

FEATURE

A brief history of physics and religion

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A brief history of physics and religion

Why do some physicists believe in God while others insist that religion and science are incompatible? **Edwin Cartlidge** talks to both sides

The interaction between science and religion has a long history. Many medieval scientists held positions in the church, Einstein famously said that God did not “play dice” with the universe, while the conflict between Galileo and Pope Pius V was one of the key events in the history of science.

This tradition has continued into the 1990s. When astrophysicist George Smoot presented the first results from the COBE satellite – showing that the cosmic background radiation was not uniform in all directions, one of the key scientific results of the decade – he said that it was like “looking at the face of God”. And the Dalai Lama, the spiritual leader of the world’s Tibetan Buddhists, regularly invites scientists to Dharamsala to discuss the links between science and Buddhism (*Physics World* August 1998 p13). However, relations are not always so cordial. Earlier this year Christian groups in Kansas persuaded the state’s Board of Education to remove the theory of evolution and all mention of the big bang from its science education curriculum.



The creation of the Earth as pictured in a bible from the 15th century

Science and God

Many scientists have strong religious beliefs. In 1996, for instance, a survey of randomly chosen American scientists revealed that 40% believed in God and 40% believed in an afterlife. The results were remarkably similar to previous surveys carried out in 1914 and 1933. However, when members of the National Academy of Sciences – America’s scientific elite – were asked the same questions, more than 90% said that they did not believe in God.

“The more educated a person is, the less likely he or she is to believe in God,” says the distinguished Russian theoretical physicist Vitaly Ginzburg. “A theistic faith in a God who intervenes in earthly affairs, who performs miracles, and a belief in an afterlife and in the holiness of the Bible all appear to me to simply have survived from ancient and medieval times.”

Ginzburg says that it is “beyond comprehension” how such faith can exist at the end of the 20th century. “That there are still many believers is due primarily to the fact that the vast majority of the six billion people in the world are uneducated and far removed from science,” he says.

But other scientists do not agree. Charles Townes, who shared the 1964 Nobel prize for his work on the laser, is deeply religious. “I believe there is a God with both cosmological and personal aspects, but of indescribable form,” he told *Physics World*.

Townes welcomes interactions between science and religion. “If we increase our understanding of science and religion, I believe they will converge and coalesce. However, that does not mean that we can ultimately understand everything.”

Science does not need God to explain the universe counters another US Nobel laureate, the particle physicist Leon Lederman: “Look at the world out there and see how orderly it is. What is the role of the creator in this?” Lederman thinks the space available for God is shrinking. “Before nuclear physics we had no idea what was inside the nucleus. Now that we know about protons, neutrons and quarks, this domain seems beholden to the laws of physics [not God]. Similarly ‘she’ could have hidden in age-old questions such as ‘where is the centre of the universe?’ and ‘how old is it?’, but not any longer.”

Townes disagrees. “I don’t believe the space for God is getting smaller, it is our understanding that is changing. As science expands it will probably include a better comprehension of God.”

Russell Stannard, a physics professor at the Open University in the UK and a reader in the Church of England, has no problem with a universe that operates purely according to the laws of physics. “One needs to make a clear distinction between ‘origins’ and ‘creation’. ‘How did the world begin?’ is

a question to do with origins. For an answer you must consult a scientist,” says Stannard. In contrast, he says, the answer to the creation question – that is, why is there something rather than nothing? – is that God created the universe.

This argument is dismissed by Peter Atkins, a physical chemist at Oxford University and an outspoken critic of religion. “The question is not ‘why’ there is something rather than nothing,” he says. “The question is ‘how’ something could apparently emerge without intervention from absolutely nothing.” Atkins points out that the total charge, angular momentum and energy in the universe is zero, and speculates that the universe today is simply nothing reorganized as something. “The question now becomes: ‘How did this reorganization take place?’ Science cannot answer this question yet – but only pessimists, including philosophers and theologians, insist that it can never be answered,” he explains.

Atkins maintains that cosmic purpose is a theologian’s invention and, like Ginzburg, he cannot comprehend how scientists can be religious. “I can understand why people in general are religious as they have been conditioned by society, the media, and the general ethos of their environment. However, acquiring knowledge through sentiment, introspection and faith – as the religious do – cannot be regarded as an equally valid way of acquiring information as science. Science is open, sharable, based on observation, transnational and transcultural.”

The scope of science

Many religious believers point out that the universe seems remarkably well-tuned for the production of conscious life (see “Life, the universe, but not quite everything” by John Barrow on page 31). Indeed, it is widely agreed that life would not be possible if several of the physical constants, such as the gravitational constant and the electron mass, were very slightly different. The probability, therefore, that life could exist in the universe by chance is exceedingly small.

Atkins says there are two possible explanations for this. Either consciousness is not a big deal, or there are many universes, each with slightly different values of the physical constants. We would then, says Atkins, exist in the universe in which the constants are tuned to our existence.

This argument does not pass muster with George Ellis, a cosmologist at the University of Cape Town in South Africa. He says that either these “universes” are somehow con-

nected to our own, in which case they are all part of a larger universe. Or we cannot observe them, which would mean we would have no way of learning their properties.

"The great success of science is arrived at precisely because it narrows its focus and closes off from consideration the ultimate questions of cosmology and of human life," explains Ellis. "There is no scientific experiment that can test any of the 'why' questions. Hence, they are not scientific questions." Ellis disagrees with atheists such as Atkins who maintain that the only meaningful questions are those that can be answered by science, and that "why" questions are meaningless (a belief known as scientism).

"These questions are only meaningless to those whose world experience is rather limited," Ellis says, "and/or to those who have a very exaggerated estimate of the implications and scope of the highly simplified scientific models by which we manage to capture some limited specific aspects of the complex nature of reality."

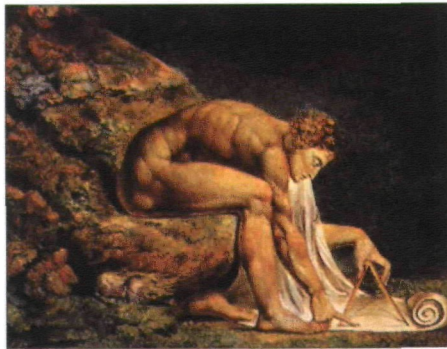
This view is shared by John Polkinghorne, a theoretical physicist and ordained Christian priest. "People can use scientism as a surrogate for religion, but it seems to me to be a very inadequate and unsatisfactory approach to the experienced richness of reality," he argues. Polkinghorne says he needs the insights of both science and religion to understand the world around him, and emphasizes how God is more than simply a cosmological deity. "As a Christian, I believe in a personal God who is the God and Father of our Lord Jesus Christ."

Like Polkinghorne, Stannard sees God as more of a personality than an inanimate force. He believes there is a close parallel between the wave-particle duality of quantum mechanics and the God-man duality of Jesus Christ. "Niels Bohr said we have to stop asking what an electron is. We can only talk about what happens when we interact with an electron." This fundamental limitation of language also gets in the way when we try to describe God, explains Stannard: "I can describe my interactions with God, but paradoxes arise if I try to go beyond these interactions."

Stannard concedes that there is not a single piece of evidence that God exists. He says his belief is based on "looking at life and all its aspects and asking does God seem to exist?". He says the most powerful basis for his faith is personal experience, particularly the answers to prayer. Then there are the cosmological arguments already discussed. "I believe in God for the same reason that physicists believe in the big bang. The theory of the big bang is economical since it explains several independent observations. So it is with God."

A dialogue between science and religion

Physicists tend to be more religious than biologists, 95% of whom classified themselves



Isaac Newton sizes up the universe, as depicted by William Blake

as atheists or agnostics when questioned by the National Academy of Sciences.

"The modern biologist really thinks that if we go down to the level of DNA, we understand things," according to Lewis Wolpert, a biologist at the University of London. "If you are a physicist, in a world of quantum mechanics and the big bang, it is so bizarre and ludicrous that the concept of understanding almost disappears."

Theoretical physicist and popular-science author Paul Davies does not believe in God as a person, but does believe in God as a timeless principle. In 1995 Davies, who has written a book called *God and the New Physics* (and who writes about quantum gravity on page 21 of this issue), won the Templeton prize for progress in religion for his work on God-centred cosmology. "The interpretation of nature I am offering is a far cry from the traditional religious view that places Homo sapiens at the pinnacle of creation, under the watchful gaze of a creator," he said after the prize was announced. "It does, however, challenge those who hold that human life is ultimately futile because we inhabit a pointless universe."

Davies maintains that science itself is founded on an act of faith: the assumption that the universe is intelligible. "Many scientists are content to accept the order in nature as a package of marvels that just happen to exist," he said, "[but I] find it hard to accept that something so elegantly clever exists without a deeper purpose."

The Templeton prize, which is now worth £750 000, was set up to "influence educated people to wake up to religion" and is awarded every year to the individual who, in the foundation's view, has helped to advance the world's understanding of God and/or spirituality. It is part of an increasing dialogue between science and religion that in the past few years has seen various conferences, courses and lectureships spring up, particularly in the US. More and more scientists are now expressing their religious views in public, and three years ago Pope John Paul II told the world of his respect for science. He acknowledged that evolution was "more than just a hypothesis", having earlier exonerated Galileo.

Russell Stannard hopes the constructive

dialogue between the science and religion camps continues, and points to a recent sea change in the attitude of scientists resulting from a more sceptical public. "Scientists recognize they need to collaborate more with other members of society, including those from the religious community. The business of speaking up about science and religion has also become respectable. There was a time when it was thought a bit woolly."

Needless to say this view is not echoed by everyone, including Steven Weinberg of the University of Texas, who shared the 1979 Nobel prize for his work on the electroweak theory of particle physics. "I am all in favour of a dialogue between science and religion," says Weinberg, "but not a constructive dialogue. One of the great achievements of science has been, if not to make it impossible for intelligent people to be religious, then at least to make it possible for them not to be religious. We should not retreat from this accomplishment."

In contrast, Stannard points to the changing ethos of one of the world's oldest scientific organizations, the Royal Society of London. "In the early days of the Royal Society, Robert Hooke said the society should deal only with science, and should not concern itself with philosophical or religious matters. Now times have changed." Stannard, who recently gave a talk to the society entitled "Cosmology: room for a creator?", admits that one or two members were shocked in the society's change of heart, but adds that "20 years ago, there is no way anyone would have been able to give such a talk".

Future debate

At a time when there are so many unsolved problems in physics, and so much suffering and inequality in the world, the musings of scientists about the existence or otherwise of God might seem academic. However, such debates have a long history and are likely to continue well into the future. And just as the arguments of religious scientists are generally deeper and more subtle than non-believers give them credit for, physicists working on the theory of everything are not as arrogant as they are often accused of being.

Stephen Hawking is often criticized for equating a complete theory of physics with knowing the mind of God in his bestseller *A Brief History of Time*. But Hawking made no such claim. What he actually said was: "If we do discover a complete theory... then we shall all, philosophers, scientists, and just ordinary people, be able to take part in the discussion of the question of why it is that we and the universe exist. If we find the answer to that, it would be the ultimate triumph of human reason - for then we would know the mind of God."

Although Hawking chose to finish his book with this paragraph, it will certainly not be the last word on the subject.