

THEISM, ATHEISM, AND BIG BANG COSMOLOGY, by William Lane Craig and Quentin Smith. Oxford: Clarendon Press, 1993. Pp. x and 342. \$45.00 (Cloth)

GRAHAM OPPY, Australian National University

Recent scientific research into the cosmological origins of the universe has prompted a flood of philosophical speculations about the consequences of that research for views which invoke supernatural causes for the existence of the universe. Much of this speculation has come from people whose primary training is not philosophical; in particular, much of it has come from the same physicists who are engaged in the scientific research in question. Moreover, much of the scientific research in question is inseparably bound up with certain kinds of speculations which not-too-distant previous generations would have considered to be solely the province of philosophers. A brief glance at the "Popular Science" section of any reasonable bookshop will confirm that not only Stephen Hawking, Paul Davies, Roger Penrose, John Barrow, Frank Tipler, Joseph Silk, Steven Weinberg, John Gribbin and Freeman Dyson, but many other physicists and journalists with considerable training in physics have turned their attention to these kinds of speculations, with varying degrees of success.

Difficulties in assessing these cosmological speculations spring from two principle sources, viz. (i) the mathematical and physical complexities of the physical theories; and (ii) the interpretative problems which arise once the mathematical and physical details are fixed. For those unversed in differential geometry -- and other relevant branches of mathematics -- even

the mere *precise* formulation of the physical theories remains out of reach; yet for those who have mastered the mathematics and physics, there remain numerous subtle questions about the bearings of the physical evidence on the resulting theories, and about the consequences of the theories for theological questions. It seems clear the professional philosophers should be able to play a useful role in the assessment of the interpretative questions -- and, in particular, that skills developed in the assessment of related problems in other areas should be transferable -- but it is unclear what level of mathematical and physical expertise is required.

Short of learning all of the relevant mathematics and physics, several courses are open to philosophers. One possibility is to rely on the descriptive interpretations which physicists give of their theories in their popular books. Another possibility is to further rely on the semi-technical descriptive interpretations which occur in the popular scientific journals: Science, Nature, Scientific American, New Scientist, etc. A third possibility is to further make use of the less theoretical scientific journals -- e.g. the astrophysical journals -- in which the relevant physical data is collected and described. A fourth possibility is further to learn some of the relevant mathematics and physics, e.g. via standard texts in the fields: introductions to differential geometry and tensor analysis on manifolds, general relativity and gravitation, quantum mechanics, quantum electrodynamics, etc. And a fifth possibility is further to skim the technical physical journals with an eye to learning something from the descriptive pronouncements -- about the assumptions required for, or the significance of, technical results -- which occur in these articles. It does not seem unreasonable to suppose that the adoption of some or all of these techniques -- perhaps in conjunction with discussion with physicists and mathematicians -- will enable philosophers to make a useful contribution to the ongoing debate.

In Theism, Atheism And Big Bang Cosmology, William Lane Craig and Quentin Smith -- two philosophers who have pursued all of the strategies just mentioned -- claim to have begun philosophical debate about Big Bang cosmology; and they hope that readers will leave the book with "an increased appreciation of the profound issues involved in .. a theistic or

atheistic interpretation of Big Bang cosmology” (vii). I think that the debate had already well and truly begun; but, as just noted, I agree with them that there is room for philosophers to make an important contribution to an appreciation of the issues involved. Whether their book makes the right kind of contribution remains to be determined.

The book is composed mainly of previously published pieces -- some **unchanged**: Craig’s “Theism And Big Bang Cosmology” (VIII) and “‘What Place, Then, For A Creator?’: Hawking On God And Creation” (XI), and Smith’s “Infinity And The Past” (II); some **abridged**: an annotated excerpt from Craig’s The Kalam Cosmological Argument (I), Craig’s “Time And Infinity” (III), and Smith’s “Atheism, Theism And Big Bang Cosmology” (VII); and some **adapted and expanded**: Craig’s “A Criticism Of The Cosmological Argument For God’s Non-Existence” (X) and Smith’s “The Uncaused Beginning Of The Universe” (IV) -- and pieces forthcoming at the time of publication -- Craig’s “The Caused Beginning Of The Universe” (V) (slightly altered when it appeared) and Smith’s “Did The Big Bang Have A Cause?” (VI). Apart from this, there are two unpublished articles by Smith: “A Defence Of The Cosmological Argument For God’s Non-Existence” (IX) and “The Wave Function Of A Godless Universe” (XII). Given the cost of the book and the accessibility of the prior publications, it seems to me that this is not exactly value for money. Moreover, some of the previously published material would have benefitted from rewriting in the light of critical comments from other authors and reviewers; in particular, the excerpt from Craig’s earlier book contains some quite weak arguments which could have been deleted or replaced without detriment to the remainder of the book. Finally, the utility of the book as a source of information about the physical and mathematical details of the relevant physical theories is somewhat lessened by the fact that these details are scattered through the book, rather than collected together in one place.

The material in the book is organised into three sections. The **first** section -- about 56% of the book -- presents and examines Craig’s defence of *kalam* cosmological arguments -- i.e. arguments with the general form: (1) Everything that begins to exist has a cause of its

existence; (2) The universe began to exist; (hence) (3) The universe had a cause of its existence. The **second** section -- about 26% of the book -- presents and examines Smith's argument that theism is inconsistent with classical Big Bang cosmology. The **third** section -- about 18% of the book -- examines the relative merits of Stephen Hawking's quantum cosmology and theism. I shall briefly discuss each section in turn.

(i) The theistic cosmological argument: As is well-known, Craig has defended *kalam* cosmological arguments with both *a priori* and *a posteriori* supporting arguments for the premise that the universe began to exist. Craig arguments have been widely discussed -- there is a partial list of references on p.92 of the book -- and not all of Smith's critical articles are included. I shall focus my discussion upon the two main points of contention between Craig and Smith, and then look at two important points upon which they agree.

(A) The first main point of contention between Craig and Smith -- debated in II and III -- concerns the *a priori* supporting arguments: on *a priori* grounds, Craig denies that there can be physically instantiated infinities formed by successive addition, and, indeed, that there can be physically instantiated infinities at all; on similar grounds, Smith disagrees. Moreover, Craig thinks that it is controversial whether there are any mathematical infinities which are more than potentially infinite. Although Craig discusses the right issues, and despite the fact that there is probably a coherent position for him to occupy, I don't think that anyone should be persuaded by the superficial arguments which he gives (at pp.5-35 and pp.92-107). The critical points which Smith makes seem to me almost all correct -- indeed, "Infinity And The Past" strikes me as the best essay in the collection -- but there are numerous other criticisms of Craig's discussion which I should also want to make. For example, to mention just four:

(i) Craig claims that Realist interpretations of set theory are RULED OUT by the set-theoretic paradoxes (pp.18-20) -- and yet it is well-known that many of those who have sought to provide new foundations for set theory have been Realists, e.g. Quine and Maddy. Moreover, he simply ignores the kinds of indispensability arguments which have been the main tool in

trade of mathematical Realists in recent times. And he fails to address the question whether General Relativity and the Hawking-Penrose singularity theorems -- or some alternative theory of gravitation -- could be reconstructed in non-classical, e.g. intuitionistic, mathematics; if not, then there is some tension between his appeal to the attractions of intuitionism to bolster his *a priori* argument, and his appeal to the consequences of observations filtered through the apparatus of classical mathematics, e.g. in calculations of the critical density of the universe, to bolster his *a posteriori* argument.

(ii) Generalising the last worry raised, one might ask: if the view that the past universe is temporally infinite is necessarily *a priori* false, how can there be evidence which **differentially** supports the claim that the past universe is temporally finite? Won't anything count equally in favour of the claim, and nothing against it? There seems to be a general strategic problem in mixing necessary *a priori* argument and contingent *a posteriori* evidence when supporting a particular claim, at least ignoring secondary sources of evidence such as testimony. Craig appears to think that his arguments **mutually support** the premise that the universe began to exist (57); but on current theories of evidential support with which I am acquainted -- e.g. Bayesian theories -- that would not be the case. Perhaps there is a fix involving some kind of relevant entailment, but the matter is clearly not straightforward.

(iii) Craig claims that it is absurd to think that Relativity -- STR and GTR -- supports a four-dimensionalist metaphysics (25)(294ff.). He suggests that there are three strategies which could be used to harmonise a 3D-metaphysics with Relativity, viz: (i) distinguish between metaphysical (A-theoretic) time and physical (B-theoretic) time; (ii) relativise becoming to reference-frames; or (iii) select a privileged reference frame -- the cosmic time of GTR -- to define objective becoming. (95) But at least two of these strategies are dubious: there is no *a priori* guarantee that a cosmic time can be defined for the universe¹, nor that there is any other privileged reference frame which could serve as a suitable replacement; and the relativisation of becoming to reference frames entails a relativisation of existence to reference frames, which -- given the local nature of frames of reference in GTR -- strongly suggests that things

like *existent mass-energy* will not be conserved quantities. Moreover, the third strategy -- with its proliferation of ideology -- is a concession to 4D-ism: if the views were equal in all other respects, then here would be a reason to prefer 4D-ism. At the very least, much more needs to be said to show that Relativity -- STR and GTR -- does not support 4D-ism.

(iv) Craig's views about space and infinity are hard to clarify. I think his view must be the following: (i) finite volumes of space are only potentially infinitely divisible; and (ii) one cannot tell *a priori* whether the whole of space is strictly finite or rather potentially infinite, since one cannot tell *a priori* whether or not space is (always) expanding. However, I am not sure: this is one of many points which could have been clarified by a rewrite of (I).

(B) The second main point of contention between Craig and Smith -- debated in IV, V and VI -- concerns the question of whether the Big Bang requires a cause. Craig holds that it is a kind of "metaphysical first principle" that everything which comes to be has a cause of its coming to be (156); whereas Smith holds that "it is probably true that **either** the universe began without cause at the beginning of the current expansion, either (1) subsequent to a singularity of infinite density, temperature and curvature, and zero radius, or (2) at a singularity with finite and non-zero values, or (3) in a vacuum fluctuation from a larger space or a tunnelling from nothing, **or** the universe spontaneously began to exist at the beginning of some prior expansion phase under conditions described in (1), (2), or (3)" (129). I think there is room to disagree with both authors²; I also think that their discussion proceeds with insufficient attention to the different things which one might mean by "cause". In particular, the discussion of whether virtual particles appear uncaused in the quantum-mechanical vacuum is marred by a failure to distinguish between material and efficient causes, and more generally by the absence of any serious discussion of the connections between physically necessary conditions and causes.³ A further problem, in evidence in Craig's writing, is the tendency to use slogans -- such as "nothing comes from nothing" -- as rhetorical substitutes for arguments, e.g. against the view that there could be things which come to be despite the absence of any prior physically necessary or physically sufficient conditions for their coming

to be.

(C) Craig and Smith agree that the scientific evidence strongly supports the claim that the universe is temporally finite, and that the Big Bang singularity -- or some suitable quantum gravitational replacement -- marks the temporal origin of the universe:

(a) Craig presents a very useful, albeit now somewhat dated⁴, account of much of the astronomical observational evidence which is alleged to support the claims that the universe is expanding (red-shift of distant galaxies), that it expanded from a hot, dense more-or-less singular state (background microwave radiation, abundance of deuterium and helium), and that it will continue to expand forever (average density of matter). I think that he occasionally slips up: for example, he says that “a neutrino is a stable atomic particle that has no charge and zero mass when at rest (which it never is, since it is travelling at the speed of light as long as it exists)” (40) -- but, while it is true that there is no rest frame for neutrinos⁵, it is just not the case that the rest mass of particles which travel with luminal velocity is defined to be the mass which they (would) have when at rest.⁶ More importantly, he sometimes draws conclusions which are not warranted by the evidence: e.g. from the claim that the universe will not stop expanding, he concludes that “creation” happened only once (76, quoting Sandage and Tammann); but, if Wheeler is right that laws and constants could be reprocessed probabilistically during the bounces of an oscillating universe, then other bounces remain an open possibility.

(b) Smith presents a useful account of some of the theoretical considerations which are alleged to support the claim that the universe began from something like an initial singularity -- e.g. the Hawking-Penrose theorems -- together with some more impressionistic details about the underlying mathematics and physics. Again, I think that he sometimes slips up. For example, in his discussion of infinitely old oscillating universes, he writes: “Smith and Weingard allude to a possibility I have not considered. ... [They] do not elaborate on which model they have in mind, but [their discussion] brings to mind the de Sitter model of the

universe.” (131) In fact, I am sure that Smith and Weingard must have been adverting to a Robertson-Walker solution discussed on p.139 of Hawking and Ellis.⁷ As Hawking and Ellis point out, the solution in question does seem to be in conflict with observational evidence, so this oversight doesn't upset Smith's argument against oscillating universes.

Smith is much more enthusiastic than Craig about recent scientific speculation about the early stages of the universe, e.g. inflationary scenarios, grand unified theories, supersymmetry, vacuum fluctuation models, creation of dark matter, etc. As Craig rightly points out, there is as yet little or no evidence which supports these hypotheses; and the non-technical explanations which physicists give of their content often seems to be confused -- e.g., proponents of vacuum fluctuation models often seem to get into trouble with claims about the evolution of the universe from **literally nothing** when they mean evolution from a pre-existing vacuum.⁸ However, it is also the case that we are very far from having a complete account of the early stages of the universe -- e.g. we don't yet have a consistent story about the evolution of stars, galaxies, clusters and superclusters -- so the same kind of methodological caution suggests that there is room for scepticism about the standard Big Bang model and the idea that the universe began from something like an initial singularity. Even now, it is not inconceivable -- though it is, I grant, unlikely -- that some kind of steady state theory might turn out to accord better with the evidence. But then it seems to me that, at the very least, a *pro tem* agnosticism about the temporal origins of the universe -- and hence about further inferences to supernatural causes etc. -- is an entirely respectable position.

(D) Craig and Smith also agree in rejecting tenseless, four-dimensionalist accounts of time, a topic which each has discussed in other publications; this allows Craig to make some good criticisms of Smith's endorsement of physical models which appear to rely on four-dimensionalism. (153, 158f., 259, 271) However, I doubt very much that there are any knockdown objections to 4D-ism; and, in particular, I doubt that there is any good reason to think that 4D-ers are, *ipso facto*, irrational. But so much of Craig's argumentation -- both *a priori* and *a posteriori* -- relies on the premise that 4D-ism is false that it is hard to see what

the point of insisting on his arguments could be. More generally, it is clear that Craig's arguments require numerous controversial metaphysical assumptions which are at best given only slight support: so what point are they supposed to serve? Neither Craig nor Smith pays any attention to these fundamental kinds of questions, to the detriment of the arguments of each, I think.⁹

(ii) The atheistic cosmological argument:

Smith's atheistic cosmological argument goes as follows:

- (1) If God exists and there is an earliest state E of the universe, then God created E.
- (2) If God created E, then E is ensured either to contain animate creatures or to lead to subsequent state of the universe that contains animate creatures.
- (3) There is an earliest state of the universe and it is the Big Bang singularity.
- (4) The earliest state of the universe is inanimate since the singularity involves the life-hostile conditions of infinite temperature, infinite density and infinite curvature.
- (5) The Big Bang singularity is inherently unpredictable and lawless and consequently there is no guarantee that it will emit a maximal configuration of particles that will evolve into an animate state of the universe.
- (6) (Hence) God could not have created the earliest state of the universe. (From 2, 3, 5, 6)
- (7) (Hence) God does not exist. (From 1, 6)

Among the objections which Craig and Smith debate -- in VII, VIII, IX, and X -- there are the following: (i) it is not clear that God is required to create an animate universe; (ii) it is not clear that God cannot intervene to ensure an animate universe; (iii) it is not clear that the Big Bang singularity is real -- perhaps it is merely a theoretical fiction; (iv) it is not clear that unpredictability entails absence of divine knowledge, since God might have middle knowledge; and (v) it is not clear whether the theistic hypothesis is more simple than the atheistic alternative. No doubt, this list of objections is incomplete. I think that Craig has much the

better of this part of the debate, though sometimes his arguments could be improved upon. There do seem to be lots of ways of reconciling the existence of God with Big Bang cosmology; see Duncan MacIntosh (1994) "Could God Have Made The Big Bang?" Dialogue 33, pp.3-20 for some suggestions.

Craig's argument about the status of the initial singularity is curious. He claims that "the metaphysician is rational in interpreting the ontological status of the singularity as nothingness" (225), by supposing that "the temporal series is like a series of fractions converging to 0 as a limit: $1/2, 1/4, 1/8, \dots, 0$ " (224). While I agree that this is an excellent suggestion, it seems to contradict Craig's own claims about the impossibility of physically instantiated infinities. Moreover, it suggests a further possibility which was overlooked in the discussion of causes for the Big Bang: viz. that the series of caused events is also like the given series of fractions, and (hence?) not in need of any external cause. At the very least, talk about "objects popping into existence from nothing", etc. would seem to be quite inappropriate on this picture, since every event -- including every event which involves an object coming into existence -- *is* caused by an earlier event.

(iii) Hawking's cosmology:

Stephen Hawking's models for the universe provide the subject matter for the third major topic of debate (XI and XII). Craig alleges that the early Hawking-Hartle model is conceptually flawed in several respects, and, in particular, that it incurs various absurdly extravagant metaphysical commitments. On the other hand, Smith claims that this and subsequent models admit of a more modest "quasi-instrumentalist" interpretation, with none of the *very* extravagant commitments which Craig deplores; more exactly, Smith defends the following three theses: (i) a "quasi-instrumentalist" interpretation of Hawking's cosmological model is physically intelligible; (ii) Hawking's cosmological model is inconsistent with theism; and (iii) Hawking's cosmological model is explanatorily superior to theism.

One important point of contention between Craig and Smith concerns the consequences of the use of: a many worlds, or consistent histories, interpretation of quantum mechanics; Feynman's technique of summing over histories; and a Euclidean configuration space, or superspace, in which time is imaginary. As Smith emphasises in the excellent second, third, and fourth sections of his essay, we need not agree with Hawking about what is required for a realistic interpretation of his theory -- indeed, we may well be misled by Hawking's speculations about the commitments entailed by acceptance of his theory¹⁰ -- but should look for ourselves at the technical details. Unfortunately, those details are so forbidding that it is hard for a non-specialist like me to tell whether the suggestions which Smith offers are plausible.

One point which clearly requires attention is the claim that "one can interpret the functional integral over all compact four-geometries bounded by a given three-geometry as giving the amplitude for that three-geometry to arise .. from nothing". (313) What notion of probability is required for the claim that a certain wave function gives the (probability) amplitude for "the universe to arise from literally nothing" (313)? Should we conclude on this basis that there are almost certainly countless universes with the same geometry which also arose from nothing, not to mention myriads of universes with alternative geometries? These points are important for Smith's -- *prima facie* quite implausible -- arguments for the inconsistency of theism with Hawking's models. I strongly suspect that, on any decent account of probability, it is simply unintelligible to speak of *the probability of a given three-geometry arising from nothing*; at the very least, there is room here for elaboration and clarification.

To conclude: I think that Craig and Smith should be commended for their recognition of the need for serious philosophical investigation of physical theories about the origins of the universe, and for their willingness to do some of the digging in the physics literature which such investigation requires. Much of the work to which they refer is essential reading for others who wish to work in the field. On the other hand, I do not think that the decision to reprint previously published essays was correct; most of the essays are neither so good nor so

hard to obtain as to call for re-publication and, in any case, the end result is far too disjointed and piecemeal to be of much use to readers seeking a point of entry to the field. What is really needed is a much more systematic examination of the bearing of recent philosophical work -- analyses of infinity, analyses of time, analyses of causation, analyses of mathematics, analyses of the ontological status of scientific theories, analyses of probability, analyses of reasoned belief revision, analyses of the content of theological theories, etc. -- on the interpretation of those physical theories. Moreover, the physical theories themselves -- and the evidence for them -- also need to be presented more systematically. Of course, to do all this would be a Herculean task: but it seems to me that a book which falls so far short is of only dubious value.

Notes

1. Or, at least, it is controversial that there is such an *a priori* guarantee. The argument of Hawking, S. (1968) "The existence of cosmic time functions" Proc. Roy. Soc. A **308**, pp.433-435 seems to show that a necessary and sufficient condition for the existence of cosmic time functions in any spacetime is the absence of closed time-like and null curves, i.e. roughly, the absence of causal loops. Some hold that causal loops are *a priori* impossible; but the matter is controversial.
2. In particular, I think that the hypothesis of a temporally finite but beginningless universe -- on analogy with a finite but open line segment -- has much to recommend it; if there is no first state of the universe, then it is far from clear that it is correct to say that it began, even if it is also temporally finite. However, I also see no good reason to think that everything which comes to be has a cause of its coming to be.
3. Smith outlines a probabilistic account of causation at pp.180-181; but it is subject to counter-example by well-known cases of pre-emption (Menzies) and double prevention (Hall).
4. The annotations to essay I -- pp.67-76 -- update the 1979 text. I suspect that Craig's discussion of the post-1979 literature exhibits certain kinds of biases; e.g. I find it tempting to think that Craig's keenness to have the density parameter turn out to be less than one leads him to ignore the reasons which many cosmologists have for thinking that the density parameter must be almost exactly one. More generally, I think that he lays too much stress on current failures to detect postulated particles and structures: dark matter, monopoles, superstrings, etc.; it is, after all, *deficiencies* in the standard models which lead most cosmologists and particle physicists to be interested in the search for such things. On the other hand, there is clearly good reason to be cautious about these kinds of speculations.

5. At least if neutrinos *do* have zero rest mass; this question has been controversial of late.

6. See, e.g., Rindler, W. (1969) Essential Relativity New York: Van Nostrand Reinhardt Company, Chapter 5, esp. p.116: “A single photon certainly does *not* [have a CM frame]”.

7. The Large-Scale Structure Of Space-Time Cambridge: Cambridge University Press, 1973

8. On the other hand, Craig himself is involved in a similar confusion when he claims that a condition of “infinite density” is precisely equivalent to “nothing” (43).

9. I have made this kind of criticism of Craig elsewhere; see my “Reply To Professor Craig”, Sophia, forthcoming.

10. Smith makes a good case for the view that Craig is thus misled. Also, *inter alia*, he strongly suggests that my own claims about how to re-interpret Hawking’s model -- in “Professor William Craig’s Criticisms Of Critiques Of *Kalam* Cosmological Arguments By Paul Davies, Stephen Hawking And Adolf Grunbaum”, forthcoming in Faith And Philosophy -- are similarly confused: if “superspace” is a configuration space, then it is simply wrong to identify it with a physical space.