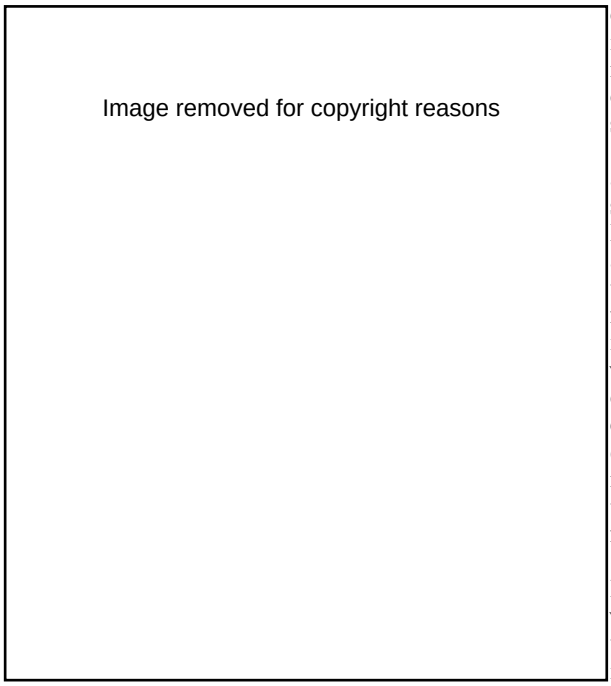
# God and physics: a new dialogue

A group of Christian physicists recently met in Cambridge to discuss the relationship between science and religion. **Edwin Cartlidge** reports on what they had to say about the existence and nature of God

Many scientists believe that there is no such thing as God and that religion is an irrelevance, if not a malign force within society. When Nobel-prize-winning US particle physicist Steven Weinberg took part in a programme organized by the American Association for the Advancement of Science in 1999 that aimed to stimulate a "constructive dialogue" between science and religion, he said that he was "all in favour" of a dialogue between the two fields. But, he added, "not a constructive dialogue". He went on to say that "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".

Many of the 30 or so people, mainly physicists, who gathered recently in Cambridge in the UK for a meeting entitled "God and physics" would beg to differ. This meeting – sponsored by the Templeton Foundation, which also funds a prestigious annual prize currently worth $1.5m and other initiatives to advance theological and spiritual issues – aimed to "explore the philosophical, theological and ethical implications of certain ideas in physics". Talks ranged from "Quantum theory and being" and "Can God know the future?" to the theological implications of quantum cosmology and the Christian perspective on global warming. Discussions over tea, wine and fried breakfasts added more food for thought. Indeed, one tea-time chat about the nature of the devil happened to coincide with a china tea cup smashing to the ground.




**Divine designer** Cambridge delegates discussed the evidence for God having designed the universe and whether this design left any scope for human free will.

### Evidence for God

One of the principal topics of discussion at the meeting was what evidence there is for God. In addressing this issue, many of the speakers were keen to distance themselves from proponents of "intelligent design", who claim that complex biological entities such as the eye cannot be explained by incremental and purposeless Darwinian natural selection. Peter Bussey, an experimental particle physicist at the University of Glasgow, said that such arguments were not very helpful theologically as they attempted to explain things that were within the domain of science and might well therefore ultimately be disproved by scientific advance. "This seems to be a kind of 'God of the gaps' argument," he said.

A better approach, said Bussey, is to argue for the existence of God using the "anthropic principle". This states that the universe must be capable of evolving life, since we are here to observe the universe, and that this principle places stringent restrictions on the laws of nature. Carbon-based life would not have been possible if the values of many of the physical constants had been just very slightly different. For example, if the gravitational-coupling constant were slightly stronger than it is, stars would burn too rapidly to support life on orbiting planets, and if it were slightly weaker, then the massive stars needed to produce the heavy elements, such as carbon, oxygen and nitrogen, which are essential for life, would not exist.

In trying to explain this match, some physicists have concluded that our universe is in fact just one of a huge number of parallel universes, each with very slightly different fundamental constants. We then live in the universe that has the right conditions for our existence. But Bussey is not convinced by this, pointing out that there is no observational evidence for the existence of parallel universes. He believes that some of the proponents of this idea have antireligious motivations and that the multiverse is a "substitute for God". "You would still need to explain the existence of the multiverse, as well as the operation of the sophisticated laws in the individual universes and in the multiverse as a whole," he says. "In other words, the multiverse buys you something but not nearly enough."

One scientist well known for his antireligious views is Oxford University biologist Richard Dawkins. In his book *The God Delusion*, Dawkins argues that God is extremely unlikely to exist since such a complex entity is far more improbable than the fortuitous conditions for life that it is invoked to explain. "To suggest that the original prime mover was complicated enough to indulge in intelligent design, to say nothing of mindreading millions of humans simultaneously, is tantamount to dealing yourself a perfect hand at bridge," he writes.

But one of the Cambridge speakers, Don Page, an astrophysicist at the University of Albert in Canada, questioned whether complexity really does imply improbability. He also argued that God might in any case not be complex, maintaining that the "whole" can be much simpler than the "parts". "An ant could be far more complex than the universe," he says.

### Restoring realism

A second reason for believing in God, in addition to the anthropic argument, was advanced by John Polkinghorne, a former particle physicist and Templeton-prize winner who is also an ordained priest in the Church of England. In a talk entitled "Why is physics possible?", Polkinghorne pointed out that mathematics has an enduring ability to accurately describe the physical world and that our brains have a capacity to comprehend abstract concepts – such as quantum superposition – that he maintains could not have arisen in response to evolutionary pressures. This profound intelligibility, he argued, is itself comprehensible if a rational God has created the world and made humans in his own image (he does not dispute Darwinism, but believes that God-given physical laws constrain the blind evolution of natural selection to the extent that the development of consciousness was inevitable). "This idea of a rational creator is not a knock-down argument," he added, "but it is

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intellectually satisfying. It's incredibly lazy to say the world is just the way it is and shrug your shoulders."

Polkinghorne also set out what he believes are strong parallels between science and theology. According to the philosophy of "critical realism", there exists an objectively knowable reality but there is no straightforward way of uncovering this reality. Polkinghorne says that this describes both science – which is the investigation of physical reality through a complex interplay of theory and experiment – and theology, which is the study of God through revelation, scripture, personal experience and culture.

For Polkinghorne, both activities are a search for the truth: a search based on "motivated belief" and guided by the "nudge of reality", as he calls it. "I'm a passionate believer in the existence of quarks even though we can't see them," he says. "God is like this, we can't see him but his existence makes sense of much of what we experience."

Another of the speakers, theoretical physicist Chris Isham of Imperial College London, laid out what he believes could be a new type of mathmatics suitable for underpinning a critical-realist view of the world. To explain this, he contrasted the ordering of a classical and a quantum breakfast. In the Boolean logic of the former, "eggs and (sausage or bacon) = eggs and sausage or eggs and bacon". But in the "non-distributive" logic of the latter, the right-hand side of this equation becomes "eggs and a superposition of sausage and bacon".

Isham pointed out that some physicists find this idea of superposition – and therefore probability – unsatisfactory. "Since there is demand from both physics and from theology, can we regain some kind of realism?" he asked the audience. His answer was "yes", by using a "mathematics of partial existence". The logical basis of this mathematics, he said, is that E implies not (not E) but not (not E) does not imply E. In other words, E and not E are not the only options available. There is also partially E. Or in the case of Schrödinger's cat: the cat is not both alive and dead but it is a certain amount alive. Theologically, he suggests that a logic of partial truth might be useful in comprehending the holy Trinity.

## Theological time

Also on the agenda at Cambridge was the relationship between God and time, and the implications this has for divine and human will. Polkinghorne said that there are two theological views on time. The first, which he referred to as "classical theology", places God outside of time. God knows all at once what people did yesterday, what they are doing now and what they will do tomorrow. Polkinghorne pointed out that this view sits naturally with the physics concept of the "block universe": the entire space–time continuum that involves the idea of "before" and "after" but that makes no distinction between past and future.

> We cannot see God, but his existence makes sense of much of what we experience

For Polkinghorne, however, the centrality of this distinction to our notion of existence calls for an alternative theological view of time. He proposes that God, while eternal, "condescends to engage truly with the time of creation" – that God cannot, in fact, predict the future. This means, that although God, unlike humans, has a very deep insight into the likely broad sweep of future events, He allows room for individual free will, and is therefore a "libertarian God".

This has potentially profound implications for Christianity. It means, for example, that although God would have forseen Jesus being executed (and therefore redeeming mankind), he could not have been 100% sure that this would happen. In response to the question, "What would have happened if Jesus had unfortunately died in childbirth instead?", Polkinghorne admitted "I don't know."

Gerard Nienhuis, an atomic and optical physicist at Leiden University in the Netherlands, pointed out that a lack of divine foresight could be inferred from quantum mechanics. Given that one cannot know the value of a quantum system before measuring it, what, he asked, causes two systems in identical states to yield different values? He said that "the wise answer is that it is something that we don't know". However, the traditional Copenhagen interpretation of quantum mechanics states that there is nothing that causes these differences. "If there is nothing to know, then even God cannot know the state of the system before the measurement is made," he concluded.

Page, however, had a different take on the notion of freedom within the universe. He argued that if God had created everything, then free will on the part of any created being seems impossible. He pointed out that this raises a severe problem: that God is then the ultimate source of all evil – both "natural" and "moral". Polkinghorne, on the other hand, sees both types of evil as the unavoidable negative flip side of the freedom that God granted the universe. But he admits that the scale of suffering in the world poses a big theological problem.

Karen Marshall

**Interdisciplinary** Physicist turned theologian John Polkinghorne was one of the speakers at the Cambridge meeting.

## Applied thinking

Profound theological questions aside, could a discussion of science and religion have any significant practical consequences? One of the speakers at the conference, geophysicist Bob White from Cambridge University, believes that a Christian perspective could be brought to bear on what is widely regarded as one of the world's most pressing science-based problems – global warming. In particular, he pointed out that the Bible's commandment to love one's neighbour includes the imperative to use the Earth's resources wisely.

Polkinghorne, meanwhile, believes that greater discussion of the interplay between science and religion could start to solve what he regards as a huge theological problem, both intellectually and practically – the differences between the world's religions. He points out, for example, that Christianity, Judaism and Islam regard the individual as centrally important to creation, whereas Hindus believe in the idea of reincarnation and Buddhists regard individualism as an illusion. Polkinghorne believes that it is far too difficult to bring together representatives from the different religions to discuss their core beliefs. He maintains it is instead better to start off slowly – by initially getting scientists from the various faiths to discuss their view of the relationship between science and religion.

Such a discussion could potentially bear fruit, says Polkinghorne, because of what he calls the "cousinly relationship" between science and theology. In other words, both science and theology, as he sees it, are attempting to find out the truth of the world in their own limited domain. Atheists such as Dawkins and Weinberg believe strongly that there simply is no such truth for theology to uncover and that scientists should not be wasting their time thinking about such matters. Many of the physicists who gathered at Cambridge would not agree.