Creation and the Big Bang

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Preacher: Dr. Martin Barlow

[0:00] Father, as we come to this talk, we pray that you will enlighten us about what we can learn about the universe and also teach us how to integrate what we learn through science with what we learn through revelation and theology.

So thank you for the introduction, Phil. So as a child, I was interested quite a lot in astronomy and have continued that interest following in an amateur way.

So I'm not an expert on the subjects discussed at this conference, but I hope nevertheless that I can tell you some things which are new to you and which are useful.

So from time to time, people give book reviews at Learners' Exchange, and I thought they had to give what we could think of as a conference review. And this is a conference that I went to in Cambridge in April, which was organized by the Faraday Centre for Science and Religion.

And the topic of the conference was on cosmology and theology, but it was called the George Lemaitre Anniversary Conference. Now George Lemaitre was a Belgian astronomer who lived from 1894 to 1996.

[1:17] So if you do some math, you might wonder what the anniversary was. It was the 100th anniversary of his 15th birthday, but normally nothing very notable happened on his 15th birthday.

It was the 45th anniversary of his death. Again, you know, so I asked one of the organizers what anniversary it was, and was told that it was the 80th anniversary of his most important paper.

Well, 80 is not a very round number, but they wanted to organize a conference on this topic, and so they just did so. So the speakers of the conference included historians, philosophers, and cosmologists, and included some quite distinguished people.

You may recognize John Polkinghorne who has written a lot on science and religion. John Barrow has also done so. Don Page talked at the Graduate and Faculty Christian Forum at UBC last year.

And Paul Shellard is an astronomer at Cambridge, and he sent me a copy of his talk, and I've stolen some of his slides. Whenever you see something which looks really good, you'll know that it's not one of the slides that I have composed.

[2:35] And some of those are from Paul Shellard. And just to show that sort of relations between atheists and Christians aren't always as unfriendly, a good dress after the first night dinner by Lord Rees, formerly Sir Martin Rees, who's an astronomer, an atheist, and who just won the Templeton Prize, which is a million pounds or dollars, I'm not sure, for science and religion.

So the conference covered a number of topics. The light and work of LeMet, who's both an astronomer and Catholic priest. What we now know about the very large-scale structure of the universe and its beginnings.

We've learnt a lot due to things like the Hubble telescope in the last 50 years. Then something which many of you may not know about, cosmic fine-tuning, which is possibly a new argument from design.

Recent speculations on what's called the multiverse, and theological implications of these. The conference was a joint effort of the sort of evangelically-based Faraday Centre in Cambridge, and the Pontifical Academy in Rome.

And so several speakers, mainly people on the historical and theological side, were Roman Catholic priests. Now, I'm going to have to go quite quickly over all the various topics here, if I'm going to cover in 45 minutes what was done in two and a half days of conference.

[4:08] And I also discovered a problem with doing a conference review as opposed to a book review. Most books are advancing a single sort of argument. And so, for example, in Chin's talk last week, there was a big idea in the book that he read, which he was able to communicate to us.

But conferences don't necessarily have a big idea. And, in fact, this conference went all over the place in people's views in a number of different directions. So I can't come to you with a single big idea.

Rather, what I can do is give some account of the current state of play, so to speak, on cosmology, the origins of the universe, and creation.

So let's start with the Lemaitre, which... OK. So, sorry. Here's an outline of my talk. I'm going to give a very brief biography of Lemaitre.

I'm going to give you a summary of what is known about the universe from astronomers' observations. I'm going to tell you about cosmic fine tuning. I'm going to tell you about the multiverse.

[5:12] And then I'm going to make some comments on the recent book of Stephen Hawking. So let's start with George Lemaitre. Here is a photograph of Lemaitre with another person.

I leave it to you to work out which is Lemaitre and who the other person is. So he was born in Belgium. Actually, we saw that photograph many times in the conference.

There are only about three photographs of Lemaitre in existence, it seems. And we saw the same photographs again and again in people's talks. He was born in Belgium in 1894. He studied mathematics and physics and philosophy and became a Catholic priest.

I think about the early twenties. The Catholic Church was quite supportive of learning among its clergy. And so his bishop encouraged him to continue his work, his scientific work.

So he went to MIT and Harvard to study general relativity. He worked with Eddington, who was a prominent astronomer, worker in the theory of relativity in Cambridge, England in the 1920s.

[6:24] He became a professor at the Catholic University of Louvain from 1925. He's one of those talented people whose talents were recognized and had a good job all his life.

His work was internationally recognized. In 1931, he proposed the idea that the universe had started from a single point, which he called the primingal atom.

People now call that the Big Bang Theory. And he died in 1966. And that's, I guess, a little more about his life later, but those are the main points.

Now, before we go on to the topic of the conference, I think I should give you a brief introduction to what we know about the universe from astronomy.

So let's start with the solar system. One of the messages that we're going to get is just how huge the universe is. The Earth is 12,750 kilometers across.

[7:30] The distance to the moon is that, and it's about 30 times the diameter of the Earth. The distance to the sun is 150 million kilometers, and that's 400 times the distance to the moon.

So we're really going to be talking about quite large numbers. The most distant planet, Neptune, is 4.5 billion kilometers away from the sun. So that's 30 times the distance of the Earth.

And you may wonder what happened to Pluto. Well, it's been demoted to a dwarf planet. So we've only now got eight planets in the solar system.

So that's the solar system. Now we come to the stars. Oh, sorry. Here is a picture of the solar system. Roughly, but not completely to scale.

You'll see Pluto's orbit is still there, so I suppose it's an old diagram before Pluto's demotion. Now the stars. So the closest star, apart from the sun, which is a star, is called Proxima Centauri.

[8:39] And it's 40 million kilometers away. So that's 9,000 times further than Neptune. So there's just a huge gap between the solar system and the nearest stars.

And if you put the solar system on UBC campus, the nearest star is going to be somewhere on the other side of the Earth. Just immense gaps between each planetary system and the next star.

And this number, we're going to be meeting a number of these, is written like in scientific notation as 4 times 10 to the 13. And 10 to the 13, that tells you that basically we've got 4, followed by 13 zeros.

We're going to be meeting even bigger numbers later on in the talk. By the way, if we want to write 4 times 10 to the minus 13 is 4 with 12 zeros in front of it, so it's a tiny fraction.

So these numbers are getting big. So we need a new measure of distance. And the distance I'm going to be using is called the light here. So light travels at 300,000 kilometers a second.

[9:57] So it takes about 8 minutes for light from the sun to reach us. And it takes about 4 hours for light from the sun to reach Neptune. It takes 4 and a quarter years for light to reach Proxima Centauri.

And so we say that Proxima Centauri is 4 and a quarter light years away from us. And if you go out to the night sky and look at the stars, most of the stars that you see, perhaps nearly all the stars you see, will be between 10 and 1,000 light years away from us.

If you look towards Orion, you'll see stars which are mainly about 500 light years away. If you look towards the Big Dipper, you'll see mainly stars which are about 50 light years away. But that's the order of distance of the stars that we can see from the Earth.

Of course, if you look through telescopes, you'll see other stars which are painter and further away. So everything that I've set up to this point was known to astronomers in 1920.

They could see stars, but they didn't quite know perhaps how far the stars extended. Also, interestingly, the general view of astronomers at the time was that the universe was static and possibly eternal.

[11:10] So they, I don't know exactly how they integrated this into things like second-order thermodynamics, but the general belief was that the universe had always existed more or less in its current form.

In the 1920s, with bigger telescopes at Mount Wilson Observatory in California, the American astronomer Hubble discovered that the stars are actually themselves organized into big clusters called galaxies.

And our galaxy consists of about 300 billion stars, and it's about 100,000 light years across. And the nearest other, the next large galaxy is the Andromeda Nebula, which you can just see on a clear night in summer.

And it's about 2.5 million light years away. So we're getting to numbers which are so large that writing them in kilometers would, you know, be going all the way across the screen of the computer.

So this is a picture of the Andromeda Nebula galaxy. With the good telescope, Hubble was able to resolve individual stars in the Andromeda Nebula.

[12:22] And basically, he saw stars which looked just like stars in the galaxy. And using that and some slightly more quantitative things, he was able to work out roughly the distance of the Andromeda galaxy.

Now, there are about 100 billion galaxies in the parts of the universe that we can observe. So, you know, 300 billion stars to a galaxy.

We can observe approximately many galaxies as we can observe stars. Later on in the talk, I'll be showing you a photograph taken by the Hubble telescope. So, if you look at a piece of the sky in a particular direction, at, you know, the highest magnification and resolution, you'll see more galaxies than stars.

Just an immense number of galaxies. And Hubble found that all galaxies, except for a handful of very close ones, are receding from us. And that the further away the galaxy is, the faster it's receding.

So, if the galaxies are getting further away from us, then earlier they were closer to us. And so, based partly on calculations from Einstein's theory of general relativity, and partly on Hubble's observations, in 1931, 80 years ago, Lemaître proposed his idea of the primeval atom.

[13:55] Which is that everything we can now see in the universe was once compressed into an inconceivably dense body. And that, that, and this, the thing he called the primeval atom, was the beginning of the universe.

And the universe, we now know, then expanded from this primeval atom. Now, as I said, he based it partly on observation, but also partly on calculations from Einstein's theory of relativity.

And the idea was unpopular with some of the leading astronomers of the time. So Einstein said, your mathematics is good, but your physics is abominable.

Mathematics is good, meaning he'd found a good solution to Einstein's equations, but Einstein didn't like the physical implications of what Lemaître was proposing.

And Eddington gave a more general, he didn't like the idea of a sort of, something like the primeval atom. He obviously liked the idea of a sort of static universe.

[15:00] But the static universe was hard to reconcile with Einstein's equations. Look at Lemaître's rather low-key response to Eddington.

Such a beginning is far enough removed from the present order of nature as to be not at all republished. But Lemaître's theory gained ground.

It's now called the theory of the Big Bang. And I get a cut to about 50 years development, very short. It was finally confirmed in 1965 by the discovery of what's called the cosmic microwave background radiation.

Before I go on, let me just say there's a very common, an understandable misunderstanding about the theory of the primeval atom and the Big Bang. And most people, when they hear it, they imagine that you have empty space and this inconceivably dense body, which then explodes into empty space.

It's natural to think that way, but that's actually not what the theory is. Either in Lemaître's form or the modern theory of the Big Bang is saying. What modern astronomers are saying is that everything, the whole universe, was filled with this inconceivably dense matter.

[16:28] That was all there was. There wasn't anything outside it. And then the expansion is caused in some sense by space itself expanding, and so carrying all the matter out with it so that the matter becomes less dense.

You might think of the space as being like water, no matter like boats on the water. And if the water sort of, if you're on a lake and the lake gets thinner, the water expands in all directions and all the boats get further away from each other.

That's a sort of picture of what astronomers are proposing, but it's hard to understand without the mathematics of either manifolds or general relativity.

So astronomers are saying in some sense that space is thinning out and carrying away, carrying things away with it. Space in modern physics is not just sort of nothing, emptiness with nothing in it, as we'll see.

Space is itself a kind of sort of active thing about which things are happening. Now, interestingly, although Lamaetre was a priest and astronomer, he resisted attempts to link his theory with God's creation of the universe.

[17:46] And in fact, he tended to keep his scientific thinking and his religious practice in separate compartments. And his reply here to Eddington perhaps indicates that. He doesn't sort of try to argue that philosophically or theologically this is an appropriate way to think. He makes a rather note of reply saying, even a scientist should realise that just so scientifically, the beginnings are so far away from us that it shouldn't upset our current intuitions.

One speaker said about Lemaitre at the conference, he was a priest and a scientist, not a philosopher and a theologian. And as I said, he kept those two aspects, his priestly devotions and his scientific thinking in separate compartments.

And at the end of the meeting, in an illuminating final reflection, John Polkinghorne said he thought that this wasn't the ideal, but that rather we should try to integrate our theology and science.

In 1952, the General Assembly of the International Astronomical Union was held in Rome. And the concerns from Lemaitre of the Pope, who was due to address the meeting, would make a connection between the Big Bang and God's creation of the universe.

So Lemaitre interrupted her journey to South Africa to have an interview with the Pope and dissuaded the Pope from making any such connection. So in fact, the Pope just said, you know, scientific research is a good thing and didn't say anything about the Big Bang in his address.

[19:21] And I think we can agree with Lemaitre here to some extent. It's a mistake to try to tie Christianity too closely with any particular scientific theory, even if that theory is well established.

And the Big Bang wasn't well established in 1952. Sorry, I've got behind on my slide. A quote about Lemaitre.

He realised quite fully the tentative and hypothetical character of scientific theories. And for this reason alone, if for no others, opposed the use of such theories to support philosophical, theological or vague statements.

Now let's go back to the universe. Here's a picture from the Hubble telescope of the most distant galaxy. The universe... Where am I going to find my thing?

The universe is now believed to be about 13.7 billion years old. You won't be able to see it. There's a tiny... There's a little white square here.

[20:25] If you magnify the little white square here, you see a tiny red, very faint red dot. Just not probably only visible if you are very close to the screen.

That little red dot is the most distant galaxy, which is 13.2 billion light years away. So that means the light from it has been travelling for 13.2 billion light years. 13.2 billion years.

The universe is only 13.7 billion years old. So the light from that galaxy has been travelling to us for 95% of the duration of the universe.

And that galaxy was formed very young in the history of the universe. And here is a colourful slide from Paul Schellert's talk summarising modern views on the understanding of the history of the universe.

So, again, I fear people at the back may have some difficulty. Let me just say that he's divided the history of the universe into three periods. The first dominated by this green arrow here is where we understand quite well the physics of what was going on.

[21:39] And I'm going to give you a magnified version of that on this slide. So the history begins at 100th of a second after the Big Bang.

For a period of about three minutes, nuclear fusion occurred. And that means that the light elements like helium and lithium were formed. Nothing very much happened from three minutes to 400,000 years in the history of the universe.

400,000 years. At this point, things are sort of the density of the temperature of the inside of the sun. Things have cooled off a lot by 400,000 years.

And ordinary atoms formed. Light was able to pass through the universe at that point. And the radiation which was passing through the universe at this time is the cosmic microwave background, which the discovery of which in 1965 really confirmed the Big Bang.

Because this radiation had exactly the properties predicted by people who, you know, by the Big Bang. 700 million years, we have the earliest visible galaxy.

[22:55] 9 billion years or so, the solar system forms. Today, 13.7 or 14 billion years. So that's a history of the universe as understood from 100th of a second.

If we go back to the slide, you can see that what he's got is three zones. This part of the universe, physics that we know about well, describes.

This part, physics that we know about reasonably well, which has been tested in particle accelerators, but is hard to work out the implications of, applies.

And that goes from 100th of a second to 100th of a nanosecond. A nanosecond being 1 billionth of a second. Before 1 billionth of a second, things are incredibly dense, incredibly hot.

And current physics breaks down. And we're in the realm of what we could call imaginative or speculative physics. That is, theories have been proposed. There are some good reasons for some of those theories.

[24:02] But these theories have not been confirmed by experiments. And the implications of these theories have not been worked out. And finally, at 10 to the minus 43 seconds, so that's 1 over 1 with 43 zeros after it.

It says space-time description breaks down. Quantum, you know, apparently it doesn't make sense to think about any sort of time theory at all than that. So we, at least at the moment, we reach a sort of end to possible descriptions.

So this is the current status of theory of the universe. And I guess the key things here are a part that we understand well and a part which is very speculative.

So that's my introduction to the universe as we understand it. Now I want to talk about cosmic fine tuning. And so there are lots of constants in physics.

And one example is the mass of the proton, which is a small elementary particle to the electron. The proton is 1836.1526 times heavier than the proton.

[25:21] And other constants give you the relative strength of gravity, electromagnetic radiation, and so on. And some of the constants like this one are easier to understand.

Others like something which is called the fine structure constant, another nice name, which is related to the strength of electromagnetic forces. They are more complicated to explain, and we don't need to worry about them.

So a remarkable discovery has been made in the last 20 to 30 years. And that is that if these constants weren't pretty close to the values that they have, we couldn't exist.

For example, if gravity were significantly stronger than it is, stars would burn out in a few million years, so much too quickly for life to form on planets.

Another example is that we're made out of carbon, and carbon is created inside stars, and then scattered in explosions of stars called supernova. If the fine structure constant were a bit different from what it is, carbon couldn't form in stars, so there would be no heavy elements, and presumably no life.

[26:32] So there's a good book here, which I brought, Just Six Numbers by Martin Rees. That's Lord Rees now. And although he's an atheist, he gives a good introduction there to some of the cosmic fine-tuning that we see.

So we're in a universe where these constants appear fine-tuned, so to speak, to allow the formation of life and the formation of consciousness.

What's the explanation? Well, there's something called the unprofit principle. If the constants were different from what they are, the universe would just consist, perhaps, of hydrogen and helium, so life wouldn't form, so there wouldn't be anybody to speculate on why the constants were what they are.

So, in some sense, we have to be in a universe where we see the constants as being the ones which support life. But the particular values of the constants, you know, the huge number of, well, about 20 of those constants, the huge number of possible values of them, only a very small collection of those values allow life and consciousness, so there still seems to be some sort of coincidence yet.

And so there are basically three sort of approaches which are really more philosophical than scientific to explanation.

[28:06] The first is just the sort of stout denial, so to speak. The universe is just the way it is. We observe the constants, we just happen to be in the universe, and constants just happen to be the way they are, and that's it.

No further explanation is necessary or possible. The second is the obvious theistic approach. God made the universe this way so that it would support life and us.

And the third approach has been introduced a lot in the last few years, and that is called the multiverse. So there are a huge number of universes with lots of different values of the constants.

Some of these universes can support life, some of them can't, and we're actually in one of the universes which can support life.

The proposal is that there are about 10 to the 500 possible universes, so an absolutely immense number, and certainly if you have that many universes, almost anything can happen in some of them.

[29:11] So the third explanation is what is favoured by Stephen Hawking and Lord Rees, and quite a number of people. So there was a lot of discussion about the multiverse at the conference.

By the way, most of the astronomers, if not all of them at the conference, were Christians. So we were seeing here discussion about the multiverse between a number of different Christians.

and the following points were all made. They don't point in the same direction, but all these points, I think, have some validity.

So the first three points are from Don Page, who some of you may have attended his talk at UBC last year. Questions should not tie themselves too closely to a new argument when designed.

The multiverse is even bigger from the universe. We've already seen the universe is pretty big, but if God can create a universe, he can create lots of universes. So God could certainly have made the multiverse just as well as the universe.

[30:14] And then some people say, well, the only reason people are proposing the multiverse is to avoid having to confront theism. And Page says, no, there are actually some valid theoretical reasons for proposing a multiverse.

So those are the three pro-multiverse comments. And then two sort of cautions. Some or all multiverse theories rely on very speculative and uncertain physics.

So all the multiverse theories rely on physics in the bottom third of the diagram. Stuff that has not been confirmed experimentally, not properly worked out. Oh, yeah.

Speculative and uncertain physics. And more extreme statements along the same lines by George Ellis, the multiverse is not science. There's no observational evidence at all for it.

And maybe there never can be any such evidence. And this viewpoint in particular is useful corrective to what you see in some newspaper articles which suggest that the multiverse idea is more or less confirmed.

[31:29] So, where is the multiverse? Oh, okay. So here's a slide which I stole from the internet just to show you that when we look away to the universe, we're also looking backwards in time.

Because, you know, light travels at one light year a year. So if we look at the Andromeda galaxy which is two and a half million light years away, we're seeing as it was two and a half million years ago.

So if we are here, the Andromeda galaxy that we see is there and the Andromeda galaxy as it is now, so to speak, which is up here, is not visible to us.

So looking back, looking further and further away, we're looking backwards in time. Forget about the bottom part of the slide for now. And 500,000 years after the universe we see microwaves from this bit of the universe or from this bit of the universe.

And the stuff up here we can't see. So astronomers, well, this bit here is what we can think of as the observable universe. And in really lancy terminology, astronomers call that the universe.

[32:47] So the universe, I mean, it's bad use of language, but if you see an astronomer talking about the universe, very likely what they really mean is the observable universe. So where is the multiverse?

Well, the first proposal is imagine ourselves starting here and being able to travel faster than light. So we shoot off the moon here and, you know, two and a half million light years away we come to the Andromeda Nebula as it is now.

We can't see the Andromeda Nebula as it is now, but it's probably pretty similar to the Andromeda Nebula as it was two and a half million years ago. So as we go on, we would presumably still see stars and galaxies and so forth.

Pretty much the same as we see as we see in the bit that we can see. But there is this really surprising idea.

If we went a very, very long way, maybe not 13 or 26 billion light years away, but some enormous number with no one knows how many zeros we should be putting there, we'd come to what they call a domain wall.

[33:57] And on one side of the wall, the constants of the universe would be the same as they are in this room. On the other side of the domain wall, constants might be different, so perhaps the protons would only weigh 400 electron masses rather than 1836.

So really this seems like an idea from science fiction, but, you know, mathematicians and cosmologists are working on it, and it's seriously proposed. And then the other idea for the multiverse is that universes can, I think, through black holes and produce new universes.

And here's a nice graphic which sort of shows that these universes and then some kind of a budding thing and new universes branch out from the old universes.

So that's the proposal for the multiverse. Both of these ideas involve physics in the bottom third, that is speculative or imaginative, so are not confirmed.

And as Ellis points out, well, if the multiverse is this far away, we're never, sorry, if the domain walls and other universes, so to speak, are that far away, we're never going to be able to observe them.

[35:17] Things are just too far to see. Now let me go on to talk a bit about Hawking's book.

This wasn't addressed directly in the conference, but a number of remarks were made about it in passing. And so this book was published, I think, in the autumn by Stephen Hawking and Leonard Lodinard.

I don't know if Lodinard. And this book proposes that the universe came from what's called a quantum singularity, i.e. from nothing.

And then, since physics explains how the universe can arise from nothing, this removes the need for God as a creator. And these arguments were discussed in passing by several speakers.

and the first thing to say is that the physics is definitely in the imaginative category. So I think I saw an interview of Stephen Hawking in The Guardian and he completely failed to, you know, indicate the very speculative nature of the physics that's being proposed here.

[36:29] The idea actually goes back to a Russian cosmologist from about 1982. And you might think that getting a huge universe full of stuff, stars and so forth, out of nothing violates the law of conservation of mass and energy.

So the surprising thing is that the positive mass energy of the matter is cancelled by its negative gravitational potential energy. Now, I don't know, don't ask me to explain why gravitational potential energy is negative, but apparently it is.

and some ways of doing sums at least, you end up with an exact energy balance of zero and the proposal therefore is you start off with this tiny quantum singularity and everything somehow comes from this.

The next thing to say after the observation about imaginative is that the nothing of physics is very different from what we ordinarily think of as nothing.

So in everyday thought, nothing is empty space, not containing it. But in modern physics, empty space is actually a hive of activity full of stuff going on.

[37:43] little things called vertical particles come into existence for very brief periods all the time and then disappear again. And so what we think of as nothing in physics is really something and we shouldn't use the word nothing to describe empty space or quantum singularity for that either.

So Stephen Barr, who also talked at the Graduate Christian Forum, gave a review of the book in September 2010 in First Things which is available on the web and discussing the proposal of Hawking he says would this be creation in the sense that theologians need it?

And in particular would it be creation ex nihilo creation from nothing? The answer is no. First of all one isn't starting from nothing. The no universe state as meant in these speculative scenarios is not nothing.

It's a very definite something. It is one particular quantum state among many of an intricate rule governed system. This no universe state has specific properties and potentialities defined by a system of mathematical laws.

So although the quantum singularity is perhaps very small, or it's certainly very small, it's not nothing. And Stephen Barr later in his review gives the analogy of a bank account.

[39:09] there's a big difference between having a bank account with a zero balance and not having a bank account at all. And the no unit, quantum singularity is like the bank account with no money in it, in other words, zero energy balance.

And that's very different from not having anything at all. And several speakers also reminded us, well I guess the word nothing is kind of, can be misleading, meaning that when theologians talk about creation ex nihilo, ex Latin from, nihilo nothing, what they don't mean is that God created the universe out of a special kind of stuff called nothing, but rather that he did not use any pre-existing material.

I know Bill agrees, but there we are. In other words, the universe was not created out of anything. And just as an aside on this, there were some useful remarks made at the conference about the responsibility of scientists when they popularise their field, to say when they're explaining a generally agreed upon and confirmed theory, and when they're explaining an unproved or disputed pet theory of their own.

For example, in Hawking's earlier book A Brief History of Time, the first two thirds of the book is on generally agreed physics, and the last one third on Hawking's pet theories.

So nobody disputes his right to explain his pet theories, but there was a view that when you make the transition from generally agreed to pet, you should warn the reader that you're making that transition.

[40:44] Actually, although Dawkins is not a popular name in Christian circles, in his Selfish Gene book, I think he's actually quite good at that, explaining where he's describing general science and where he's describing more speculative ideas.

science and most theories, non-scientists you may not realise, most scientific theories of which are proposed turn out to be wrong.

And here's a slide from Shellard's talk. There's something called inflation in the history of the universe. Here are some of the theories of inflation. This slide went on further.

further. And basically, only one of them, perhaps none of those theories are right, but basically only one or two of them can be correct, as all that lot.

So most theories which are proposed perhaps turn out to be wrong. So after a theory is proposed, and sometimes have a brief period in the limelight, objections pop up to the theory, perhaps sometimes very obvious objections, and the theory is quietly retired and is never heard from again.

[41:53] And so this is something to remember when you read newspaper articles about a new theory to explain something. New theory to explain something is news, old theory still explains something, is not news.

So, I think I'm going to skip some remarks on whether the universe has always existed, and its theological implications. You can ask me later if you really want to hear about that.

And let me just say that the conference was concluded by a short talk by Sir John Polkinghorne called Final Theological Reflections. And very briefly, he reminded us that the future of the world, as shown by science, is ultimate decay and death.

The stars will die, all but the closest galaxies will vanish as the expansion of the universe continues and takes them out of our view. St. Paul in Ephesians talks about this world being bound to futility.

But then, Polkinghorne reminded us that we have the promise and hope of a new heaven and a new earth, which will not pass away in the same way. Okay. That's the end of my talk.

[43:10] Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Any questions?

The last paragraph that we were talking about, the universe is eventually dying and spreading out something we did, we were not able to see any galaxies other than those closest around us.

What about the theory of critical mass? Is that one that's been discounted at this point? Well, it's not exactly, I mean, the knowledge here is not certain.

but the general view seems to be that there is something mysterious called dark energy which is pushing the expansion of the galaxies and which is going to mean that basically the universe goes on expanding forever.

And so all the galaxies except the ones in our local group, like the Andromeda Nebula, will ultimately disappear from view. And the universe is, I mean, some theories were that the universe would then come back down again.

[44:20] But on the whole the evidence is against that. But it's not completely ruled out as I understand it. But I have to say I'm not an astronomer and a cosmologist and this is an area where it's definitely the case that our knowledge is not certain of this point.

doesn't the Genesis story actually say that God created something out of nothing or is there a theological speculation?

well, I don't know the best way of reading the Genesis story.

I think as Katie said last week, if you start thinking about the universe, there are basically two possibilities. One is which God, you know, there was something other than God around always, so to speak.

And the other is that God is the first cause and an ultimate cause of all being. And I think that the second alternative has all kinds of bad theological implications and is sort of more or less contradicted by the general view of God's sovereignty in Scripture.

[45:44] If we think about the... Shin pointed out that the verses in Genesis about the great whales were perhaps there explicitly to contradict the idea that the great sea monsters were something outside God's control.

Well, if there was any sort of pre-existing stuff other than God, that is in some sense something which is outside God's control. So I would say it's a theological rather than something which can be taken directly from Revelation.

But it seems to be a very firmly established theological argument. We shouldn't be afraid of using our minds to think theologically in that way.

I would say it's a little bit in the solar system.

Yeah. Yeah. But they said that within the next three to four years it will actually break through that magnetic field.

[47:08] Is that something that you followed and what sort of information would you... No. I mean, I guess, you know, when you go out in the solar system things get very, very, you know, very sparse and you can make various different perhaps descriptions of where the solar system properly ends.

And that's not something I know anything about. Harvey. Unconsciously or unconsciously, just on your impressions from the conference, would an astronomer feel awkward, perhaps, of saying it's beautiful what I'm looking at?

Or is that just in regard as subjective and that's irrelevant and that's another issue? But does the idea of beauty ever come into it? Because apparently Newton thought the universe was beautiful.

It doesn't seem to be discussed a lot. I mean, I suppose the aspect of beauty was not discussed at this conference.

The aspect of intelligibility was discussed. In other words, the universe is intelligible to us. One might imagine universes even with conscious beings where the universe wasn't intelligible.

[48:24] So, that was discussed, but beauty was not discussed. Hello. Thank you for this. Lamentra said that he kept his theological perspectives and his science separate.

And Sir John Falkenhorn suggests there's something bad about this that we should try to integrate. And I mean, in principle, of course, we agree, but where are we in relation to integration?

I guess it depends on the particular topic. I think that here, there is no particular difficulty in integrating what we learn about the about the universe with our theological understanding.

You know, understandings of creation allow God to have created the universe 14 billion years ago. A more sophisticated understanding of creation like Aquinas would even allow us to view God as creating an eternal universe.

In other words, a universe has already existed. There are other areas where I think, like perhaps the fall of man, where it's harder to reconcile our theology and our understanding from, you know, sort of early history of the human race.

[49:43] So there are definitely challenges there. There don't seem to be particular challenges in this area that I can see. Like the baseline ignorance. The ease of integration.

Maybe. It is because of our ignorance. Well, yeah. Jim. Did the topic of extraterrestrial life come up at the conference?

Not much. I mean, what we now know is that a lot of stars have planets. Most planetary systems are not suitable for life. But there are an awful lot of stars and maybe some of them have.

But it wasn't discussed, really. I have heard that even the greater miracle than the creation of the earth is that God is creator and sustainer.

of the earth. Does that benefit of this conflict, line-tuning? And these concepts, do you think that they were built in at the beginning and just kind of long enough like a flock and they just maintain themselves?

[50:53] Or does God need to be constantly tingling with the universe to the earth? Well, I think Hebrews says God sustains the universe by his word of power.

I mean, a number of different ways of reading that. But what we can think in some sense is that the universe is only maintained in existence by the continual sort of effort, so to speak, of God.

And if he, so to speak, if he stopped thinking about the universe, it will all disappear. But that's just one possible picture. The constants, the general understanding is that the constants, have been the same since certainly in all the green period, that is of standard physics.

In the very early period, things are more muddled and it's difficult to say about that. But, you know, the constants are fixed, so God doesn't need to sort of tinker with the constants, but perhaps he does need to maintain the universe in existence.

Who knows? things. If the story about Babylon is not disputed, heaven said at that point, look, they can understand and do things that we can do, but they'll have the same confusion.

[52:12] what you've described is so immense, so incredible. the Hubble Telegraph perhaps should be named Humble Telegraph because of what it's showing.

should the next book be written called Is That the Sound of Laughter in Heaven? As we look down at our speculations, it sounds as if we're just scratching the surface of something.

In a way, I mean, I guess one way you can say we've made huge progress, you know, down to reliable knowledge of one hundredth of the second half of the beginning of the universe. On the other hand, there's still an awful lot of stuff which is not known, so I think it depends in a way on your mood as whether you're proud of the achievements or humble about the situation.

You've spoken God hung a scripture out there that you have a Hubble to find. What would the next meeting or conference sound like? People would be very surprised but so far they haven't found it.

I'm just curious about your talk about the tie-in with Shin particularly in terms of how space is now starting to be thought of as something active and how he told us that we are just in philosophical how we can do the thing now too complicated on material.

[54:00] Is physics about to get more like the ancient Near East life? Are you thinking of ontology? I don't think so.

No. I mean, physics has got all kinds of stuff in it but all that stuff is thought of as material. So I think physics is very firmly thinking in terms of the material.

It's just that the way that physics thinks about material either at very short times or very long times. Very small objects or very big objects.

Contrajects of beta are intuition which is formed by objects of the size of this room and so forth. So void would just be material in the future? I think so, yes.

I don't think there's... In quantum mechanics, there's this curious thing about the status of the observer. physics really is still trying to get an understanding of the philosophical basics of quantum mechanics.

[55:06] So that's the one area where the material view has to take a step back. But it's still a wilderness really in terms of philosophical understanding of quantum mechanics.

Was it Lumetri that he was fearful or reluctant to involve the design?

Yes. He wanted to keep the scientific speculation of the primeval atom distinct from the idea that God...

Theological creation. In fact, a nice quote from one of the speakers at the conference was, we must distinguish beginnings from creation. So, Lumetra's theory was about beginnings, not necessarily about creation.

Is there some kind of relation to the idea of God of the gap in that relation? I don't know that we can really speculate or know exactly why Lumetra had this reluctance to bridge things.

[56:22] That was just the way he was. He was a scientist and a priest, as they said, not a theologian or a philosopher.

But he may have felt that to tie Christianity to the Big Bang theory in 1952 was a bad idea because the Big Bang theory was only one of two competing hypotheses, and it might turn out to be the wrong one.

people. I remember a Sunday school teacher saying, in my father's house are many mansions, and he's that to save, there's a likely sort of life other than you.

So that agrees with the current theory. Well, the current theories just don't know. I mean, one thing is, I think, perhaps, there's some view that low-level life is perhaps quite common, but high-level life like us or rabbits or whatever is rather rare.

No one really knows. So a huge number of stars, but what we don't know is exactly how many things have to go right in order for a star to produce complicated life.

[57:53] There seems to me to be a similar conclusion then from both Shin's presentation and yours that the attempt to tie faith statements to the very transient position of science is always a mistake.

And those of us who fear... Look at the theories which are mostly wrong. So those who fear the announcement in the media that physics have suddenly resolved these problems and still misdied them.

We are under pressure. Yes. Well, I might also say the atheists shouldn't pin their beliefs on scientific theories either. come. Martin, but is there any unease amongst the scientists who pin their faith on Hollywood's theory whilst admitting there's no scientific evidence whatsoever for it?

Are they at least uneasy about that? What I think they would say, which is true, is that although there's no observational evidence for it, there may be theories...

There are some valid theoretical reasons for proposing it. Speculative. Yes. And some of them, by engaging in slightly dubious philosophy, say that if we reject assumption one, assumption two is not science, so the only scientific explanation for cosmic fine-tuning is the multiverse.

[59:28] I think that's a bad philosophical argument. I mean, what can admit that two and three are at least equally conceivable? Well, it depends on the person, but some people might say, this is scientific, this is not scientific, because it's got the word God in it.

So we rule out two. As scientists, we rule out two, and therefore we letter it through. I think that's a bad argument, logically, but it's an argument that if, in fact, you look on the Wikipedia page for cosmic fine-tuning, you'll see that kind of confusion on that page.

Thank you. Thank you. Thank you. I don't think I have a shot at it. Yeah. It seems like a few comments are circling around the idea that we want.

There's a tendency among someone to say, this idea here, here, here, proves God. I think Romans 1 must be saying something like that.

that. So it's bothering when I pin my hopes on this explanation, this observation, and say this to me says God, and then 20 years later that's proven to be incorrect.

[60:40] But Romans 1 seems to say that I should have no reluctance to have some form of that whole reasoning within myself.

And it seems interesting, I've become aware of the last year or two, that Francis Collins wrote a book a couple of years ago, I think he might have a second one now, but, and he said that he didn't like any of the God's out of the gaps reasoning, and that he did reason that way.

He became a Christian, I think, based on there being no explanation for morality apart from God. God. And I read a reviewer that pointed out rightly, I wish I could have seen that, that that's nothing else than a God of the gaps reasoning itself.

So anyway, I just wanted to comment about Romans 1, it just seems to be saying, look, you see this stuff here, I made this stuff, and there isn't an explanation of it apart from God. I mean, these are difficult questions to the extent to which the existence of God can be apprehended by human intellect without revelation and the way in which people come to believe in God.

I mean, Aquinas would agree with you. He thought that you could demonstrate the existence of God by reasoning, but most evangelicals don't like that idea. Time to rest?

[62:11] applause at 5ARDt Okay.