ending in the present seems to be absurd. To give just one illustration: suppose we meet a man who claims to have been counting from eternity and is now finishing: . . ., -3, -2, -1, 0. We could ask, why did he not finish counting yesterday or the day before or the year before? By then an infinite time had already elapsed, so that he should already have finished by then. Thus, at no point in the infinite past could we ever find the man finishing his countdown, for by that point he should already be done! In fact, no matter how far back into the past we go, we can never find the man counting at all, for at any point we reach he will have already finished. But if at no point in the past do we find him counting, this contradicts the hypothesis that he has been counting from eternity. This illustrates the fact that the formation of an actual infinite by successive addition is equally impossible whether one proceeds to or from infinity.

Premiss (2.22) presupposes a dynamical view of time according to which events are actualized in serial fashion, one after another. The series of events is not a sort of timelessly subsisting world-line which appears successively in consciousness. Rather becoming is real and essential to temporal process. Now this view of time is not without its challengers, but to consider their objections in this article would take us too far afield. [15] In this piece, we must rest content with the fact that we are arguing on common ground with our ordinary intuitions of temporal becoming and in agreement with a good number of contemporary philosophers of time and space.

Given the truth of (2.21) and (2.22), the conclusion (2.23) logically follows. If the universe did not begin to exist a finite time ago, then the present moment could never arrive. But obviously, it has arrived. Therefore, we know that the universe is finite in the past and began to exist.

Again, it would be profitable to consider various objections that have been offered against this reasoning. Against (2.21), Mackie objects 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. But there would in an infinite past be no starting point, not even an infinitely distant one. Yet from any given point in the infinite past, there is only a finite distance to the present. [16] Now it seems to me that Mackie's allegation that the argument presupposes an infinitely distant starting point is entirely groundless. The beginningless character of the series only serves to accentuate the difficulty of its being formed by successive addition. The fact that there is *no beginning at all*, not even an infinitely distant one, makes the problem more, not less, nettlesome. And the point that from any moment in the infinite past there is only a finite temporal distance to the present may be dismissed as irrelevant. The question is not how any finite portion of the temporal series can be formed, but how the whole infinite series can be formed. If Mackie thinks that because every segment of the series can be formed by successive addition therefore the whole series can be so formed, then he is simply committing the fallacy of composition.

Sorabji similarly objects that the reason it is impossible to count down from infinity is because counting involves by nature taking a starting number, which is lacking in this case. But completing an infinite lapse of years involves no starting year and is, hence, possible. [17] But this response is clearly inadequate, for, as we have seen, the years of an infinite past could be enumerated by the negative numbers, in which case a completed infinity of years would, indeed, entail a beginningless countdown from infinity. Sorabji anticipates this rebuttal, however, and claims that such a backwards countdown is possible in principle and therefore no logical barrier has been exhibited to the elapsing of an infinity of past years. Again, however, the question I am posing is not whether there is a logical contradiction in such a notion, but whether such a countdown is not metaphysically absurd. For we have seen that such a countdown should at any point already have been completed. But Sorabji is again ready with a response: to say the countdown should at any point already be over confuses counting an *infinity* of numbers with counting *all* the numbers. At any given point in the past, the eternal counter will have already counted an infinity of negative numbers, but that does not entail that he will have counted all the negative numbers. I do not think the argument makes this alleged equivocation, and this may be made clear by examining the reason why our eternal counter is supposedly able to complete a count of the negative numbers ending at zero. In order to justify the possibility of this intuitively impossible feat, the argument's opponent appeals to the so-called Principle of Correspondence used in set theory to determine whether two sets are equivalent (that is, have the same number of members) by matching the members of one set with the members of the other set and *vice versa*. On the basis of this principle the objector argues that since the counter has lived, say, an infinite number of years and since the set of past years can be put into a one-to-one correspondence with the set of negative numbers, it follows that by counting one number a year an eternal counter would complete a countdown of the negative numbers by the present year. If we were to ask why the counter would not finish next year or in a hundred years, the objector would respond that prior to the present year an infinite number of years will have already elapsed, so that by the Principle of Correspondence, all the numbers should have been counted by now. But this reasoning backfires on the objector: for, as we have seen, on this account the counter should at any point in the past have already finished counting all the numbers, since a one-to-one correspondence exists between the years of the past and the negative numbers. Thus, there is no equivocation between counting an infinity of numbers and counting all the numbers. But at this point a deeper absurdity bursts in view: for suppose there were another counter who counted at a rate of one negative number per day. According to the Principle of Correspondence, which underlies infinite set theory and transfinite arithmetic, both of our eternal counters will finish their countdowns at the same moment, even though one is counting at a rate 365 times faster than the other! Can anyone believe that such scenarios can actually obtain in reality, but do not rather represent the outcome of an imaginary game being played in a purely conceptual realm according to adopted logical conventions and axioms?

As for premiss (2.22), many thinkers have objected that we need not regard the past as a beginningless infinite series with an end in the present. Popper, for example, admits that the *set* of all past events is actually infinite, but holds that the *series* of past events is potentially infinite. This may be seen by beginning in the present and numbering the events backwards, thus forming a potential infinite. Therefore, the problem of an actual infinite's being formed by successive addition does not arise. [18] Similarly, Swinburne muses that it is dubious whether a completed infinite series with no beginning but an end makes sense, but he proposes to solve the problem by beginning in the present and regressing into the past, so that the series of past events would have no end and would therefore not be a completed infinite. [19] This objection, however, clearly confuses the *mental regress* of counting with the *real progress* of the temporal series of events itself. Numbering the series from the present backwards only shows that if there are an infinite number of past events, then we can denumerate an infinite number of past events. But the problem is, how can this infinite collection of events come to be *formed* by successive addition? How we mentally conceive the series does not in any way affect the ontological character of the series itself as a series with no beginning but an end, or in other words, as an actual infinite completed by successive addition.

Once again, then, the objections to (2.21) and (2.22) seem less plausible than the premisses themselves. Together they imply (2.23), or that the universe began to exist.

First Scientific Confirmation

These purely philosophical arguments for the beginning of the universe have received remarkable confirmation from discoveries in astronomy and astrophysics during this century. These confirmations might be summarized under two heads: the confirmation from the expansion of the universe and the confirmation from thermodynamic properties of the universe.

With regard to the first, Hubble's discovery in 1929 of the red-shift in the light from distant galaxies began a revolution in astronomy perhaps as significant as the Copernican revolution. Prior to this time the universe as a whole was conceived to be static; but the startling conclusion to which Hubble was led was that the red-shift is due to the fact that the universe is in fact *expanding*. The staggering implication of this fact is that as one traces the expansion back in time, the universe becomes denser and denser until one reaches a point of infinite density from which the universe began to expand. The upshot of Hubble's discovery was that at some point in the finite past-probably around 15 billion years ago-the entire known universe was contracted down to a single mathematical point which marked the origin of the universe. That initial explosion has come to be known as the "Big Bang." Four of the world's most prominent astronomers described that event in these words:

The universe began from a state of infinite density. . . . Space and time were created in that event and so was all the matter in the universe. It is not meaningful to ask what happened before the Big Bang; it is like asking what is north of the North Pole. Similarly, it is not sensible to ask where the Big Bang took place. The point-universe was not an object isolated in space; it was the entire universe, and so the answer can only be that the Big Bang happened everywhere. [20]

This event that marked the beginning of the universe becomes all the more amazing when one reflects on the fact that a state of "infinite density" is synonymous to "nothing." There can be no object that possesses infinite density, for if it had any size at all it could still be even more dense. Therefore, as Cambridge astronomer Fred Hoyle points out, the Big Bang Theory requires the creation of matter from nothing. This is because as one goes back in time, one reaches a point at which, in Hoyle's words, the universe was "shrunk down to nothing at all." [21] Thus, what the Big Bang model of the universe seems to require is that the universe began to exist and was created out of nothing.

Some theorists have attempted to avoid the absolute beginning of the universe implied by the Big Bang theory by speculating that the universe may undergo an infinite series of expansions and contractions. There are, however, good grounds for doubting the adequacy of such an oscillating model of the universe: (i) The oscillating model appears to be physically impossible. For all the talk about such models, the fact seems to be that they are only theoretically, but not physically possible. As the late Professor Tinsley of Yale explains, in oscillating models "even though the mathematics say that the universe oscillates, there is no known physics to reverse the collapse and bounce back to a new expansion. The physics seems to say that those models start from the Big Bang, expand, collapse, then end." [22]In order for the oscillating model to be correct, it would seem that the known laws of physics would have to be revised. (ii) The oscillating model seems to be observationally untenable. Two facts of observational astronomy appear to run contrary to the oscillating model. First, the observed homogeneity of matter distribution throughout the universe seems unaccountable on an oscillating model. During the contraction phase of such a model, black holes begin to gobble up surrounding matter, resulting in an inhomogeneous distribution of matter. But there is no known mechanism to "iron out" these inhomogeneities during the ensuing expansion phase. Thus, the homogeneity of matter observed throughout the universe would remain unexplained. Second, the density of the universe appears to be insufficient for the re-contraction of the universe. For the oscillating model to be even possible, it is necessary that the universe be sufficiently dense such that gravity can overcome the force of the expansion and pull the universe back together again. However, according to the best estimates, if one takes into account both luminous matter and non-luminous matter (found in galactic halos) as well as any possible contribution of neutrino particles to total mass, the universe is still only about one-half that needed for re-contraction. [23] Moreover, recent work on calculating the speed and deceleration of the expansion confirms that the universe is expanding at, so to speak, "escape velocity" and will not therefore re-contract. According to Sandage and Tammann, "Hence, we are forced to decide that . . . it seems inevitable that the Universe will expand forever"; they conclude, therefore, that "the Universe has happened only once." [24]

Second Scientific Confirmation

As if this were not enough, there is a second scientific confirmation of the beginning of the universe based on the thermodynamic properties of various cosmological models. According to the second law of thermodynamics, processes taking place in a closed system always tend toward a state of equilibrium. Now our interest is in what implications this has when the law is applied to the universe as a whole. For the universe is a gigantic closed system, since it is everything there is and no energy is being fed into it from without. The second law seems to imply that, given enough time, the universe will reach a state of thermodynamic equilibrium, known as the "heat death" of the universe. This death may be hot or cold, depending on whether the universe will expand forever or eventually re-contract. On the one hand, if the density of the universe is great enough to overcome the force of the expansion, then the universe will re-contract into a hot fireball. As the universe contracts, the stars burn more rapidly until they finally explode or evaporate. As the universe grows denser, the black holes begin to gobble up everything around them and begin themselves to coalesce until all the black holes finally coalesce into one gigantic black hole which is coextensive with the universe, from which it will never re-emerge. On the other hand, if the density of the universe is insufficient to halt the expansion, as seems more likely, then the galaxies will turn all their gas into stars and the stars will burn out. At 10[30] years the universe will consist of 90% dead stars, 9% supermassive black holes, and l% atomic matter. 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 into radiation and elementary particles. Eventually all the matter in the dark, cold, ever-expanding universe will be reduced to an ultra-thin gas of elementary particles and radiation. Equilibrium will prevail throughout, and the entire universe will be in its final state, from which no change will occur.

Now the question which needs to be asked is this: if, given sufficient time, the universe will reach heat death, then why is it not now in a state of heat death if it has existed for infinite time? If the universe did not begin to exist, then it should now be in a state of equilibrium. Some theorists have suggested that the universe escapes final heat death by oscillating from eternity past to eternity future. But we have already seen that such a model seems to be physically and observationally untenable. But even if we waive those considerations and suppose that the universe does oscillate, the fact is that the thermodynamic properties of this model imply the very beginning of the universe which its proponents seek to avoid. For the thermodynamic properties of an oscillating model are such that the universe expands farther and farther with each successive cycle. Therefore, as one traces the expansions back in time, they grow smaller and smaller. 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." [25] Novikov and Zeldovich of the Institute of Applied Mathematics of the USSR Academy of Sciences therefore conclude, "The multicycle model has an infinite future, but only a finite past." [26] As another writer points out, the oscillating model of the universe thus still requires an origin of the universe prior to the smallest cycle. [27]

So whatever scenario one selects for the future of the universe, thermodynamics implies that the universe began to exist. According to physicist 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, the universe simply did not exist. Therefore, Davies concludes, even though we may not like it, we must conclude that the universe's energy was somehow simply "put in" at the creation as an initial condition. [28]

We therefore have both philosophical argument and scientific confirmation for the beginning of the universe. On this basis I think that we are amply justified in concluding the truth of premiss (2) that the universe began to exist.

First Premiss

Premiss (1) strikes me as relatively non-controversial. It is based on the metaphysical intuition that something cannot come out of nothing. Hence, any argument for the principle is apt to be less obvious than the principle itself. Even the great skeptic David Hume admitted that he never asserted so absurd a proposition as that something might come into existence without a cause; he only denied that one could *prove* the obviously true causal principle. [29] With regard to the universe, if originally there were absolutely *nothing*-no God, no space, no time-, then how could the universe possibly come to exist? The truth of the principle *ex nihilo*, *nihil fit* is so obvious that I think we are justified in foregoing an elaborate defense of the argument's first premiss.

Nevertheless, some thinkers, exercised to avoid the theism implicit in this premiss within the present context, have felt driven to deny its truth. In order to avoid its theistic implications, Davies presents a scenario which, he confesses, "should not be taken too seriously," but which seems to have a powerful attraction for Davies. [30] He has reference to a quantum theory of gravity according to which spacetime itself could spring uncaused into being out of absolutely nothing. While admitting that there is "still no satisfactory theory of quantum gravity," such a theory "would allow spacetime to be created and destroyed spontaneously and uncaused in the same way that particles are created and destroyed spontaneously and uncaused. The theory would entail a certain mathematically determined probability that, for instance, a blob of space would appear where none existed before. Thus, spacetime could pop out of nothingness as the result of a causeless quantum transition." [31]

Now in fact particle pair production furnishes no analogy for this radical *ex nihilo* becoming, as Davies seems to imply. This quantum phenomenon, even if an exception to the principle that every event has a cause, provides no analogy to something's coming into being out of nothing. Though physicists speak of this as particle pair creation and annihilation, such terms are philosophically misleading, for all that actually occurs is conversion of energy into matter or vice versa. As Davies admits, "The processes described here do not represent the creation of matter out of nothing, but the conversion of pre-existing energy into material form." [32] Hence, Davies greatly misleads his reader when he claims that "Particles . . . can appear out of nowhere without specific causation" and again, "Yet the world of quantum physics routinely produces something for nothing." [33] On the contrary, the world of quantum physics *never* produces something for nothing.

But to consider the case on its own merits: quantum gravity is so poorly understood that the period prior to 10[-43] sec, which this theory hopes to describe, has been compared by one wag to the regions on the maps of the ancient cartographers marked "Here there be dragons": it can easily be filled with all sorts of fantasies. In fact, there seems to be no good reason to think that such a theory would involve the sort of spontaneous becoming *ex nihilo* which Davies suggests. A quantum theory of gravity has the goal of providing a theory of gravitation based on the exchange of particles (gravitons) rather than the geometry of space, which can then be brought into a Grand Unification Theory that unites all the forces of nature into a supersymmetrical state in which one fundamental force and a single kind of particle exist. But there seems to be nothing in this which suggests the possibility of spontaneous becoming *ex nihilo*.

Indeed, it is not at all clear that Davies's account is even intelligible. What can be meant, for example, by the claim that there is a mathematical probability that nothingness should spawn a region of spacetime "where none existed before?" It cannot mean that given enough time a region of spacetime would pop into existence at a certain place, since neither place nor time exist apart from spacetime. The notion of some probability of something's coming out of nothing thus seems incoherent.

I am reminded in this connection of some remarks made by A.N. Prior concerning an argument put forward by Jonathan Edwards against something's coming into existence uncaused. This would be impossible said Edwards, because it would then be inexplicable why just any and everything cannot or does not come to exist uncaused. One cannot respond that only things of a certain nature come into existence uncaused, since prior to their existence they have no nature which could control their coming to be. Prior made a cosmological application of Edwards's reasoning by commenting on the steady state model's postulating the continuous creation of hydrogen atoms *ex nihilo*:

It is no part of Hoyle's theory that this process is causeless, but I want to be more definite about this, and to say that if it is causeless, then what is alleged to happen is fantastic and incredible. If it is possible for objects-objects, now, which really are objects, "substances endowed with capacities" -to start existing without a cause, then it is incredible that they should all turn out to be objects of the same sort, namely, hydrogen atoms. The peculiar nature of hydrogen atoms cannot possibly be what makes such starting-to-exist possible for them but not for objects of any other sort; for hydrogen atoms do not have this nature until they are there to have it, i.e. until their starting-to-exist has already occurred. That is Edwards's argument, in fact; and here it does seem entirely cogent. . . . [34]

Now in the case at hand, if originally absolutely nothing existed, then why should it be spacetime that springs spontaneously out of the void, rather than, say, hydrogen atoms or even rabbits? How can one talk about the probability of any particular thing's popping into being out of nothing?

Davies on one occasion seems to answer as if the laws of physics are the controlling factor which determines what may leap uncaused into being: "But what of the laws? They have to be 'there' to start with so that the universe can come into being. Quantum physics has to exist (in some sense) so that a quantum transition can generate the cosmos in the first place." [35] Now this seems exceedingly peculiar. Davies seems to attribute to the laws of nature themselves a sort of ontological and causal status such that they constrain spontaneous becoming. But this seems clearly wrong-headed: the laws of physics do not themselves cause or constrain anything; they are simply propositional descriptions of a certain form and generality of what does happen in the universe. And the issue Edwards raises is why, if there were absolutely nothing, it would be true that any one thing rather than another should pop into being uncaused? It is futile to say it somehow belongs to the nature of spacetime to do so, for if there were absolutely nothing then there would have been no nature to determine that spacetime should spring into being.

Even more fundamentally, however, what Davies envisions is surely metaphysical nonsense. Though his scenario is cast as a scientific theory, someone ought to be bold enough to say that the Emperor is wearing no clothes. Either the necessary and sufficient conditions for the appearance of spacetime existed or not; if so, then it is not true that nothing existed; if not, then it would seem ontologically impossible that being should arise out of absolute non-being. To call such spontaneous springing into being out of non-being a "quantum transition" or to attribute it to "quantum gravity" explains nothing; indeed, on this account, there is no explanation. It just happens.

It seems to me, therefore, that Davies has not provided any plausible basis for denying the truth of the cosmological argument's first premiss. That whatever begins to exist has a cause would seem to be an ontologically necessary truth, one which is constantly confirmed in our experience.

Conclusion

Given the truth of premisses (1) and (2), it logically follows that (3) the universe has a cause of its existence. In fact, I think that it can be plausibly argued that the cause of the universe must be a personal Creator. For how else could a temporal effect arise from an eternal cause? If the cause were simply a mechanically operating set of necessary and sufficient conditions existing from eternity, then why would not the effect also exist from eternity? For example, if the cause of water's being frozen is the temperature's being below zero degrees, then if the temperature were below zero degrees from eternity, then any water present would be frozen from eternity. The only way to have an eternal cause but a temporal effect would seem to be if the cause is a personal agent who freely chooses to create an effect in time. For example, a man sitting from eternity may will to stand up; hence, a temporal effect may arise from an eternally existing agent. Indeed, the agent may will from eternity to create a temporal effect, so that no change in the agent need be conceived. Thus, we are brought not merely to the first cause of the universe, but to its personal Creator.

Summary and Conclusion

In conclusion, we have seen on the basis of both philosophical argument and scientific confirmation that it is plausible that the universe began to exist. Given the intuitively obvious principle that whatever begins to exist has a cause of its existence, we have been led to conclude that the universe has a cause of its existence. On the basis of our argument, this cause would have to be uncaused, eternal, changeless, timeless, and immaterial. Moreover, it would have to be a personal agent who freely elects to create an effect in time. Therefore, on the basis of the *kalam* cosmological argument, I conclude that it is rational to believe that God exists.

Footnotes:

[1]

G.W. Leibniz, "The Principles of Nature and of Grace, Based on Reason," in *Leibniz Selections*, ed. Philip P. Wiener, The Modern Student's Library (New York: Charles Scribner's Sons, 1951), p. 527.

[2]

Aristotle *Metaphysica* Lambda. l. 982b10-15.

[3]

Norman Malcolm, *Ludwig Wittgenstein: A Memoir* (London: Oxford University Press, 1958), p. 70.

[4]

J.J.C. Smart, "The Existence of God," *Church Quarterly Review* 156 (1955): 194.

[5]

G.W. Leibniz, *Theodicy: Essays on the Goodness of God, the Freedom of Man, and the Origin of Evil*, trans. E.M. Huggard (London: Routledge & Kegan Paul, 1951), p. 127; cf. idem, "Principles," p. 528.

[6]

John Hick, "God as Necessary Being," *Journal of Philosophy* 57 (1960): 733-4.

[7]

David Hume, *Dialogues concerning Natural Religion*, ed. with an Introduction by Norman Kemp Smith, Library of the Liberal Arts (Indianapolis: Bobbs-Merrill. 1947), p. 190.

[8]

Bertrand Russell and F.C. Copleston, "The Existence of God," in *The Existence of God*, ed. with an Introduction by John Hick, Problems of Philosophy Series (New York: Macmillan & Co., 1964), p. 175.

[9]

See William Lane Craig, *The Cosmological Argument from Plato to Leibniz*, Library of Philosophy and Religion (London: Macmillan, 1980), pp. 48-58, 61-76, 98-104, 128-31.

[10]

Wallace Matson, *The Existence of God* (Ithaca, N.Y.: Cornell University Press, 1965), pp. 58-60.

[11]

J.L. Mackie, *The Miracle of Theism (*Oxford: Clarendon Press, 1982), p. 93.

[12]

Quentin Smith, "Infinity and the Past," *Philosophy of Science* 54 (1987): 69.

[13]

Richard Sorabji, *Time, Creation and the Continuum* (Ithaca, N.Y.: Cornell University Press, 1983), pp. 213, 222-3.

[14]

Charles Hartshorne, *Man's Vision of God and the Logic of Theism* (Chicago: Willett, Clark, & Co., 1941), p. 37.

[15]

G.J. Whitrow defends a form of this argument which does not presuppose a dynamical view of time, by asserting that an infinite past would still have to be "lived through" by any everlasting, conscious being, even if the series of physical events subsisted timelessly (G.J. Whitrow, *The Natural Philosophy of Time*, 2d ed. Oxford: Clarendon Press, 1980 , pp. 28-32).

[16]

Mackie, *Theism*, p. 93.

[17]

Sorabji, Time, Creation, and the Continuum, pp. 219-22.

[18]

K.R. Popper, "On the Possibility of an Infinite Past: a Reply to Whitrow," *British Journal for the Philosophy of Science* 29 (1978): 47-8.

[19]

R.G. Swinburne, "The Beginning of the Universe," *The Aristotelian Society* 40 (1966): 131-2.

[20]

Richard J. Gott, *et.al.*, "Will the Universe Expand Forever?" *Scientific American* (March 1976), p. 65.

[21]

Fred Hoyle, *From Stonehenge to Modern Cosmology* (San Francisco: W.H. Freeman, 1972), p. 36.

[22]

Beatrice Tinsley, personal letter.

[23]

David N. Schramm and Gary Steigman, "Relic Neutrinos and the Density of the Universe," *Astrophysical Journal* 243 (1981): p. 1-7.

[24]

Alan Sandage and G.A. Tammann, "Steps Toward the Hubble Constant. VII," *Astrophyscial Journal* 210 (1976): 23, 7; see also idem, "Steps toward the Hubble Constant. VIII." *Astrophysical Journal* 256 (1982): 339-45.

[25]

Duane Dicus, *et.al.* "Effects of Proton Decay on the Cosmological Future." *Astrophysical Journal* 252 (1982): l, 8.

[26]

I.D. Novikov and Ya. B. Zeldovich, "Physical Processes Near Cosmological Singularities," *Annual Review of Astronomy and Astrophysics* 11 (1973): 401-2.

[27]

John Gribbin, "Oscillating Universe Bounces Back," *Nature*259 (1976): 16.

[28]

P.C.W. Davies, *The Physics of Time Asymmetry* (London: Surrey University Press, 1974), p. 104.

[29]

David Hume to John Stewart, February, 1754, in *The Letters of David Hume*, ed. J.Y.T. Greig (Oxford: Clarendon Press, 1932), 1:187.

[30]

Paul Davies, *God and the New Physics* (New York: Simon & Schuster, 1983), p. 214.

[31]

Ibid., p. 215.

[32]

Ibid., p. 31.

[33]

Ibid., pp. 215, 216.

[34]

A.N. Prior, "Limited Indeterminism," in *Papers on Time and Tense* (Oxford: Clarendon Press, 1968), p. 65.

[35]

Davies, *God*, p. 217.