The Big Bang, Stephen Hawking, and God

by Henry F. Schaefer III

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ABSTRACT

Stephen Hawking is now perhaps the world's best-known scientist. Hawking's books, and the subject of cosmology more generally, pose many questions about the interface between science and theism, and some of these questions will be explored in this essay.

THE BIG BANG

Cosmology is the study of the universe as a whole—its structure, origin, and development. The subjects cosmology addresses are profound, both scientifically and theologically. Perhaps the best way to define cosmology is in terms of the questions that it asks. Hugh Ross does an excellent job of stating these questions in his important book, THE FINGERPRINT OF GOD[1]:

1. Is our universe finite or infinite in size and content?
2. Has this universe been here forever or did it have a beginning?
3. Was the universe created?
4. If the universe was not created, how did it get here?
5. If the universe was created, how was this creation accomplished, and what can we learn about the agent and events of creation?
6. Who or what governs the laws and constants of physics?
7. Are such laws the products of chance or is something more profound involved?

8. How do the laws and constants of physics relate to the support and development of life?
9. Is there any knowable existence beyond the apparently observed dimensions of the universe?
10. Do we expect the universe to expand forever, or is a period of contraction to be followed by a big crunch?

The idea that the universe had a specific time of origin, and hence, a creator, has been philosophically resisted by some very distinguished scientists. Arthur Eddington (1882-1944), who experimentally confirmed Einstein's (1879-1955) general theory of relativity in 1919 stated a dozen years later: *"Philosophically, the notion of a beginning to the present order is repugnant to me. I should like to find a genuine loophole."* Eddington later said, *"We must allow evolution an infinite amount of time to get started."*[2]

Albert Einstein's response to the consequences of his own general theory of relativity may be reasonably interpreted to reflect a possible concern about the peril of a confrontation with the Creator. Through the equations of general relativity, we can trace the origin of the universe backward in time to some sort of a beginning. However, to evade this seemingly inevitable cosmological conclusion, Einstein introduced a cosmological constant, a "fudge factor," to yield a static model for the universe. He longed for a universe that was infinitely old. In fairness, Einstein later considered this to be one of the only mistakes of his scientific career. However, even this concession must have been painful, as Einstein had a strong conviction that all physical phenomena ultimately should be accounted for in terms of a strict reductionism.[3]

Einstein ultimately gave at best reluctant assent to what he called, "the necessity for a beginning" and eventually to "the presence of a superior reasoning power." But he never did embrace the concept of a personal Creator of the universe.

So then, why has there been such resistance to the idea of a definite beginning of the universe? Much of it goes all the way back to an argument advanced by thinkers as diverse as Plato, Aquinas, and Leibniz, the cosmological argument. It may be useful to break down the cosmological argument into three parts:

1. Everything that begins to exist must have a cause;
2. If the universe began to exist, then
3. The universe must have a cause.

You can see the direction this argument is flowing—a direction of discomfort to some physicists and others knowledgeable about these matters. Such a person was the Princeton physicist Robert Dicke, advocate of the infinitely oscillating theory of the universe. Dicke stated in 1965 that an infinitely old universe, "would relieve us of the necessity of understanding the origin of matter at any finite time in the past."[4]

In 1946 George Gamow (1904-1968), a Russian-born American physicist, proposed that the primeval fireball, or "Big Bang," was an intense concentration of pure energy. It was the source of all the matter that now exists in the universe. The Big Bang Theory predicts that all the galaxies in the universe should be rushing away from each other at high speeds as a result of that initial event, which some have described as a singular explosion. A possible future dictionary definition of the hot big bang theory encompasses the idea that the entire physical universe, all the matter and energy and even the four dimensions of time and space, burst forth from a state of infinite or near infinite density, temperature, and pressure.

The 1965 observation of the microwave background radiation by Arno Penzias (1933-) and Robert Wilson (1936-) of the Bell Telephone Laboratories (regrettably partially dismantled following the breakup of AT&T) convinced most scientists of the validity

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Arthur Eddington, experimentally confirmed Einstein's general theory of relativity in 1931

of the Big Bang Theory. Further observations beginning in 1992 have moved the Big Bang Theory from a consensus view to the nearly unanimous view among cosmologists: there was an origin to the universe, perhaps 13.7 billion years ago. My former Berkeley colleague Joseph Silk and his coworkers gave a brief summary of the evidence for the Big Bang Theory in SCIENCE magazine: *The hot big bang model is enormously successful. It provides the framework for understanding the expansion of the universe, the cosmic background radiation, and the primeval abundance of light elements, as well as a general picture of how the structure seen in the universe today was formed.*[5]

Many scientists have been willing to comment on the philosophical consequences of the Big Bang Theory. For example, Arno Penzias, co-discoverer of the microwave background radiation and 1978 Nobel Prize recipient in physics, stated to the NEW YORK TIMES: *The best data we have (concerning the Big Bang) are exactly what I would have predicted, had I nothing to go on but the five books of Moses, the Psalms, the Bible as a whole.*[6]

When asked more recently why some cosmologists were so affectionate in their embrace of the steady state theory (the idea that the universe is infinitely old), Penzias responded: *"Some people are uncomfortable with the purposefully created world. To come up with things that contradict purpose, they tend to speculate about things they haven't seen."*[7]

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An amusing statement in this regard came from Cambridge University physicist Dennis Sciama, perhaps the most distinguished advocate of the steady state theory of the universe. Shortly after he gave up on the steady state hypothesis, Sciama stated: *"The steady state theory has a sweep and beauty that for some unaccountable reason the architect of the universe appears to have overlooked."*[8] Of course, we theoretical scientists have an abundance of excuses why our cherished theories sometimes fail. But the notion of blaming our failures on the "architect of the universe" is very creative.

It is an unusual day when newspapers all over the world devote their front page headlines to a story about science. But that is exactly what happened on April 24, 1992. Announced on that date were the results of the so-called "big bang ripples" observations made by the cosmic background explorer (COBE) satellite of NASA. These ripples are the small variations in the temperature of the universe (about 2.7 degrees Celsius above absolute zero) far from heavenly bodies.

These observations were remarkably consistent with the predictions of the Big Bang Theory. The particular item that the LONDON TIMES, NEW YORK TIMES, etc. seemed to pick up on was a statement by George Smoot, the team leader from the Lawrence Berkeley Laboratory. Smoot said, *"It's like looking at God."*[9] For obvious reasons, this headline captured the attention of thinking people throughout the world. In the euphoria that followed, Stephen Hawking described the big bang ripples observations as "the scientific discovery of the century, if not all time."[10] For his research George Smoot received the 2006 Nobel Prize in Physics.

A more sober assessment of the big bang ripples observations was given one week later in the LOS ANGELES TIMES. Frederick Burnham, a science-historian, said, *"These findings, now available, make the idea that God created the universe a more respectable hypothesis today than at any time in the last 100 years."*[11]

Hugh Ross, an astrophysicist turned generalist, has written very persuasively on this topic. He brings us to the philosophical implications of the Big Bang Theory. Ross states: *By definition, time is that dimension in which cause and effect phenomena take place. If time's beginning is concurrent with the beginning of the universe, as the space-time theorem says, then the cause of the universe must be some entity operating in a time dimension completely independent of and pre-existent to the time dimension of the cosmos. This conclusion is powerfully important to our understanding of who God is and who or what God is*

not. It tells us that the creator is transcendent, operating beyond the dimensional limits of the universe. It tells us that God is not the universe itself, nor is God contained within the universe.[12]

Following the remarkable financial success of Stephen Hawking's 1988 book, A BRIEF HISTORY OF TIME, a number of distinguished physicists tried their hand at the same literary genre. One such book is that by the brilliant physicist, Leon Lederman, a Nobel Prize winner and a gifted and dedicated educator. He wrote a book called THE GOD PARTICLE and, although the title sounds appealing, the best material is limited to the first few pages. The first section is a good summary of what I have attempted to say in this article thus far. Leon Lederman states:

In the very beginning, there was a void—a curious form of vacuum—a nothingness containing no space, no time, no matter, no light, no sound. Yet the laws of nature were in place and this curious vacuum held potential. A story logically begins at the beginning. But this story is about the universe and unfortunately there are no data for the very beginning. None, zero! We don't know anything about the universe until it reaches the mature age of a billionth of a trillionth of a second—that is, some very short time after the creation in the Big Bang. When you read or hear anything about the birth of the universe, someone is making it up. We are in the realm of philosophy. Only God knows what happened at the very beginning.[13]

In candid moments, outstanding cosmologists make statements similar to that quoted above. For example, Stephen Hawking stated in 1993 that, "The actual point of creation lies outside the scope of the presently known laws of physics."[14] M.I.T. professor Alan Guth, critical contributor to the "inflationary" understanding of the Big Bang Theory, is often considered the American counterpart of Hawking and has said analogously, "The instant of creation remains unexplained."[15]

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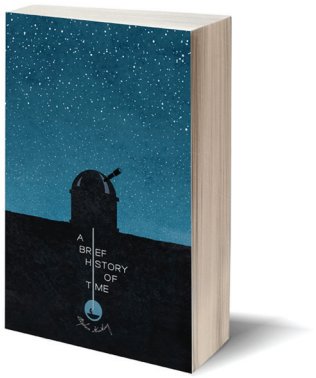
Frederick Burnham, a science historian quoted in the *Los Angeles Times*

STEPHEN HAWKING

Stephen Hawking is probably the most famous living scientist. His 1988 book, A BRIEF HISTORY OF TIME,[16] expertly introduced cosmology to a wide audience. In his latest book, THE GRAND DESIGN[17] (published in 2010), co-authored with Caltech Physicist Leonard Mlodinow, Hawking asserts, without plausible scientific evidence that the universe popped into existence out of nothing via the laws of nature. Thus, we can discern an early Hawking (that is, the Hawking of A BRIEF HISTORY OF TIME) and a later Hawking (that is, the Hawking of THE GRAND DESIGN). The former is open to a spiritual reality and somewhat restrained, the latter appears atheistic and overstepping. I shall begin by considering the scientific theories of early Hawking.

The tenth anniversary edition of his book, A BRIEF HISTORY OF TIME,[18] is available in paperback and I strongly recommend it. The book has sold in excess of 20 million copies. For such a book to sell so many copies is essentially unheard of in the history of science writing. I have used A BRIEF HISTORY OF TIME as the centerpiece of a course that I teach for a select group of 15 University of Georgia freshmen. For balance, the class also studies the novel, THAT HIDEOUS STRENGTH,[19] the third book in the C. S. Lewis space trilogy. My course falls in the "Get to know the professor" category that is becoming popular in large public universities to offset the sense of anonymity that many entering freshmen feel.

I want to begin our discussion of Stephen Hawking by saying something about his scientific research, without getting bogged down in details. Hawking has made his well-deserved scientific reputation by investigating in great detail one particular set of problems: the singularities and horizons around black holes and at the beginning of time.



A Brief History of Time by Stephen Hawking, Published in 1988

Now, every writer in this general area is convinced that if you encountered a black hole, it would be the last thing you ever encountered. A black hole is a massive system so centrally condensed that the force of gravity prevents everything within it, including light, from escaping. The reassuring thing is that, despite what our children see on the Saturday morning cartoons, no black hole appears to be in our neighborhood. That is, the closest black hole to planet earth is more distant than could be traveled in the lifetime of a human being using conventional rocketry.

Stephen Hawking's first major scientific work was published with Roger Penrose (a physicist very famous in his own right) and George Ellis (not as famous as Penrose and Hawking, but still very well known), during the period 1968-1970. They demonstrated that every solution to the equations of general relativity guarantees the existence of a singular boundary for space and time in the past. This landmark is now known as the "singularity theorem," and is a tremendously important finding, being about as close as we can get to a mathematical rationalization for the Big Bang Theory. Later, of course, Hawking began to carry out independent research, both by himself and with his own doctoral students and postdoctoral fellows. As early as 1973, he began to formulate ideas about the quantum evaporation of black holes, exploding black holes, "Hawking radiation," and so on. Some of Hawking's work is radical, exploratory, and even speculative in nature. However, by any reasonable standard Stephen Hawking is a great scientist. Even if time shows some of his more radical proposals to be flawed, Hawking will have had a profound impact on the history of science.

The scientific centerpiece of A BRIEF HISTORY OF TIME would appear to fall in the speculative category of his research. In fact, I think it is fair to say that the scientific centerpiece of A BRIEF HISTORY OF TIME was not considered one of Hawking's most important papers prior to the publication of the book in 1988. I am referring to the "no boundary proposal" that Hawking published in 1984 in work with James Hartle, a physics professor at the University of California at Santa Barbara.[20] Using a grossly simplified picture of the universe in conjunction with an elegant vacuum fluctuation model, Hartle and Hawking were able to provide a mathematical rationalization for the entire universe popping into existence at the beginning of time. This model has also been called the "universe as a wave function" and the "no beginning point" model. While such mathematical exercises are highly speculative, they may eventually lead us to a deeper understanding of the creation event. I postpone my analysis of the no boundary proposal for a few pages.

GOD

Those who have not read A BRIEF HISTORY OF TIME may be surprised to find that the book has a main character. That main character is God. This was the feature of the book that the well-known atheist Carl Sagan found distressing. Sagan wrote the preface to the first edition of the book, but was less famous than Hawking by the time of arrival of the tenth anniversary edition, in which Sagan's preface does not appear. God is discussed in A BRIEF HISTORY OF TIME from near the beginning all the way to the crescendo of the final sentence. So let us try to put Hawking's opinions about God in some sort of a context. The context is that Stephen Hawking seems to have made up his mind about God long before he became a cosmologist.

Not surprisingly, the principal influence in Stephen's early life was his mother, Isobel. Isobel Hawking was a member of the Communist Party in England in the 1930's, and her son has carried some of that intellectual tradition right through his life. By the time he was 13, Hawking's hero was the brilliant atheist philosopher and mathematician, Bertrand

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Russell. At the same age, two of Hawking's friends became Christians as a result of the 1955 Billy Graham London campaign. According to his biographers,[21] Hawking stood apart from these encounters with "a certain amused detachment." There is little in A BRIEF HISTORY OF TIME that deviates in a significant way from what we know of the religious views of the 13-year-old Stephen Hawking. In public questioning early, Hawking insisted that he was not an atheist. Things have changed however. Hawking now admits that he does not believe in a personal God. In an interview for British television, Hawking recently stated, *"The question is: is the way the universe began chosen by God for reasons we can't understand, or was it determined by a law of science? I believe the second. If you like, you can call the laws of science 'God', but it wouldn't be a personal God that you could meet, and ask questions."* [22]

For me (and for Hawking's most distinguished student Don Page, whom I will discuss in more depth later) the most precious jewel in A BRIEF HISTORY OF TIME reflects Hawking's interest in the writings of Augustine of Hippo (354-430 A.D.). Hawking states:

The idea that God might want to change His mind is an example of the fallacy, pointed out by St. Augustine, of imagining God as a being existing in time. Time is a property only of the universe that God created. Presumably, God knew what He intended when He set it up.[23]

The first time I read A BRIEF HISTORY OF TIME, admittedly not critically, for the first 100 pages or so I thought, "This is a great book; Hawking is building a splendid case for creation by an all-powerful being." But, things then changed and I realized this magnificent cosmological epic was adulterated by poor philosophy and theology. For example, Hawking writes in the first edition, "These laws (of physics) may have originally been decreed by God, but it appears that He has since left the universe to evolve according to them and does not now intervene in it."[24] The grounds on which Hawking claims "it appears" are unstated, and his conception of god is certainly not the God revealed in time and space and history in the Person of Jesus Christ. What follows is a curious mixture of deism and the ubiquitous "god of the gaps."

One of the frequently quoted statements in A BRIEF HISTORY OF TIME is: *So long as the universe had a beginning, we would suppose it had a creator (the cosmological argument). But if the universe is really completely self-contained, having no boundary or edge, it would have neither beginning nor end: it would simply be. What place, then, for a creator?*[25]

Hawking answers his own question in THE GRAND DESIGN. There is no place for a Creator, hence the god hypothesis is unnecessary: *"Given the state of the universe at one time, a complete set of laws fully determines both the future and the past. This would exclude the possibility of miracles or an active role for God."*[26]

After reading 100 pages the first time through A BRIEF HISTORY OF TIME, I thought, "This is a great book; Hawking is building a splendid case for creation by an all-powerful being." But, things then changed and I realized this magnificent cosmological epic was adulterated by poor philosophy and theology.

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THE ANTHROPIC CONSTRAINTS

In 1955 G. J. Whithrow published a paper in the BRITISH JOURNAL OF THE PHILOSOPHY OF SCIENCE in which he argued that a "variety of astronomical conditions must be met if a universe is to be habitable."[27] During the next 30 years, scientists continued to amass new evidence supporting this hypothesis. By 1986 British astronomer John Barrow and American mathematical physicist Frank Tipler were able to publish a 700-page book entitled THE ANTHROPIC COSMOLOGICAL PRINCIPLE with Oxford University Press. In their book Barrow and Tipler report that there are a surprising number of peculiar physical features of the universe that conspire to make life possible.

One statement of the anthropic principle would be that there are a number of fundamental constants (for example, the mass of the electron) or derived scientific parameters (for example, the dipole moment of the water molecule), any one of which if changed just

a little bit, would make the earth uninhabitable by human beings. The Amherst College astronomy professor George Greenstein (a pantheist or something similar) makes this statement: *As we survey all the evidence, the thought insistently arises that some supernatural agency, or rather Agency, must be involved. Is it possible that suddenly, without intending to, we have stumbled upon scientific proof of the existence of a Supreme Being? Was it God who stepped in and so providentially created the cosmos for our benefit?*[28]

Personally, I fear that Greenstein has gone, relative to Hawking, too far in the other direction. We do not have indisputable scientific proof of the existence of God. But, I am convinced that we do have, in the Big Bang understanding, some very good evidence for the existence of the transcendent God of the universe.

Others have commented, sometimes inadvertently, on this evidence. A book I recommend is DREAMS OF A FINAL THEORY by Steven Weinberg (1933-), winner of the Nobel Prize in Physics in 1979 and considered by many to be the greatest physicist of the last third of the twentieth century. Although Steven Weinberg is a staunch atheist, Chapter XI of his book is titled "What About God?" Therein, Weinberg tells a story related by the Venerable Bede (672-735), English theologian and historian. In the story, a speech is made before King Edwin of Northumbria in favor of the adoption of Christianity. In this speech the term "banqueting hall" is used to describe the ordinary existence of human beings on planet earth. Weinberg's perceptive comment on the speech is, *"It is an almost irresistible temptation to believe with Bede and Edwin that there must be something for us outside the banqueting hall."*[29] In other words, there must be something beyond strict reductionism or materialism. This view is echoed in the NEW TESTAMENT. For example, St. Paul wrote, *"Ever since the creation of the world, God's eternal power and divine nature, invisible though they are, have been understood and seen through the things He has made"* (Letter to the ROMANS 1:20). This is essentially what Steven Weinberg is attempting to describe—that almost "irresistible temptation" to believe in God.

It is relatively unusual that a physical scientist is truly an atheist. Why is this true? Some point to the anthropic constraints, the remarkable fine tuning of the universe. For example, Freeman Dyson, a Princeton faculty member, has said, *"Nature has been kinder to us than we had any right to expect."*[30] Martin Rees, one of Hawking's colleagues at Cambridge, notes the same facts when he recently stated:

The possibility of life as we know it depends on the values of a few basic, physical constants and is in some respects remarkably sensitive to their numerical values. Nature does exhibit remarkable coincidences.[31]

Science writer extraordinaire Paul Davies adds: *There is for me powerful evidence that there is something going on behind it all.... It seems as though somebody has fine-tuned nature's numbers to make the Universe.... The impression of design is overwhelming.*[32]

Some scientists express surprise at what they view as so many "accidental occurrences." However, this astonishment quickly disappears when one sees purpose instead of arbitrary laws of nature. Against powerful logic, some atheists continue to claim, irrespective of the anthropic constraints, that the universe and human life were created by chance. The main argument seems to be "Since we human beings are here, it must have happened in a purely reductionist manner." This argument strikes me like the apocryphal response of a person waking up in the morning to find an elephant in his or her bedroom and concluding that this is no surprise since the probability of the elephant being in the bedroom is a perfect 100%. Obviously this is a philosophical rather than scientific response to the situation.

A reply to this argument has been developed by the philosopher/historian William Lane Craig. The atheist's argument states that since we're here, we know every element of the

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creation must have happened by strictly material forces. Craig's philosophical counterargument goes like this: Suppose a dozen sharpshooters are sent to execute a prisoner by firing squad. They all shoot a number of rounds in just the right direction, but the prisoner escapes unharmed. The prisoner could conclude, since he is alive, that all the sharpshooters missed by some extremely unlikely chance. He may wish to attribute his survival to some remarkable piece of good luck. But he would be far more rational to conclude that the guns were loaded with blanks or that the sharpshooters had all deliberately missed. Not only is life itself overwhelmingly improbable, but its appearance almost immediately (in geological terms), perhaps within as short a period as 10 million years following the solidification and cooling of our once-molten planet, challenges explanation by conventional physical and chemical laws.[33]

THE NO BOUNDARY PROPOSAL

Let us return to Hawking's "no boundary proposal"—the idea that the universe has neither beginning nor end. By treating the universe as a wave function, early Hawking hoped to rationalize the universe's popping into existence 13.7 billion years ago. Critical to Hawking's research in this regard is the notion of imaginary time. The concept of imaginary time is a powerful mathematical device used on occasion by theoretical chemists and physicists. I remember clearly the day in the autumn of 1965, during my Complex Variables class as a senior at M.I.T., when I learned that the result of contour integration was $2\pi i$ times the sum of the residues. For me, it was about as close to a revelation as I had received up to that time in my life. My closest colleague at Berkeley, Professor William H. Miller, in 1969 used imaginary time to understand the dynamics of chemical reactions, and it made him a household word in the world of science. The use of imaginary time is indeed a powerful tool.

Hawking and Hartle's "no boundary proposal" begins by adopting a grossly oversimplified model of the universe. Then the authors make time imaginary, and prove in their terribly restricted model that the universe has neither beginning nor end. The flaw in the exercise is that the authors never go back to real time. Thus the notion that the universe has neither beginning nor end is something that exists in mathematical terms only. In real time, to which we as human beings are necessarily attached, rather than in Hawking's use of imaginary time, there will always be a singularity, that is, a beginning of time.

In an obviously contradictory statement in A BRIEF HISTORY OF TIME, Hawking actually concedes this point. What we are seeing in this situation is Hawking versus Hawking. I view the following statement as Hawking speaking in his right mind: "*When one goes back to the real time in which we live, however, there will still appear to be singularities …. In real time, the universe has a beginning and an end at singularities that form a boundary to space-time and at which the laws of science break down.*"[34] Only if we lived in imaginary time (not coming soon to a neighborhood near you!) would we encounter no singularities. In real time the universe sprang into existence ex nihilo 13.7 billion years ago. Not surprisingly, the No Boundary Proposal has acquired few advocates in the physics community.

In THE GRAND DESIGN, we again seem to see Hawking versus Hawking over the issue of the origin of the universe. Hawking and Mlodinow set out to answer three questions:[35]

1. Why is there something rather than nothing?
2. Why do we exist?
3. Why this particular set of laws and not some other?

In answering questions (1) and (2), Hawking and Mlodinow again appeal to the "no

boundary proposal"—sadly, without providing any evidence for it or responding to the above criticism that the model's use of imaginary time is physically unintelligible. Given the no boundary condition, we begin with the present state of the universe and then calculate the various histories allowed by quantum physics to reach our present state. The most probable history represents the history of our observable universe and, we are told, reveals that "the universe appeared spontaneously."[36] So, "Why is there something rather than nothing?" and "Why do we exist?" Hawking seems to shrug his shoulders and say, "There just is," and "We just do." The universe, assuming the no boundary condition, is just an uncaused, brute fact about reality.

But (and here is the Hawking versus Hawking part), they return to the question, "Why is there something rather than nothing?" at the end of THE GRAND DESIGN, and give a quite different answer. Hawking and Mlodinow there state, *"because there is a law like gravity, the universe can and will create itself from nothing"*[37]—where "nothing" is now understood as the constant vacuum energy contained in empty space. But to say that the universe causes itself to exist is absurd—a logically impossible state of affairs. Further, the fact that there really isn't nothingness but space filled with vacuum energy just goes to show that the "no boundary proposal" doesn't really offer an answer to the age old question, "Why is there something rather than nothing?" Hawking and Mlodinow have failed to answer questions (1) and (2). The primary purpose of the "no boundary proposal" seems to be an attempt to evade the cosmological argument for the existence of God, via the claim that nature is self-contained and effectively eternal.

Regarding question (3), Hawking and Mlodinow appeal to chance and the many worlds hypothesis to explain the apparent fine-tuning of the universe.[38] This proposal has been given wide attention through the popular book JUST SIX NUMBERS by Martin Rees.[39] Rees's logic flows something like this:

(α) he concedes that a universe like ours is overwhelmingly improbable; but
(β) we know that God doesn't exist, or if He does He had nothing to do with the design of the universe;
(χ) thus there must be a near infinite number of universes;
(δ) ours happens to be the universe that is just right for human life.

Since no evidence for other universes is provided, Rees's argument is less than convincing, particularly for those who are prepared to consider the possibility of the existence of a personal God.

Rodney Holder critiques the postulation of the existence of many universes as an alternative to design in his paper published in SCIENCE & CHRISTIAN BELIEF.[40] Holder states some of the problems associated with the postulate of an infinite number of universes:

(a) the existence of infinitely many universes depends critically on parameter choices;
(b) the probability that any universe in an ensemble is fine-tuned for life is zero;
(c) the physical realization of any ensemble will exclude an infinity of possibilities;
(ε) the hypothesis is untestable and unscientific;
(f) The hypothesis is not consistent with the amount of order found in our universe, nor with the persistence of order.

In summarizing this section, I suggest that a Christian worldview does not exclude the possibility of other universes. One of the great hymns of the Christian faith begins with the words, *"O Lord my God, when I in awesome wonder, consider all the worlds Thy hands have made."*[41] However, moving from possibility to scientific evidence seems far away. Even Hawking and Mlodinow's appeal to M-Theory or superstring theory to generate the world ensemble is problematic. As William Lane Craig states: *The "cosmic landscape" of 10^{500} different possible universes consistent with nature's laws which M-Theory allows are just*

that: possibilities. They are not real worlds…. [Further,] it is not clear that 10^{500} possibilities are sufficient to guarantee the existence of finely tuned-universes in the landscape. What if the probability of fine-tuning is less than 1:10^{500}?[42]

I conclude that a plausible scientific case for an infinite or near infinite number of universes has yet to be made.

A BROADER VIEW

Does everyone agree with Stephen Hawking concerning the metaphysical consequences of recent cosmological discoveries? Certainly not. Alan Lightman, an M.I.T. professor with no obvious theistic inclinations, states in his book, *"Contrary to popular myths, scientists appear to have the same range of attitudes about religious matters as does the general public."*[43] This fact can be established either from anecdotes or from statistical data. Sigma Xi, the scientific honorary society, conducted a systematic poll a few years ago that showed that, on any given Sunday, around 41 percent of American Ph.D. scientists claim to be in church; for the general population the figure is perhaps 42 percent. So, whatever influences people in their beliefs about God, it does not appear to have much to do with having a Ph.D. in science.

Contrary to popular myths, scientists appear to have the same range of attitudes about religious matters as does the general public.

Alan Lightman, M.I.T. professor with no obvious theistic inclinations.

There are many prominent scientific counterexamples to Stephen Hawking. One is my former colleague at Berkeley for 18 years, Charles Townes (1915-). Townes won the Nobel Prize in Physics in 1964 for discovering the maser, which led quickly to the laser, surely one of the most important scientific advances of the twentieth century. In a statement from his book MAKING WAVES, Professor Townes appears to take dead aim on Hawking by stating, *"In my view, the question of origin seems to be left unanswered if we explore from a scientific view alone. Thus, I believe there is a need for some religious or metaphysical explanation. I believe in the concept of God and in His existence.*[44]

Of Hawking's two earliest collaborators (1970, the singularity theorem), Roger Penrose seems to be some sort of an unconventional theist, while George Ellis is a Christian. Ellis is Professor of Applied Mathematics at the University of Cape Town, South Africa. Parenthetically, Ellis was a fierce opponent of the apartheid system in South Africa, when it was dangerous to hold such a view. In the book, QUANTUM COSMOLOGY AND THE LAWS OF NATURE,[45] Ellis states his position with respect to ultimate questions:

1. God is the creator and sustainer of the universe and of humankind, transcending the universe but immanent in it;
2. God's nature embodies justice and holiness, but He is also a personal and loving God who cares for each creature (so the name "father" is indeed appropriate);
3. God's nature is revealed most perfectly in the life and teachings of Jesus of Nazareth, as recorded in the NEW TESTAMENT summarized in "God is Love;"
4. God has an active presence in the world that still touches the lives of the faithful today.

One of the scientists closest to Stephen Hawking is Donald Page. Page is Professor of Physics at the University of Alberta, where he hosted my lecture on this topic in July 1997. Our discussions following my lecture lasted for four hours spread over three days.

Don Page has had an excellent physics career in quantum cosmology in his own right, but he began to achieve fame as a postdoctoral fellow with Stephen Hawking. The Hawkings were not financially well off in the years prior to publication of his best selling book and needed some help to keep going. Don Page went to live with the Hawkings for the period 1976-1979.

Page is quoted as follows: *I would usually get up around 7:15 or 7:30 AM, take a shower, read in my Bible and pray. Then I would go down at 8:15 and get Stephen up. At breakfast,*

I would often tell him what I'd been reading in the Bible, hoping that maybe this would eventually have some influence. I remember telling Stephen one story about how Jesus had seen the deranged man, and how this man had these demons, and the demons asked that they be sent into a herd of swine. The swine then plunged over the edge of the cliff and into the sea. Stephen piped up and said, 'Well, the Society for the Prevention of Cruelty to Animals would not like that story, would they!'[46]

Page has also stated: *I am a conservative Christian in the sense of pretty much taking the Bible seriously for what it says. Of course, I know that certain parts are not intended to be read literally, so I am not precisely a literalist. But, I try to believe in the meaning I think it is intended to have.*[47]

Expressing the universal yearning of theoretical physicists for simplicity in their methods, Page makes an interesting connection to the spiritual world: *If the universe basically is very simple, the theological implications of this would need to be worked out. Perhaps the mathematical simplicity of the universe is a reflection of the personal simplicity of the Gospel message, that God sent His Son Jesus Christ to bridge the gap between Himself and each of us, who have rejected God or rejected what He wants for us by rebelling against His will and disobeying Him. This is a message simple enough even to be understood by children.*[48]

THE LIMITS OF SCIENCE

A statement I think gives some balance to this discussion was made by one of my scientific heroes, Erwin Schröedinger, after whom the most important equation in science is named: the Schröedinger Equation. I have spent a good bit of my professional life trying to solve this equation for atoms and molecules. Toward the end of Schröedinger's career he began to write more expansively. His book WHAT IS LIFE?[49] is thought to have inspired an entire generation of molecular biologists. I would like to quote from Schröedinger's book, NATURE AND THE GREEKS. In it he takes a dim view of the worldview variously called logical positivism, reductionism, scientism, or scientific imperialism. The Schröedinger statement in question is: *I am very astonished that the scientific picture of the real world around me is very deficient. It gives us a lot of factual information, puts all of our experience in a magnificently consistent order, but it is ghastly silent about all and sundry that is really near to our heart that really matters to us. It cannot tell us a word about red and blue, bitter and sweet, physical pain and physical delight; it knows nothing of beautiful and ugly, good or bad, God and eternity. Science sometimes pretends to answer questions in these domains but the answers are very often so silly that we are not inclined to take them seriously.*[50]

Although science is an inspiring pursuit in its proper domain, it is not the whole story. Jane Hawking commented on this aspect of her husband's work following the publication of A BRIEF HISTORY OF TIME. She said: *Stephen has the feelings that because everything is reduced to a rational, mathematical formula, that must be the truth. He is delving into realms that really do matter to thinking people and, in a way that can have a very disturbing effect on people—and he's not competent.*

In a similar vein, my longtime friend and Berkeley faculty colleague, Phillip Johnson writes: *The irony of the situation is that Hawking's professional life currently is devoted to telling a story about the cosmos in which the elements that make his life interesting—love, faith, courage, and even creative imagination—disappear from view. Aspiring to know the mind of God, he can imagine nothing more interesting than a set of equations governing the*

movement of particles. A unified field theory would be a major scientific accomplishment, of course. But to Hawking it is just a step toward a distant but attainable goal of what he calls 'a complete understanding of the events around us, and of our own existence.' The way to this goal does not seem to require reading the Bible or Shakespeare, living in a variety of cultures, experiencing art, climbing mountains, or falling in love and having children. All it involves is 'the intellectually challenging task of developing better approximation methods.'[51]

Although Phil does not seem to appreciate the great affection with which persons such as Hawking and I hold equations, there is much that is worthy of consideration in Professor Johnson's analysis.

Richard Feynman states in his book THE CHARACTER OF PHYSICAL LAW, that: *Everything in physical science is a lot of protons, neutrons and electrons (parenthetical remark by HFS—and don't we love them, especially electrons!), while in daily life, we talk about men and history, or beauty and hope. Which is nearer to God—beauty and hope or the fundamental laws? To stand at either end, and to walk off that end of the pier only, hoping that out in that direction is a complete understanding, is a mistake.*[52]

In this sense I would have to say that the Stephen Hawking of THE GRAND DESIGN has walked off one end of Feynman's pier.

WHERE FROM HERE?

Having presented the opinions of many others in this article, the following represents my own position:

1. The Big Bang represents an immensely powerful, yet carefully controlled, release of matter, energy, space, and time within the strict confines of very carefully fine-tuned physical constants and laws which govern their behavior and interactions.
2. A Creator must exist. The Big Bang ripples (April 1992) and subsequent scientific findings are clearly pointing to an *ex nihilo* ("out of nothing") creation consistent with the first few verses of Genesis, the first segment of the Bible. The power and care this explosion reveals, without the advantage of infinite time and infinite do-overs, pushes other explanations for what is seen in the universe today beyond credulity.
3. The Creator must have awesome power and intelligence. The quantity of material and power resources within our universe is truly immense. The information, or intricacy, manifest in any part of the universe, points to a God who exceeds the human capacity of intelligence, creativity, and power by multiple orders of magnitude. And what we do see is only what God has shown us within our four dimensions of space and time!

WHAT ELSE DOES THE BIG BANG REVEAL?

To extrapolate much more from The Big Bang about the Creator God could easily lead to wild conjecture. For now, I'd rather stick with where the scientific evidence is leading—there must be a Creator God. Stephen Hawking has gone to great lengths with his flawed formula of imaginary time to try to explain away the Creator God's existence, without much satisfaction. He is one of the most brilliant men of this era and my great hope is that one day he will arrive at the same conclusion that many other scientists and myself have.

Understanding the evidence for The Big Bang and believing that it points to a Creator God is just the starting point for discovery. What if I told you that it's possible to know the Creator God personally? Think of the implications of that.

Notes:

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[23] Hawking, *Updated and Expanded Edition*, 183.
[24] Ibid., 122.
[25] Ibid., 146.
[26] Hawking, *The Grand Design*, 30.
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[35] Hawking, *The Grand Design*, 10.
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DIALOGUE

Here are some questions to consider and discuss with others after reading this article:

1. Do you believe that The Big Bang actually occurred?
   If no, why not?
   If yes, what is most convincing to you?
2. Do you believe in a Creator God?
   If no, how did the universe come into being?
   If yes, what else do you believe about God? How do you know this?
3. If it were possible to have a personal relationship with the Creator God, would you be interested? Why or why not?