Faith and Philosophy: Journal of the Society of Christian Philosophers

Volume 9 | Issue 2

Article 6

4-1-1992

A Big Bang Cosmological Argument for God's Nonexistence

Quentin Smith

Follow this and additional works at: <https://place.asburyseminary.edu/faithandphilosophy>

Recommended Citation

Smith, Quentin (1992) "A Big Bang Cosmological Argument for God's Nonexistence," *Faith and Philosophy: Journal of the Society of Christian Philosophers*: Vol. 9 : Iss. 2 , Article 6.

DOI: 10.5840/faithphil19929215

Available at: <https://place.asburyseminary.edu/faithandphilosophy/vol9/iss2/6>

This Article is brought to you for free and open access by the Journals at ePLACE: preserving, learning, and creative exchange. It has been accepted for inclusion in Faith and Philosophy: Journal of the Society of Christian Philosophers by an authorized editor of ePLACE: preserving, learning, and creative exchange.

A BIG BANG COSMOLOGICAL ARGUMENT FOR GOD'S NONEXISTENCE

Quentin Smith

The big bang cosmological theory is relevant to Christian theism and other theist perspectives since it represents the universe as beginning to exist *ex nihilo* about 15 billion years ago. This paper addresses the question of whether it is reasonable to believe that God created the big bang. Some theists answer in the affirmative, but it is argued in this paper that this belief is not reasonable. In the course of this argument, there is a discussion of the meta-physical necessity of natural laws, of whether the law of causality is true *a priori*, and of other pertinent issues.

1. Introduction

The advent of big bang cosmology in this century was a watershed for theists. Since the times of Copernicus and Darwin, many theists regarded science as hostile to their world-view and as requiring defence and retrenchment on the part of theism. But big bang cosmology in effect reversed this situation. The central idea of this cosmology, that the universe exploded into existence in a 'big bang' about 15 billion years ago or so, seemed tailor made to a theistic viewpoint. Big bang cosmology seemed to offer empirical evidence for the religious doctrine of creation *ex nihilo*. The theistic implications seemed so clear and exciting that even Pope Pius XII was led to comment that 'True science to an ever increasing degree discovers God as though God were waiting behind each door opened by science.'¹ But the theistic interpretation of the big bang has not only received widespread dissemination in popular culture and official sanction but also a sophisticated philosophical articulation. Richard Swinburne, John Leslie and especially William Lane Craig² have developed powerful arguments for theism based on a well-grounded knowledge of the cosmological data and ideas.

The response of atheists and agnostics to this development has been comparatively weak, indeed, almost invisible. An uncomfortable silence seems to be the rule when the issue arises among nonbelievers or else the subject is briefly and epigrammatically dismissed with a comment to the effect that 'science has no relevance to religion.' The reason for the apparent embarrassment of nontheists is not hard to find. Anthony Kenny suggests it in this summary statement:

According to the big bang theory, the whole matter of the universe began to exist at a particular time in the remote past. A proponent of such a theory, at least if he is an atheist, must believe that the matter of the universe came from nothing and by nothing.³

This idea disturbs many for the reason it disturbs C. D. Broad:

I must confess that I have a very great difficulty in supposing that there was a first phase in the world's history, i.e., a phase immediately before which there existed neither matter, nor minds, nor anything else.... I suspect that my difficulty about a first event or phase in the world's history is due to the fact that, whatever I may say when I am trying to give Hume a run for his money, I can not really *believe* in anything beginning to exist without being *caused* (in the old-fashioned sense of *produced* or *generated*) by something else which existed before and up to the moment when the entity in question began to exist.... I...find it impossible to give up the principle; and with that confession of the intellectual impotence of old age I must leave this topic.⁴

Motivated by concerns such as Broad's, some of the few nontheists who have been vocal on this subject have gone so far as to deny, without due justification, central tenets of big bang cosmology. Among physicists, the most notorious example is Fred Hoyle, who vehemently rejected the suggestion of a big bang that seemed to imply a Creator and unsuccessfully attempted to construe the evidence for a big bang as evidence for an evolving 'bubble' within a larger unchanging and infinitely old universe (I am referring to his 1970s post-steady-state theory⁵). An example of this contrary approach among philosophers is evinced by W. H. Newton-Smith. Newton-Smith felt himself compelled to maintain, in flat contradiction to the singularity theorems of big bang cosmology (which entail that there can be no earlier state of the universe than the big bang singularity) that the evidence that macroscopic events have causal origins gives us 'reason to suppose that some prior state of the universe led to the production of this particular singularity.'⁶

It seems to me, however, that nontheists are not put in such dire straits by big bang cosmology. Nontheists are not faced only with the alternatives of embarrassed silence, confessions of impotence, epigrammatic dismissals or 'denial' when confronted with the apparently radical implications of big bang cosmology. It will be my purpose in this paper to show this by establishing a coherent and plausible atheistic interpretation of the big bang, an interpretation that is not only able to stand up to the theistic interpretation but is in fact *better justified* than the theistic interpretation. But my argument is intended to establish even more than this. I have elsewhere⁷ made the case that big bang cosmology does not lend support to theism but here I wish to make the stronger case that big bang cosmology is actually *inconsistent* with theism. I will argue that if big bang cosmology is true, then God does not exist.

The cosmological theory I shall discuss in this paper is the so-called 'standard hot big bang theory,' which is based on Friedmann's solutions to the

equations of Einstein's General Theory of Relativity and the Hawking-Penrose singularity theorems. I shall explain these ideas in an introductory and nontechnical manner in section 2, so that philosophers who are unfamiliar with this theory may follow my argument. One point I wish to emphasize at the outset concerns the provisional status of the big bang theory. Cosmologists believe that this theory will one day be replaced by a cosmology based on a quantum theory of gravity and, consequently, theistic or atheistic conclusions that are derived from the 'standard hot big bang theory' must be treated with a similarly provisional status.

After my introductory explanation of big bang cosmology in section 2, I outline the 'big bang cosmological argument for God's nonexistence' in section 3. Most of the paper, sections 4-8, is devoted to responding to objections to the argument outlined in section 3.

2. *The Big Bang Cosmological Theory*

In this section the relevant aspects of the big bang theory are explained in four steps. These aspects will constitute the four scientific premises of the atheistic argument I shall construct in section 3.

(i) The first step is the introduction of the so-called 'Einstein equation,' which is the heart of Einstein's General Theory of Relativity.⁸ Einstein's equation says, in simplified terms, that the geometry (curvature) of spacetime is determined by the distribution of mass and energy in spacetime. The equation may be simplified as

$$(\text{curvature of spacetime}) = 8\pi (\text{density of matter}).$$

This equation suggests that if the matter in the universe is sufficiently dense, then the curvature of spacetime will become so great that it eventually curves to a point, as at the tip of a cone. The history of a particle or light ray is a path in spacetime, and if spacetime eventually curves to a point then these spacetime paths will converge and intersect at the point. If this intersection occurs at some time in the future, the point of intersection would seem to constitute the end of spacetime. If the intersection occurs in the past, such that the spacetime paths emerge from the point of intersection and gradually curve away from each other, the point of intersection would appear to constitute the beginning of spacetime. This possibility leads to a discussion of the next relevant aspect of big bang cosmology.

(ii) Einstein's equation admits of many solutions and it is an empirical question which solution describes our universe. The Friedmann solutions (first obtained by Friedmann in 1922 and 1924⁹) are the ones thought to apply to our universe. His solution describe a universe that is perfectly isotropic (it looks the same in every direction) and perfectly homogeneous (matter is evenly distributed). If we apply to Einstein's equation a metric that describes

a perfectly isotropic and homogeneous universe, the Friedmann solutions are obtained, which in a simplified form read

$$\begin{aligned} & -3(\text{acceleration of expansion or deceleration of contraction of the universe}) \\ & = 4\pi (\text{density of matter}) \end{aligned}$$

The Friedmann solutions tell us that if there is matter evenly distributed throughout the universe, then the universe must be expanding at a decreasing rate or contracting at an increasing rate (except at the instant, if any, at which the expansion stops and changes to a contraction). To see this, note that the right side of the above (simplified) equation represents the density of matter multiplied by 4π . If there is matter present in the universe, then the matter density of the universe is positive. This implies that the right side of the equation, 4π (density of matter), will be positive. This in turn implies that the value for the acceleration of the expansion or the deceleration of the contraction will be negative. This is because the acceleration of the expansion or the deceleration of the contraction is multiplied by -3 and the result must be equal to the positive number represented by the right side of the equation. If the value of the expansion's acceleration is negative, this means that the universe is expanding at an ever decreasing rate. If the value of the contraction's deceleration is negative, this means that the universe is contracting at an ever increasing rate. This result is of momentous significance, for it implies that if the universe contains evenly distributed matter then its existence is temporally limited. If the universe is contracting at an ever increasing rate, then it cannot contract *forever* but must eventually reach an endpoint, when it curves to a point and its radius becomes zero. If the universe is expanding at an ever decreasing rate, then it cannot have been expanding *forever* but must have begun expanding at some time in the past, when its radius began extending from zero.

Let us further consider the case of expansion, since the universe is now expanding. The further we trace the universe into the past, the faster we find its rate of expansion. As the rate of expansion increases, the curvature of the universe and the density of matter increase and the radius of the universe decreases, until a time is reached when the curvature of the universe is infinite, the density of matter infinite and the radius of the universe is zero. Due to the infinite curvature, the past-directed spacetime paths of particles converge, such that each spacetime path ends at some point at which other spacetime paths also end. If the Friedmann equations describe a spherical universe, the universe is finite in extent and consequently the past-directed spacetime paths all intersect in one point. All of matter is squeezed into this one point, which has zero spatial dimensions. This point exists instantaneously before exploding in the big bang. The instantaneously existing point is a singularity, which means that it is an end-

point of spacetime; there is no earlier time than the instant of the singularity for it itself is the first instant of time. On the other hand, if the universe is flat (uncurved) or hyperbolic (curved like a saddle) it is infinite in extent, which implies that the past-directed spacetime paths end in a spatially one dimensional singularity. Only a finite volume of space can be compressed into a point; consequently, if there are an infinite number of spatial volumes of any given finite size (which there would be if the universe were flat or hyperbolic), then there must be an infinite number of points constitutive of the singularity. These points exist instantaneously (at the first instant of time) and then explode in an infinitely extended big bang.

However, Friedmann's solutions to Einstein's equation do not by themselves show that our universe began in a big bang singularity. There exists a certain discrepancy between his solutions and the global features of our universe, a discrepancy that might seem to render inapplicable their prediction of a big bang singularity. The statement and resolution of this problem leads to the third aspect of big bang cosmology that is pertinent to my argument.

(iii) Friedmann's solutions are based on the assumption that the universe is perfectly isotropic and homogeneous. But this assumption is inconsistent with observational evidence, which reveals the universe to consist of clusters or superclusters of galaxies separated by vast stretches of empty or near empty space. The universe is isotropic and homogeneous only when averaged over distances of billions of light years. (For example, we may assume that different cubic regions of space differ in mass by less than one percent only if these regions are taken to be three billion light years or more in diameter.) This might suggest that the prediction of a big bang singularity is inapplicable to the universe since this prediction is based on the assumptions of perfect homogeneity and isotropy. The assumption of perfect isotropy entails that the relative motion of any pair of particles is purely radial and the assumption of perfect homogeneity entails there are no pressure gradients. The fact that our universe is imperfectly isotropic and homogeneous entails that past directed spacetime paths of particles exhibit transverse velocities and clusterings that make up clumpings of matter. This suggests that the paths will miss each other instead of converging at a point. This in turn suggests that the present expansion phase of the universe results from a 'bounce' that terminated a prior contracting phase of the universe. But this suggestion of an oscillating universe was contradicted in the late 1960s by the Hawking-Penrose singularity theorems,^{9A} which demonstrate that under certain conditions imperfectly isotropic and homogeneous universes also originate in a big bang singularity. Precisely put, the theorems state that a singularity is inevitable given the following five conditions:

- a) Einstein's General Theory of Relativity holds true of the universe.
- b) There are no closed timelike curves (i.e. time travel into one's past is impossible and the principle of causality is not violated).
- c) Gravity is always attractive.
- d) The spacetime manifold is not too highly symmetric; i.e., every spacetime path of a particle or light ray encounters some matter or randomly oriented curvature.
- v) There is some point p such that all the past directed (or future directed) spacetime paths from p start converging again. This condition implies that there is enough matter present in the universe to focus every past directed (or future directed) spacetime path from some point p .

The solutions for the Hawking-Penrose theorems show, as Hawking notes, that 'in the general case there will be a curvature singularity that will intersect every world line. Thus general relativity predicts a beginning of time.'¹⁰

(iv) The last aspect of big bang cosmology that I need as a premise in my argument for atheism is Hawking's *principle of ignorance*, which states that singularities are inherently chaotic and unpredictable. In Hawking's words,

A singularity is a place where the classical concepts of space and time break down as do all the known laws of physics because they are all formulated on a classical space-time background. In this paper it is claimed that this breakdown is not merely a result of our ignorance of the correct theory but that it represents a fundamental limitation to our ability to predict the future, a limitation that is analogous but additional to the limitation imposed by the normal quantum-mechanical uncertainty principle.¹¹

One of the quantum-mechanical uncertainty relations concerns the position q and momentum p of a particle. This relation states that $\Delta p \Delta q \geq h/4\pi$, which implies that if the position of a particle is definitely predictable then its momentum is not, and *vice versa*. The principle of ignorance is stronger in that it implies that one can definitely predict neither the position nor the momentum of any particles emitted from a singularity. In fact, this principle implies that *none* of the physical values of the emitted particles are definitely predictable. According to this principle, the big bang singularity 'would...emit all configurations of particles with equal probability.'¹²

The unpredictability of the singularity implies that we should expect a chaotic outpouring from it. This expectation is in line with big bang cosmologists' representation of the early stages of the universe, for these states are thought to be maximally chaotic (involving complete entropy). The singularity emitted particles with random microstates, and this resulted in an over-all macrostate of thermal equilibrium.

The significance of the principle of ignorance can be easily missed. It implies that the big bang singularity behaves in a completely unpredictable manner *in the sense that no physical laws govern its behavior*. The unpre-

dictability of the singularity is not simply an epistemic affair, meaning that 'we humans cannot predict what will emerge from it, even though there is a law governing the singularity which, if known, would enable precise predictions to be made.' William Lane Craig assumes unpredictability to be merely epistemic; he writes that 'unpredictability [is] an epistemic affair which may or may not result from an ontological indeterminism. For clearly, it would be entirely consistent to maintain determinism on the quantum level even if we could not, even in principle, predict precisely such events.'¹³ Now I grant that there are legitimate uses of 'unpredictability' that are merely epistemic in import, but this is not how the word is used in Hawking's principle of ignorance. The unpredictability that pertains to Hawking's principle of ignorance is an unpredictability that is a consequence of lawlessness, not of human inability to know the laws. There is no law, not even a probabilistic law, governing the singularity that places restrictions on what it can emit. Hawking writes that

A singularity can be regarded as a place where there is a breakdown of the classical concept of space-time as a manifold with a pseudo-Reimannian metric. Because all known laws of physics are formulated on a classical space-time background, they will all break down at a singularity. This is a great crisis for physics because it means that one cannot predict the future. One does not know what will come out of a singularity.¹⁴

Deterministic or even probabilistic laws cannot obtain on the quantum level in the singularity, since *there is no quantum level* in the singularity; the space-time manifold that quantum processes presuppose has broken down. The singularity is a violent, terrifying caldron of lawlessness. As Paul Davies notes, 'anything can come out of a naked singularity—in the case of the big bang the universe came out. Its creation represents the instantaneous suspension of physical laws, the sudden, abrupt flash of lawlessness that allowed something to come out of nothing.'¹⁵ The question I shall examine is whether this primordial lawlessness is consistent with the hypothesis of divine creation. I shall argue it is not.

3. *The Big Bang Cosmological Argument for Atheism*

I shall use the four aspects of big bang cosmology explicated in the last section as the scientific premises of my atheistic argument. The first three scientific premises articulated in the last section, the Einstein equation, Friedmann's solutions to this equation and the Hawking-Penrose singularity theorems, provide us with the two premises

- (1) The big bang singularity is the earliest state of the universe.
- (2) The earliest state of the universe is inanimate

(2) follows from (1) since the singularity involves the life-hostile conditions of infinite temperature, infinite curvature and infinite density.

The fourth scientific idea explained in the last section, the principle of ignorance, gives us the summary premise

- (3) No law governs the big bang singularity and consequently there is no guarantee that it will emit a configuration of particles that will evolve into an animate universe.

(1)-(3) entail

- (4) The earliest state of the universe is not guaranteed to evolve into an animate state of the universe.

My argument is that (4) is inconsistent with the hypothesis that God created the earliest state of the universe, since it is true of God that *if he created the earliest state of the universe, then he would have ensured that this state is animate or evolves into animate states of the universe*. It is essential to the idea of God in the Judeo-Christian-Islamic tradition that if he creates a universe, he creates an animate universe, and therefore that if he creates a first state of the universe, he creates a state that is, or is guaranteed to evolve into, an animate state. If somebody says, 'it does not matter to God whether the universe he creates is animate or inanimate,' this person is operating with a concept of God that is at odds with classical theism. I think it would be granted by virtually all contemporary theists in the analytic tradition (M. and R. Adams, Craig, Menzel, Morris, Plantinga, Quinn, Schlesinger, Swinburne, Wainwright, Wolterstorff and many others) that God, if he creates a universe, intends his creation to be animate. Richard Swinburne writes, for example, that 'orderly universes' are those required by animate creatures and that 'God has overriding reason to make an orderly universe if he makes a universe at all.'¹⁶

The above statement of the 'big bang cosmological argument for God's nonexistence' is of course just a starter, since the theist has available to himself or herself numerous counterarguments or objections. In the remainder of this paper I will state and respond to some of these objections.

4. *The Question of Divine Intervention*

One objection to the argument of section 3 is that it does not take into account the possibility of divine intervention. If the big bang singularity is lawless, then it is feasible for God to intervene at the instant of the singularity and supernaturally constrain it to explode in a certain way, namely, to explode by emitting a life-producing maximal configuration of particles. In this way, God can guarantee that the earliest state of the universe will evolve into an animate state.

But it is not at all obvious that this objection is consistent with the classical theist conception of the divine nature. God is omniscient, omnipotent and perfectly rational and it is not a sign of a being with these attributes to create as the first state of the universe some inherently unpredictable entity that

requires immediate 'corrective' intervention in order that the universe may be set on the right course. If God intends to create a universe that will eventually contain living beings, then there is no reason for him to begin the universe with a completely unpredictable singularity. In fact, choosing such a beginning is both irrational and inefficient. It is a mark of incompetent planning or poor design to create as the first natural state something that requires supernatural intervention 'right off the bat' to ensure that it leads to the desired outcome. The rational and efficient thing to do is to create some state *that by its own lawful nature evolves into a life-containing universe*.

The problem I am alluding to is not that God institutes laws which he must immediately violate if his intentions are to be realized. The problem concerns God's intervention in his creation, not violations of the laws governing it. 'God violates the natural law L' entails 'God intervenes in his creation' but there is no converse entailment, since God can intervene in natural events or processes that are not governed by laws. Since the big bang singularity is governed by no law, God's constraint that this singularity emit a life-producing configuration would be an instance of an intervention that is not a nomological violation. Accordingly, the objection that 'God can intervene in the explosion of the singularity so as to make it emit a life-producing configuration of particles without violating his own laws' is an *ignoratio elenchi*, since my argument is instead that this intervention entails an incompetently planned first state.

I would note, in addition, that my argument does not presuppose that there is a 'most rational, competent or efficient way of creating an animate universe' and therefore does not succumb to an analogue of the 'no best possible world' theodicy, such as the one developed by George Schlesinger.¹⁷ My argument presupposes only that there are efficient ways and inefficient ways, where an efficient way is one whereby animate states predictably evolve in accordance with natural laws and an inefficient way one whereby animates states do not evolve in accordance with natural laws but require divine interventions.

5. The Question of the Reality of the Singularity

It might be objected that a crucial premise of the atheistic argument, premise (1) that 'the big bang singularity is the earliest state of the universe,' is false since it is based on a reification of the singularity. The singularity is not a real physical state but a mathematical fiction. The earliest physical state is the big bang explosion, which is governed by physical laws. This explosion leads by a natural and lawful evolution to a state of the universe that contains living creatures. Accordingly, we are able to conclude that God created as the earliest state some state that by its own lawful nature evolved into an animate universe.

My response to this objection is that it is based on a misinterpretation of big bang cosmology, for this cosmology represents the singularity as real. For example, Penrose writes that "we think of the initial singularity as a single point [which] gives rise to an infinity of causally disconnected regions at the next instant,"¹⁸ which entails that the point is earlier than the explosion and therefore real.

But this response may miss the point of the objection, which is not that big bang cosmologists represent the singularity as unreal, but that the singularity *is* unreal, given reasonable principles for interpreting scientific theories. This is the position of William Lane Craig and Richard Swinburne. Craig notes that the big bang singularity is represented as having zero volume and zero duration and that this is sufficient reason to regard it as unreal. He asserts that 'a physical state in which all spatial and temporal dimensions are zero is a mathematical idealization whose ontological counterpart is nothing.'¹⁹ But Craig offers no justification for this assertion. Cosmologists find no difficulty in the concept of a space that has zero dimensions (a spatial point) and that exists for an instant and a simple assertion that a 0D space cannot instantaneously exist seems to be an expression of an unwarranted scepticism.

Richard Swinburne also believes that the singular point is a mathematical idealization. He provides an argument for this, namely, that it is logically necessary that space be 3D. Swinburne presents an argument against the logical possibility of 2D objects and suggests that analogous arguments can be constructed against 1D and 0D objects. He asks us to consider a two dimensional surface that contains two dimensional objects:

'...it is clearly logically possible that the two-dimensional "material objects" should be elevated above the surface or depressed below it...the logical possibility exists even if the physical possibility does not. Since it is logically possible that the "material objects" be moved out of the surface, there must be places, and so points, outside the surface, since a place is wherever, it is logically possible, a material object could be.'²⁰

Therefore, Swinburne concludes, if there exists a two dimensional object or surface there must also exist a third spatial dimension. Swinburne's argument instantiates the following invalid argument-form:

- (1) Fx is logically possible (i.e. it is logically possible for x to possess the property F).
- (2) C is a necessary condition of Fx .
- (3) x exists.
- (4) Therefore, C exists.

The fact that Swinburne's argument has this form becomes clear if we state his argument as follows:

- (1A) It is logically possible for any object on a two dimensional surface to possess the property of *moving above or below the surface*.
- (2A) A third spatial dimension is a necessary condition of any object on a two dimensional surface moving above or below the surface.
- (3A) There exists an object on a two dimensional surface.
- (4A) Therefore, there exists a third spatial dimension.

If (1A)-(4A) proves that objects on two dimensional surfaces require a third spatial dimension, then the following argument proves that there is a heaven:

- (1B) It is logically possible for any human body to be resurrected after death and occupy a heavenly space.
- (2B) Heaven is a necessary condition of any human body being resurrected.
- (3B) There are human bodies.
- (4B) Therefore, there is a heaven.

The fallacy, if the reader has not already grasped it, is the assumption that a necessary condition of an object possessing a certain property must be actual if the object is actual. This of course is not so; the necessary condition need be actual only if the object's possession of the property is actual. I conclude that Swinburne has given us no reason to believe that it is impossible for there to be a big bang singularity that occupies less than three spatial dimensions. Given that Swinburne's argument fails, and that no other arguments against the coherency of the big bang singularity have been presented (at least of which I am aware), the above considerations warrant the conclusion that there is no reason to deny reality to the big bang singularity. Thus, the problem of unpredictability remains.

6. *The Question of the Relative Simplicity of the Theistic and Atheistic Hypotheses*

There may not be any *a priori* truth that rules out the big bang singularity, but there is a probabilistic argument that supports the view that the universe began with a divinely created big bang explosion rather than with a God-incompatible singularity. The hypothesis of divine creation is *simpler* and for this reason is more likely to be true than the atheistic hypothesis.

The argument that the theistic hypothesis is simpler has been made by Swinburne. He claims that God is simpler than the physical universe and therefore is more likely than it to exist unexplained. 'If something has to occur unexplained, a complex physical universe is less to be expected than other things (e.g., God).'²¹ If the physical universe is created by God then it has its explanation in God and consequently does not exist unexplained; in this case, only God exists unexplained. Since the hypothesis that only God

exists unexplained is simpler than the atheistic hypothesis, it is more likely to be true.

The principle Swinburne is appealing to is

- (1) The more simple an existent is, the more likely it is to exist unexplained.

I believe, however, that even if we grant Swinburne this and other of his premises it can be shown that considerations of simplicity support atheism rather than theism. Swinburne's criterion of simplicity is that there is a simplicity 'about zero and infinity which particular finite numbers lack.'²² For example, 'the hypothesis that some particle has zero mass, or infinite velocity is simpler than the hypothesis that it has a mass of 0.34127 of some unit, or a velocity of 301,000 km/sec.'²³ Likewise, a person with infinite power, knowledge and goodness is simpler than a person with a certain finite degree of power, knowledge and goodness. Furthermore, a person with infinite power, knowledge, etc., is simpler than a physical object that has particular finite values for its size, duration, velocity, density, etc. Assuming these premises, let us examine the hypothesis that a finite universe begins with an uncaused singularity. The singularity in question has zero spatial volume and zero temporal duration and does not have particular finite values for its density, temperature or curvature. It seems reasonable to suppose that by virtue of these zero and non-finite values this instantaneous point is the simplest possible physical object. If we grant to Swinburne that God is the simplest possible person and hold that God and the uncaused singularity cannot both exist (for reasons stated in the atheistic argument in section 3), then our alternatives are to suppose that either the simplest person exists and creates the four dimensional spatiotemporal universe or the simplest physical object exists and emits the four dimensional spatiotemporal universe. If we use criteria of simplicity, are there any reasons to prefer one of these hypotheses over the other? It seems reasonable to suppose that the simplest possible physical object is equally as simple as the simplest possible person, such that there is no basis to prefer one over the other on grounds of intrinsic simplicity. Swinburne holds that God exists unexplained and so God and the simplest physical object are also on a par in this respect. But the hypothesis that the four dimensional spatiotemporal universe began from the simplest physical object is in one crucial respect simpler than the theistic hypothesis. It is simpler to suppose that the 4D physical universe began from the simplest instance of the same basic kind as itself, *viz.*, something physical, than it is to suppose that this universe began from the simplest instance of a different basic kind, *viz.*, something nonphysical and personal. The atheistic account of the origin of the 4D universe posits phenomena of only one basic kind (physical phenomena), whereas the theistic account of its origin posits phenomena of two basic kinds (physical phenomena and disembodied personal

phenomena). Thus on grounds of simplicity the postulation of a singularity that explodes in a big bang wins out over the postulation of a deity that creates the big bang explosion *ex nihilo*.

7. The Question of the Metaphysical Necessity of a Big Bang Universe

According to essentialism, natural laws, such as the law that water is H_2O , are metaphysically necessary; they hold in all possible worlds, such that God could not have created a universe in which they are violated. Consequently, if it is a natural law that a universe obeying the Friedmann solutions to Einstein's equation and the Hawking-Penrose singularity theorems begins in a singularity, then God could not have created a Friedmann-Hawking-Penrose (FHP) universe otherwise than by first creating an unpredictable singularity. Given this, and given his desire that the universe be animate, he would then have to intervene to ensure that the universe be animate. This would not be a sign of inefficiency or bungling since this would be the only possible way in which an animate universe could be guaranteed.

My response to this objection is that even if its essentialist assumption is sound, it does not follow that God must create a big bang singularity if he intends to create an animate universe. For the fact that certain natural laws are metaphysically necessary does not entail that they are necessarily instantiated. If we borrow the symbolism, if not the position, of D. M. Armstrong,²⁴ we may say that a metaphysically necessary natural law is of a form such as

$$(L) \square (N (F,G))$$

where F and G are universals and N a relation between them. N is the relation of nomic necessitation. Armstrong takes N to be primitive, but I think we can define N in terms of co-exemplification. (L) means that in every possible world in which F is exemplified, G is co-exemplified. If F is water and G H_2O , then (L) says that in each world in which *being water* is exemplified, *being H_2O* is exemplified by whatever exemplifies *being water*. But (L) does not entail that F or G is *exemplified*. The fact that water is H_2O in every world in which there is water does not entail that there is water in every world. Analogously, the fact that a universe that satisfies the FHP laws begins in a big bang singularity in every world in which such a universe exists does not entail that there is a FHP universe in every world. For other sorts of universes are also possible, ones that satisfy other sets of laws, including sets of laws that enable an earliest state to be, or evolve predictably into, an animate state. If God exists and intends there to be an animate universe, he would have created one of these universes (or a beginningless animate universe).

This response to the essentialist objection might be rejected on the grounds that essentialism and the FHP theory jointly entail that the only metaphysical

possible universes are FHP universes. Let *F* be the property *being a universe* and *G* the property *being a FHP universe*. According to (L), *being a universe* cannot be exemplified unless *being a FHP universe* is co-exemplified.

I believe, however, that we can concede even this objection consistently with the soundness of the atheological argument. To see this, we must reflect on the evidence adduced for the metaphysical necessity of natural laws. Kripke, Putnam and other originators of essentialism have recognized that some reason must be given for holding a natural law to be necessary that defeats the standard reason for regarding them to be contingent, namely, that they can be coherently conceived not to obtain. The reason for holding some principles to be necessary, such as tautologies (all unmarried men are men), analytic principles (all unmarried men are bachelors) and synthetic *a priori* principles (all completely green objects are not simultaneously completely red), is that they cannot coherently be conceived to be false. But this is not the case for natural laws. As Putnam remarks, 'we can perfectly well imagine having experiences that would convince us (and that would make it rational to believe that) water isn't H₂O. In that sense, it is conceivable that water isn't H₂O.'²⁵ But in this case, conceivability of being otherwise is a defeated guide to contingency, for considerations of how the reference of 'water' is established, in conjunction with scientific observations, show that water is necessarily H₂O. But I will not strictly follow Putnam in presenting "the argument from the rigidity of 'water'" since subsequent formulations have provided improved versions. Keith Donnellan²⁶ offered a version improved over Putnam's and Nathan Salmon²⁷ has improved upon Donnellan's version. But Paul Copeck²⁸ has recently improved upon Salmon's version and I shall partly borrow from Copeck's version in the following summary statement of this argument. The first premise is a formalization of the rigid meaning of 'water' in term's of the word's ostensive definition and the second premise is borrowed from current scientific theory:

- (1) It is necessarily the case that: something is a sample of water *iff* it exemplifies *dthat* (the properties $P_1, \dots, P_n$, such that $P_1, \dots, P_n$ are causally responsible for the observable properties [e.g. being tasteless, odorless and clear] of the substance of which *that* is a sample).
- (2) This (liquid sample) has the chemical structure H₂O, such that *being H₂O* is the property causally responsible for the observable properties of being tasteless, odorless, clear, etc.

Therefore,

- (3) It is necessarily the case that: every sample of water has the chemical structure H₂O.

The word '*dthat*' in premise (1) is Kaplan's rigidifying functor, which operates on '*that*' to produce a demonstrative reference that is rigid. Now if we

construct an analogous argument for the necessity of a universe being FHP, it would appear as

- (4) It is necessarily the case that: something is an instance of a universe *iff* it exemplifies *dthat* (the properties $P_1, \dots, P_n$, such that $P_1, \dots, P_n$ are causally responsible for the observable properties [e.g. receding galactic clusters, the background microwave radiation of 2.7 K] of the kind of which that is an instance)
- (5) This instance of a universe has a FHP structure, such that *being an FHP universe* is the property causally responsible for the observable properties of receding clusters, background radiation, etc.

Therefore,

- (6) It is necessarily the case that: every instance of a universe has the property of *being an FHP universe*.

I shall not challenge the soundness of (4)-(6) but merely show its soundness is consistent with the soundness of the big bang cosmological argument for God's nonexistence. It will be helpful if a parallel with the example of water is drawn. As Putnam has pointed out, there is another possible world W in which a substance has a certain chemical structure, XYZ, such that XYZ is causally responsible for the substance's observable properties of being a clear, odorless, tasteless liquid. This substance is not water but something whose observational properties are indistinguishable from those of water. This substance may be called 'water₁,' such that it is metaphysically necessary that water₁ is XYZ. Analogously, there is another possible world W in which the cosmic structure responsible for the observable properties of receding clusters, background radiation, etc., is not a FHP structure but some other structure, say ABC. That which has this structure is not a universe, since 'universe' rigidly refers to something with a FHP structure. But we can call it a 'universe₁,' just as we can call XYZ 'water₁.' There are still other worlds in which the relevant observational properties do not include receding clusters and background radiation but such properties as the systems of the Ptolemy, Copernicus, or Newton were thought to exemplify. What is causally responsible for these properties may be called 'an universe₂,' 'an universe₃,' etc. Accordingly, the proponent of the atheological argument may grant that God could not have created an animate universe without creating a big bang singularity, but he will point out that it would be irrational and incompetent on the part of God to create an animate universe; the rational thing to do is to create an animate universe₁, or an animate universe₂, etc., such that these systems do not require divine interventions for animate states to be ensured.

8. The Question of the Causal Principle

The theist might retort at this point that the atheistic interpretation of big

bang cosmology is infected by a problem more severe than the problems of inefficient design and lesser simplicity that are faced by the theistic interpretation. The atheist must suppose that the universe began to exist uncaused and this supposition violates the principle of causality (P₁), *that everything that begins to exist has a cause, a sufficient condition of its coming-into-existence*.

It will be admitted that this objection seems to have a certain force to it, inasmuch as it has seemed compelling to some nontheists (such as C. D. Broad, quoted in the introduction) and has provoked in them various reactions of denial, embarrassment and silence when faced with the implications of big bang cosmology. However, I believe this objection is untenable. For one thing, if the causal principle (P₁) is taken as an empirical generalization it is false, since quantum mechanics has shown that many particles (virtual particles) begin to exist without being caused to do so. If (P₁) is taken to be synthetic and *a priori*, the evidence of which is its intuitive obviousness, then quantum mechanics again undermines it by providing many intuitively clear cases of particles springing into existence uncaused. If (P₁) were true *a priori*, then quantum mechanics, the most successful scientific theory yet developed, would have to be consigned to the garbage heap, a prospect that no rational person would countenance.

The theist, however, may retreat to one of two more conservative positions, each of which avoids the problems posed by quantum mechanics. One of these positions is to allow that particular things within the universe may spontaneously begin to exist, but that the universe itself cannot spontaneously begin to exist. The causal principle that is synthetically *a priori* is not (P₁) but the weaker one (P₂), *that it is impossible for being to arise uncaused out of absolutely nothing*.

The second more conservative position involves retaining the original claim about all beginnings of existence but redefining 'cause' so that it no longer means a sufficient condition but a probabilistic condition of some degree. A probabilistic theory of causality, such as Wesley Salmon's, Patrick Suppes, Richard Otte's or David Papineau's²⁹, may be adopted, with x being a cause of y if and only if x is antecedent to or simultaneous with y and x has a probability, which may be low, of being associated in a certain way with y. (The definitions of Salmon *et al.* are of course considerably more complicated and precise but it is not necessary to explain the details here.) Consider virtual particles that begin to exist in a vacuum. It could be said that the vacuum has a probability of a very low degree of being associated with the birth of a certain pair of virtual particles and in this sense is a 'cause' of the virtual particles. These reflections suggest a causal principle that is not violated by quantum mechanics but is violated by the atheistically interpreted big bang singularity, namely, (P₃), *that everything that begins to exist has a*

probabilistic cause, with the relevant probability being greater than zero and possibly one.

My comment about (P₃) is that if it is an empirical generalization it is based on observations of the category of events for which it is logically possible that there be natural causes and therefore that there is no justification for supposing (P₃) applies to events of a different category, to events for which it is logically impossible that there be natural causes. The initial state of the universe by definition has no natural cause and therefore falls outside of the scope of (P₃).

However, if (P₃) were synthetically necessary its application would not be restricted to a certain empirical domain but could be construed as applying to everything, even the big bang singularity. (P₃), like (P₂), could be used to rule out on *a priori* grounds the atheistic interpretation of big bang cosmology. But are either of these two principles synthetically *a priori*? The evidence that one of them would be synthetically *a priori* would be its 'intuitive obviousness.' This is Craig's position, for example; he insists that 'it is *intuitively* obvious that anything that begins to exist, especially the entire universe, must have a cause of its existence.'³⁰ My response is to deny that either of these two principles is intuitively obvious. I suggested in an earlier section that there are four species of necessary truth, viz. (1) tautologies, (2) analytic truths, (3) synthetic *a priori* truths and (4) metaphysically necessary *a posteriori* truths. Synthetic *a priori* truths are exemplified by 'Nothing that is green all over at time t is red all over at time t' and metaphysically necessary *a posteriori* truths are exemplified by 'Water is H₂O.' Now the issue before us concerns synthetic *a priori* truths, since the causal propositions are alleged to be of this sort. As I suggested in the previous section, the *evidence* that a proposition is a synthetic *a priori* truth is that it cannot be conceived to be false (in any possible world) and is not tautological or analytic. This is clearly the case for 'Nothing that is green all over at time t is red all over at time t.' It cannot be conceived to be possibly the case that something, say, a piece of grass, is green all over at t and yet is simultaneously red. But this is not the case for our causal propositions. I can conceive the possibility of the universe beginning to exist uncaused. This uncaused beginning may be utterly astonishing, but it *can* be conceived to possibly occur, unlike a blade of grass simultaneously being both green all over and red all over.

Craig responds to this line of argument as follows: 'We can picture in our mind's eye the universe springing into existence uncaused, but the fact that we can construct and label such a mental picture does not mean the origin of the universe could really have come about in this way.'³¹ But this response is unsound since it is based on a failure to distinguish between *a posteriori* and *a priori* metaphysically necessary truths. It is true of the *a posteriori* metaphysical necessities that the conception of them as possibly not obtaining

is not evidence that they are not necessary. I can conceive water to be XYZ rather than H₂O, but that is not a reason to think that it is not metaphysically necessary that water is H₂O. But it is the distinguishing mark of a *a priori* metaphysical necessities that they cannot be conceived to possibly not obtain; this is precisely why they are said to be '*known a priori*.' If the universe can be conceived to possibly begin uncaused, then that is conclusive evidence that *the universe cannot begin uncaused* is not a synthetic *a priori* proposition. To deny this is to suppose that this causal principle is an *a posteriori* metaphysically necessary truth, and no one, to my knowledge, has maintained that implausible supposition. Thus, I think it is rational to believe that the universe can begin uncaused and therefore that the objection based on 'the causal principle' fails.

By way of conclusion, I would point out that even if all my arguments in this paper are sound, that does not entail God does not exist. For big bang cosmology may be false. But even if it is true, atheism does not follow, since there are other objections to my argument I have not considered. Some of these unconsidered objections have been considered elsewhere, however. For example, I have argued³² it makes no sense to suppose that God knows, logically prior to creation, that *if the universe were to begin with a singularity, this singularity would emit a life-producing configuration of particles*, since the supposition that this counterfactual is true logically prior to creation is inconsistent with the essential semantic properties of counterfactuals. But there are also other objections I have not considered elsewhere (including, obviously, those I have so far not even thought of). So my final position is that the atheistic conclusion of this paper must be held tentatively, if it is to be held rationally.^{33,34}

Antioch College

NOTES

1. See the *Bulletin of the Atomic Scientists* 8 (1952), 143-146.

2. See Richard Swinburne, *The Existence of God* (Oxford: Clarendon Press, 1979) and *Space and Time*, 2nd. ed. (New York: St. Martin's Press, 1982). Swinburne doubts that the prediction of a first event by big bang cosmology is probably true but nonetheless shows how this prediction can be theologically construed.

Also see John Leslie, 'Anthropic Principle, World Ensemble, Design,' *American Philosophical Quarterly* 19 (1982), 141-151, 'Modern Cosmology and the Creation of Life,' in E. McMullin (ed.), *Evolution and Creation* (South Bend: University of Notre Dame Press, 1985) and numerous other articles. Leslie, of course, operates with a neoplatonic conception of God, but his arguments are obviously relevant to classical theism.

The most developed theistic interpretation of big bang cosmology is William Lane

Craig's. See his *The Kalam Cosmological Argument* (New York: Harper and Row, 1979), 'God, Creation and Mr. Davies,' *British Journal for the Philosophy of Science* 37 (1986), 163-175, 'Barrow and Tipler on the Anthropic Principle vs. Divine Design,' *British Journal for the Philosophy of Science* 39 (1988): 389-95; 'What Place, Then, for a Creator?,' *British Journal for the Philosophy of Science*, 41 (1990): 473-91; "The Caused Beginning of the Universe: A Response to Quentin Smith," mimeograph (1989).

3. Anthony Kenny, *The Five Ways* (New York: Schocken Books, 1969), p. 66.

4. C. D. Broad, 'Kant's Mathematical Antinomies,' *Proceedings of the Aristotelian Society* 40 (1955), 1-22. This passage and the passage from Kenny are quoted on pages 142 and 141-42 respectively of Craig's *The Kalam Cosmological Argument*.

5. See Fred Hoyle, *Astrophysical Journal* 196 (1975), 661.

6. W. H. Newton-Smith, *The Structure of Time* (London: Routledge and Kegan Paul, 1980), p. 111.

7. Quentin Smith, 'The Anthropic Principle and Many-Worlds Cosmologies,' *The Australasian Journal of Philosophy* 63 (1985): 336-348, 'World Ensemble Explanations,' *Pacific Philosophical Quarterly* 67 (1986): 73-86, 'The Uncaused Beginning of the Universe,' *Philosophy of Science* 55 (1988), 39-57, 'A Natural Explanation of the Existence and Laws of Our Universe,' *Australasian Journal of Philosophy* 68 (March 1990): 22-43.

8. See Einstein's 'The Foundation of the General Theory of Relativity' and 'Cosmological Considerations on the General Theory of Relativity' in Einstein *et al.*, *The Principle of Relativity* (London: Dover, 1923). The Einstein equation reads

$$R_{ab} - \frac{1}{2} g_{ab} = (8\pi G/c^2) T_{ab}$$

R_{ab} is the Ricci tensor of the metric g_{ab} , R is the Ricci scalar, λ is the cosmological constant (probably zero), c is the velocity of light and G is Newton's constant of gravitation.

9. Alexander Friedmann, 'Über die Krümmung des Raumes,' *Zeitschrift für Physik* 10 (1922), 377-386; a translation of this paper appears in *A Source Book in Astronomy and Astrophysics: 1900-1975*, eds. by K. R. Lang and O. Gingerich (Cambridge, MA: Harvard University Press, 1979). Friedmann's second paper on models with negative curvature was first published in *Zeitschrift für Physik* 21 (1924), 326. The Friedmann solutions, with the cosmological constant omitted, are

$$\begin{aligned} -3 \left(\frac{da}{dt} \right)^2 &= 4 \pi G (p + 3P/c^2) a \\ 3 \left(\frac{da}{dt} \right)^2 &= 8 \pi G \rho a^2 - 3kc^2 \end{aligned}$$

In these equations a is the scale factor representing the radius of the universe at a given time. da/dt is the rate of change of a with time; it is the rate at which the universe expands or contracts. d^2a/dt^2 is the rate of change of da/dt ; it is the acceleration of the expansion or the deceleration of the contraction. G is Newton's gravitational constant and c the velocity of light. P is the pressure of matter and ρ its density. k is a constant which takes one of three values: 0 for a flat Euclidean space, -1 for a hyperbolic space, or +1 for a spherical space.

9A. See R. Penrose's 'Gravitational Collapse and Space-Time Singularities,' *Physical Review Letters* 14 (1965), 57-59; S. W. Hawking's 'Singularities in the Universe,' *Physical Review Letters* 17 (1966), 444-445 and 'The Occurrence of Singularities in Cosmology.

III. Causality and Singularities,' *Proceedings of the Royal Society of London A*, 300 (1967), 187-201; S. W. Hawking's and R. Penrose's 'Singularities in Homogenous World Models,' *Physical Letters* 17 (1965), 246-247 and 'The Singularities of Gravitational Collapse and Cosmology,' *Proceedings of the Royal Society of London A*, 314 (1970), 529-548.

10. S. W. Hawking, 'Theoretical Advances in General Relativity,' *Some Strangeness in the Proportion*, ed. H. Woolf (Addison-Wesley, 1980), p. 149.

11. S. W. Hawking, 'Breakdown of Predictability in Gravitational Collapse,' *Physical Review D*, 14 (1976), 2460.

12. *Ibid.*

13. W. L. Craig, 'The Caused Beginning of the Universe: A Response to Quentin Smith,' *op. cit.*, p. 29, n. 2.

14. S. W. Hawking, *ibid.*

15. P. Davies, *The Edge of Infinity* (New York: Simon and Schuster, 1981), p. 161.

16. Swinburne, *The Existence of God*, *op. cit.*, p. 147. Swinburne's complete definition is that orderly universes are those required by both natural beauty and life. Cf. p. 146.

17. George Schlesinger, *Religion and Scientific Method* (Boston: D. Reidel, 1977). For a sound criticism of Schlesinger's theodicy, see Keith Chrzan, 'The Irrelevance of the No Best Possible World Defence,' *Philosophia* 17 (1987): 161-167.

18. R. Penrose, 'Singularities in Cosmology,' in *Confrontation of Cosmological Theories with Observational Data*, ed. M. S. Longair (IAU, 1974), p. 264.

19. W. L. Craig, 'The Caused Beginning of the Universe: A Response to Quentin Smith,' *op. cit.*, p. 8.

20. R. Swinburne, *Space and Time*, *op. cit.*, p. 125.

21. R. Swinburne, *The Existence of God*, *op. cit.*, p. 130.

22. *Ibid.*, p. 94.

23. *Ibid.*

24. D. M. Armstrong, *What Is A Law of Nature?* (Cambridge: University Press: 1983), p. 163. Armstrong rejects the idea that laws of nature are metaphysically necessary. Alfred J. Freddoso, on the other hand, argues that natural laws are correctly represented by (L). See his 'The Necessity of Nature,' in *Midwest Studies in Philosophy XI*, ed. P. French, *et al.* (Minneapolis: University of Minnesota Press, 1986), pp. 215-42.

25. Hilary Putnam, *Philosophical Papers*, Vol. 2 (Cambridge: University Press, 1975), p. 233.

26. Keith Donnellan, 'Substance and Individuals,' APA address, 1973.

27. Nathan Salmon, *Reference and Essence* (Princeton: University Press, 1981).

28. Paul Coppock, Review of Nathan Salmon's *Reference and Essence*, in *The Journal of Philosophy* 81 (1984): 261-270.

29. Wesley Salmon, *Scientific Explanation and the Causal Structure of the World* (Princeton: University Press, 1984); Patrick Suppes, *A Probabilistic Theory of Causality* (Amsterdam: North-Holland, 1970); Richard Otte, 'Indeterminism, Counterfactuals, and Causation,' *Philosophy of Science* 54 (1987): 45-62; David Papineau, 'Probabilities and Causes,' *The Journal of Philosophy* 82 (1985): 57-74.

30. W. L. Craig, *The Kalam Cosmological Argument*, *op. cit.*, p. 148. My italics.

31. *Ibid.*, p. 145.

32. Quentin Smith, 'Atheism, Theism and Big Bang Cosmology,' *Australasian Journal of Philosophy* 69 (March 1991): 48-66.

33. This atheistic conclusion need not be taken as a rejection of a religious world-view (in a wide sense of 'religion'). For one may instead reject the traditional assumption that *if God does not exist, nothing is holy*. If atheism is true, there arguably is still something that is holy, namely the *existence* of the universe. Cf. Quentin Smith, 'An Analysis of Holiness,' *Religious Studies* 24 (1988): 511-528. Moreover, the universe itself is a target of 'religious emotions' in a wide sense. Cf. Quentin Smith, *The Felt Meanings of the World: A Metaphysics of Feeling* (West Lafayette: Purdue University Press, 1986).

34. I should like to thank William P. Alston and an anonymous referee for *Faith and Philosophy* for helpful criticisms of an earlier version of this paper, although editorial and space considerations require that my responses to some of their criticisms be reserved for a future publication.