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Perhaps you could begin by saying a bit about your background in cosmology?

I'm not the type of child who built a telescope at the age of four or anything like that! It took me a long time to get into science. I was pretty good at mathematics at school and then, when it came to choosing university, I took the easy option and thought physics wouldn't require a great deal of work. It would allow me plenty of time to play cricket. But what happened at university was that, just before coming up to university, I became a Christian. I also found myself with this new degree in physics and the first two courses that were taught in those days were Quantum Theory and Relativity. Those were the first two things. This was very, very different from the kind of stuff that I'd done at school. And I began to get excited with some of the big questions in physics and cosmology, alongside my own Christian faith beginning to emerge, and the two questioned each other, enriched each other. Part of my fascination in cosmology is the big questions that physics poses. But there's also the sense that here physics and science were beginning to tell me something of what this creator God had actually made, and therefore had a value in itself because of that. Over years, then, as I moved into research in astrophysics, those things have always enriched each other.

What kind of research were you doing?

I worked first on star formation and the evolution of galaxies. If you can work out how stars form, what rate they form over history, that tells you a little bit about how galaxies evolve. The chemical distribution, particularly of oxygen, nitrogen and iron, which are made in the death throes of stars, will also tell you a little bit about how galaxies evolve. So that was one particular area we were interested in. Then a little bit about the amount of helium in the universe, and how that relates to Big Bang models. The third area was a little more tangential, and that was why the dinosaurs died. One of the things we were interested in was whether massive clouds of molecular hydrogen, as they pass by the Solar System, disrupt the Oort cloud of comets (which is a huge cloud of comets on the edges of our Solar System) and the disruption leads to many comets coming into the inner Solar System, and whether this leads to terrestrial mass extinctions, including the dinosaurs or not. So those were the areas that I worked in.

You've moved on from being a cosmologist and astrophysicist to being a minister in the Methodist Church, which is a bit of a change. What prompted it?

I find myself as an ordained minister and a theologian here at Durham University, the very place where I studied physics and cosmology. And many people find that an extraordinary transition from the sublime to the ridiculous, many will say. I think I simply came to a point where I felt a call of God upon my life into a different form of ministry. It wasn't that I became bored by science or disillusioned by science. I'm still fascinated by science and excited by science. But it was simply that I felt God wanted to use gifts that He'd given me in a different arena. What's been really interesting since I made the move from physics, is that now I get the chance to spend quite a bit of my time thinking about the relationship between science and theology, which I find very enriching indeed.

The particular subject of this interview is the design argument in terms of cosmic fine-tuning. Can you begin by explaining a bit about what fine-tuning actually is?

One of the things that we've discovered since the 1960s is that the universe is very finely balanced, in both circumstance and law. Most of us know that the orbit of the Earth is in just the right place. If it were slightly closer to the Sun it would be too hot for life to exist. If it were just slightly further away from the Sun it would be too cold for life to exist. We also know that by looking at Mars and seeing that life, if it did develop at a very primitive level, didn't go forward in the way that life on Earth has. Now that's a circumstance. It means that the orbit of the Earth is 'just right,' as Goldilocks would have said, for life to develop. But when you look at the universe as a whole you see, embedded in the laws themselves, this Goldilocks enigma, as Paul Davies says. The fact that the universe is 'just right' for the development of intelligent life. And it's not 'just' right, it's extraordinarily 'just right.' One of the things about cosmic fine-tuning is not just that it's fine-tuned but it's fine-tuned to the most extraordinary degree. As you look around, for instance, in the energy levels of carbon or oxygen, which make possible the fact that there's lots of carbon in the universe, and that's important for us because we're made of the stuff. Or in the balances in the early universe, embedded in the physical constants, there is an extraordinary fine-tuning which makes possible life. For many of us, whether we have religious faith or not, this raises a question of what is going on. Is there a deeper story to the universe, or is there an explanation for this cosmic fine-tuning?

One response is to say, yes, the settings of the physical parameters are very unusual but any combination of circumstances is very unusual. Look at who's standing on the platform of your local railway station on a particular morning and it's a highly improbable gathering of people, but it doesn't actually signify anything. So is there really something that needs to be explained or not?

Many people will simply take the view that this is just the way it is. John Leslie, the philosopher, tells a parable about this that goes something like this. He says, Imagine you find yourself in front of a firing squad, condemned to death. Fifty rifles are all pointing at you. You hear the order to fire, you see the rifles discharge, the bullets travel towards you in the general direction but none of them hit you. They all impact the wall behind you. Now you could say at that stage, 'I've been pretty lucky this morning,' and walk away and enjoy the rest of your life. But John Leslie says that most of us would say that's such an extraordinary set of circumstances that we struggle with the question, is there a deeper story going on? Was there, for instance, a freak tornado which passed by just at the time that the bullets were going past and put them out of your direction? Was this a mock execution, in fact there was some kind of story going on which we weren't aware of? Now I think that's a fair point to make about this Goldilocks enigma. The fact that this fine-tuning of constants is just so amazing that we find ourselves wanting to ask the question, 'Is there a deeper story?' We've got to be careful about taking the question into proof, but I think it's of such an interesting and surprising level of detail that we find ourselves saying, 'Let's talk about the deeper story.'

One counter-argument often put forward is that the universe has to be like it is, otherwise we wouldn't be here to see it. Is this an explanation?

A lot of people will try to provide an explanation to this Goldilocks enigma by saying it has to be like this or we wouldn't be here to see it. Now what's implied behind that is that in other universes where the constants were different we wouldn't be there to see it. And it's a fair point. However, we need to be careful that at the moment this idea of many universes is speculation. There are some theories of physics which explain our early universe, which imply the existence of many universes. But we've no hard evidence that many universes are there. In order to have the hard evidence we'd have to pass information from one universe to another and we don't have that at the moment. So, at the moment, that's a philosophical suggestion, it's a

metaphysical suggestion, for me, rather than being a scientific account. However, it does remind me that this fine-tuning of the universe shouldn't be used as a proof. Going back a long time ago, to the time of the design argument, where people took the apparent design of the universe and argued that this was proof of the existence of a designer, David Hume, the Scottish philosopher pointed out that this attempt to prove God would be undermined if there was an alternative explanation. If you could imagine another explanation for this apparent design, then that hard logical proof would be undermined. Now what many universes, and the speculation about many universes, remind us of is that this is a possible explanation. It therefore doesn't take away the possible explanation that God is behind the fine-tuning of the universe but it does undermine any attempt to revive completely the design argument in a logical proof kind of way. We can't today take fine-tuning and use it as proof of the existence of God because we know that many universes are an alternative explanation. But I don't worry about a God who creates many universes. I mean, the God who creates this universe with a hundred billion stars in each of a hundred billion galaxies is big enough for me to try to struggle with as a concept. A few more billion galaxies wouldn't be too worrying to me - it's just a few noughts at the end of what is already a very long number. But it's an important reminder that we can't prove God in this kind of way.

Could there be evidence that there are multiple universes, or is it in the nature of the case that if there were we'd never know anything about them?

I want to leave open the question of evidence for other universes. There is a kind of evidence which says that in order to explain a particular phase of our own universe's evolution, one candidate theory predicts the existence of other universes. Now the argument is a little subtle, but it says that if this theory is needed to explain the first few moments of our own universe, and it predicts other universes then there's some evidence that there are other universes there. But direct evidence of passing information from one to another is more difficult. It has been speculated that one could get this kind of evidence, so I want to leave that open. It certainly doesn't worry me and I don't want to be dogmatic about it. Physics is that exploration of the most surprising things about the universe that you can come across, and it wouldn't surprise me too much if we got evidence of other universes.

You were saying just now that the fine-tuning argument is not proof in the sense that people in the past advanced - the sort of clockmaker argument as proof for God's

existence. Is it nonetheless evidence? Do you personally, both as an astrophysicist and as a Christian believer, find it personally persuasive?

I find the fine-tuning argument not to be proof, but I do like those who talk about it as a pointer towards a creator God. As I have worked as an astrophysicist, one of the things that struck me is the fine-tuning argument, but not just the fine-tuning argument. It's the fine-tuning argument held together with the intelligibility of the laws of physics, the beauty and simplicity of the laws of physics which underlie the complexity of the universe, and the fact that they are intelligible to us. Put that alongside the sense of awe that one gets when one looks both at the vastness of the universe and the beauty of the physical laws. Put those arguments together and I think you've got a set of pointers towards a deeper story in the universe. Now, who is behind that deeper story? Or what is that deeper story about? I think at that point we are speculating, and for me as a Christian, the Christian faith is tremendously important, as it says that you can only know the author of the story on the basis that the author reveals himself in a way that our finite minds can understand. At the heart of my Christian faith is the conviction and the experience that God has revealed himself supremely in the life, death and resurrection of Jesus of Nazareth. I know what the deeper story is about because I've seen it in Jesus. I know that there's a creator God and that creator God is a loving God. So the fine-tuning argument, the intelligibility of the universe, the awe-inspiring nature, the elegance of the physical laws, all of these things are pointers which raise questions for me, but my knowledge and experience of God comes from the fact that I believe that God is a revealing God and that revelation comes in Jesus.