What Do Physicists Say About God?
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In 1992 readers of *Newsweek* had an opportunity to read in the science section an article entitled "The Handwriting of God." And subscribers to *Time* could read a cover story called "What Does Science Tell Us About God?"

An American astrophysicist named George Smoot had held a press conference. There he announced the results of data gathered by a cosmic background explorer satellite. Smoot's team of researchers detected slight, but persistent fluctuations in the universe's "cosmic background radiation." Smoot believes these are echoes of the Big Bang, echoes of the moment of creation. Then he said something that led to all the press attention. "If you are religious," he said, "this is like looking at God." In an interview Smoot elaborated on the statement: "It really is like finding the driving mechanism for the universe, and isn't that what God is? . . . What matters is the science. I want to leave the religious implications to theologians and to each person, and let them see how the findings fit into their idea of the universe."

Smoot was suggesting that an uncontrolled explosion would result in perfectly even cosmic background radiation. The fluctuations in background radiation led him to suggest that there might be an intentionality, a control, a design behind the big bang.

As a minister, I feel it is my responsibility to investigate this. If science has found proof for the existence of God, it is part of my job to pass the news to all of you. I studied the articles that followed the headlines.

I found that skeptics argue the discovery of fluctuations in cosmic background radiation is not proof of the existence of God. They say that slight differences in background radiation only suggest that the Big Bang was not a perfectly uniform explosion. The skeptics argue that this is an interesting discovery; however, it is not necessarily the handwriting of God. Scientists observe many explosions that are not perfectly uniform. Intelligent beings do not control most of these uneven explosions. Skeptics argue that the fluctuations neither prove nor disprove the theory that there is a master plan for the universe that went into the Big Bang. They argue that adequate scientific evidence still does not exist to prove or to disprove the existence of God.

The modern involvement of physicists in religion dates to Copernicus. Around 1512 this Polish astronomer sent a paper about the structure of the planetary system to several acquaintances. The earth, he wrote, orbits around the sun. It was a revolutionary idea, which questions the foundation of religious teachings. One hundred years passed before the Catholic Church became aware of the threat. Then the church leadership directed their full force against the man who was the strongest advocate of the new astronomy: a teacher

named Galileo.

Following Copernicus's lead, Galileo presented evidence supporting the view that the earth orbited the sun. A highly respected celebrity, Galileo sometimes gave lectures to more than two thousand students. His fame reached new heights when, in 1609, he built a telescope and made sensational observations with it. He showed that Jupiter had four moons and these moons change their positions every night. Therefore one could conclude that they moved in orbits around the planet, which meant that a smaller likeness of our solar system existed in space. Even stronger evidence that the earth orbited the sun was found in the fact that with a telescope seeing the phases of Venus was possible. To the naked eye Venus had always presented itself as bright and unchanging. However, looking through the telescope, Galileo could see that Venus passed through various phases of different brightness, from a narrow crescent to a full disk.

Catholic Church leaders compelled Galileo to journey to Rome in 1633 to stand trial. He was found guilty of having "held and taught" the Copernican doctrine and ordered to recant. Faced with the possibility of torture, Galileo recited a formula in which he "cursed and detested" his past errors. The court sentenced him to prison, but the Pope changed the penalty to house arrest. Galileo remained under house arrest for the last eight years of his life.

The men who created this split between science and religion, astronomers like Copernicus and Galileo, did not believe that their discoveries contradicted proofs of God's existence. For these scientists, a world with the sun at its center was no less godly than one centered around the earth. Copernicus believed he had discovered evidence of God's divine harmony. Galileo believed his discoveries gave people a better understanding of the divine order of the universe.

Isaac Newton, who described the laws of gravity that governed the movement of the universe, was still convinced that it was God who created these laws. He wrote:

“The most beautiful system of the sun, plants, and comets could only proceed from the counsel and dominion of an intelligent and powerful Being.”

Church leaders were slow to update their theology and adapt it to the latest scientific findings. However, for many people 400 years ago the new scientific discoveries inaugurated the age of enlightenment emphasizing reason and scientific method.

In the 19th century an example is the Unitarian Maria Mitchell, the first American woman astronomer, was the first professor of Astronomy at Vassar College and the first director of Vassar's observatory. Maria Mitchell was one of the most celebrated American scientists of the 19th century. About the relationship between science and religion she said "Scientific investigations, pushed on and on, will reveal new ways in which God works, and bring us deeper revelations of the wholly unknown." She said that the revelations of the Bible and

understanding of nature through science are not in conflict. "If they seem to be," she said, "it is because you do not understand one or the other."

In the first half of the 20th century the most famous physicist was Albert Einstein. Raised in a Jewish family, Einstein was occasionally asked about his religious beliefs. He wrote:

> [A physicist's] religious feeling takes the form of a rapturous amazement at the harmony of natural law, which reveals an intelligence of such superiority that, compared with it, all the systematic thinking and acting of human beings is an utterly insignificant reflection.

Notice that in this quotation Einstein did not use the word "God." For Einstein, the term God was too closely linked to the idea of a God with human features and human mentality. Such an idea of God was, for Einstein, incompatible with scientific knowledge. He saw the image of God as the old man in the sky as a relic from the past. He believed that if we say farewell to the bearded guy in the clouds, we eliminate any reason for hostility between religion and science. Einstein wrote:

A knowledge of the existence of something we cannot penetrate, of the manifestations of the profoundest reason and the most radiant beauty, which are only accessible to our reason in their most elementary forms-it is this knowledge and this emotion that constitute the truly religious attitude. In this sense, and in this alone, I am a deeply religious man.

Another physicist who holds ideas about religion and God similar to Einstein is a man named Paul Davies. Although originally from England, today Davies is on the Faculty of Arizona State University where he serves as the director of Center for Fundamental Concepts in Science. In his book God and the New Physics Davies wrote that in looking at the fundamental constants of nature, he finds evidence for a grand design.

By fundamental constants, physicists mean certain quantities that play a basic role in physics and which have the same numerical value everywhere in the universe and at all moments in time. (p187) [For example,] An atom of hydrogen is the same in a distant star as it is on earth. It has the same size, mass and internal electric charges. (p187)

Gravitational force is another fundamental constant. If it were slightly different, stars like our sun would not exist. If the values of such fundamental constants were only slightly different it would change the structure of our physical world. Only a very small shift in a fundamental constant would cause a drastic change in the structure of the universe, and life as we know it could not exist. Davies wrote:

. . . the numerical coincidences could be regarded as evidence of design. The delicate fine-tuning in the values of the constants, . . . might be attributed to God. It is hard to resist the impression that the present structure of the universe, apparently so sensitive to minor alterations on the numbers, has been rather carefully thought out. . . . the seemingly

miraculous concurrence of numerical values that nature has assigned to her fundamental constants must remain the most compelling evidence for an element of cosmic design. (p189)
Einstein said "[A physicist's] religious feeling takes the form of a rapturous amazement at the harmony of natural law." Davies says "the seemingly miraculous concurrence of numerical values that nature has assigned to her fundamental constants must remain the most compelling evidence for an element of cosmic design."

In the second half of the 20th century and now at the beginning of the 21st century the most famous physicist is Stephen Hawking. Jesuits invited Stephen Hawking to the Vatican in 1981 to give a lecture at a conference on modern cosmology. Hawking wrote:

At the end of the conference participants were granted an audience with the Pope [John-Paul II]. He told us that it was all right to study the evolution of the universe after the Big Bang, but we should not inquire into the Big Bang itself because that was the moment of creation and therefore the work of God. I was glad then that he did not know the subject of the talk I had just given at the conference-the possibility that space-time was finite but had no boundary, which means that it had no beginning, no moment of creation. I had no desire to share the fate of Galileo, with whom I felt a strong sense of identity, partly because of the coincidence of having been born exactly three hundred years after his death!

In 1988, Hawking's book A Brief History of Time was on the best seller list for many months. I do not think this popularity reflected a sudden awakening of public interest in physics. Instead, I suspect the interest in Hawking's book expressed a religious longing for a new world view. Hawking believes physics can develop a unified theory of nature. He concluded his book with this sentence, "If we get a final theory it will be the ultimate triumph of human reason for then we would know the mind of God."

Part of Hawking's celebrity no doubt derives from his strength in the face of physical adversity. Now 72 years old, Hawking was first diagnosed with ALS in 1963, when he was 21. On average people with ALS live three years after diagnosis. But average means that half the people live longer and few people, like Stephen Hawking, live for a long time.

All of us are fragile creatures who live only for a short time. We are limited to one small planet. However, we dare to hope that we have the intelligence and the imagination that can grasp the physics of the universe. Hawking symbolizes our hope that, with our physical limits, we might comprehend the universe.

In his 2010 book The Grand Design Hawking says something similar to Paul Davies. Hawking wrote: "Our universe and its laws appear to have a design that both is tailor-made to support us and, if we are to exist, leaves little room for alternation. That is not easily explained, and raises the natural question of why it is that way." The answer, he says, lies with M-theory. M apparently stands for "master, miracle, or mystery." The book is not clear. The vital point is that M-theory allows for the existence of 11 dimensions of space-

time.

The M-theory is a variation of superstring theory, which physicists started to develop in 1984. String theory is an attempt to link quantum physics to the theory of general relativity to develop a unified theory of nature. String theory physicists say the theory holds out the promise that we can really understand questions about how the universe began and questions of why the universe is the way it is. For the equations that describe superstring theory to work physicists need to use additional dimensions. Hawking speaks of eleven dimensions.

How do they test this theory? Some hope that the Large Hadron Collider will be able to detect Quantum gravity and prove superstring theory correct. However, some physicists are skeptical of superstring theory. One writes: "no theoretical picture has so successfully permeated the consciousness of the physics community without having yet demonstrated its ability to successfully resolve a single experimental mystery about nature."

So, what do physicists think about God? In my small survey there does appear to be a consensus.

Before the 20th century, Copernicus, Galileo, Newton, and Mitchell, all agreed that physics and astronomy reveal the way God works.

Albert Einstein disliked the word God, and instead spoke of a "religious feeling takes the form of a rapturous amazement at the harmony of natural law, which reveals an intelligence of such superiority that, compared with it, all the systematic thinking and acting of human beings is an utterly insignificant reflection."

Paul Davies, also dislikes the word God, but, like Einstein, he believes that there is a rational and intelligible scheme of things that we uncover through scientific investigation.

Stephen Hawking also does not like the word God, does argue for the M-theory, The mystery or miracle-theory that includes 11 dimensions of space-time.

As for George Smoot, in 2007 he was awarded the Nobel Prize for his discovery of cosmic background radiation. An interviewer asked him "What possessed you to use the God word when you announced your findings?" Smoot said: "I invoked God because it's a cultural icon people understand--but there's something deeper. Talking about cosmology, you can't help making the connection to religion. In all religions, all cultures, there's always, 'In the beginning.'"

It is a fantastic time to be alive. A hundred years ago we did not even know that DNA existed or how our brains worked or that other galaxies existed. Today we have the human genome; we have scans that tell us about how our brains work. We have the Hadron Collider and the Hubble Telescope. Each day we learn more about human nature and the

nature of the universe.
It is an amazing, wonderful, exciting time to be alive!