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SPEAKERS

Roger Penrose, Michael Brooks

R **Roger Penrose** 00:00

The Big Bang was the conformal continuation of the remote future of a previous eon. And maybe, we, maybe others, to produce a very, very advanced civilization which will learn how to send signals into the next eon.

M **Michael Brooks** 00:19

So Roger, thank you for talking to new scientists, making time for this. One thing I wanted to ask, sort of leading off, was about black holes, because this is where you started your career, effectively. And then, of course, we're now in the era where we're taking photographs of black holes. And so I was wondering how it felt to you when you first saw the photograph of a black hole. I think it was a sort of a splotch in the middle, that's right, yeah. So it didn't make much, much impression on me, because I was expecting these things by then, the reaction that many people was quite well. Let me give you an example of this Bob Dickey, who is a well known cosmologist, physicist, very distinguished man, and he came and slapped me on the back and said, You've done it. You've shown general relativity is wrong. And that was quite a common view, the fact that you got these singularities.

R **Roger Penrose** 01:13

And I suspect that even Einstein would probably have had that reaction, because he was very much against the existence of singularities. Einstein, I think, would have thought, no, no, we can't have singularities. There must be something wrong with the theory. I think the view had been that it would swish around and come swirling out again. And this showed that's not what happens. That's what I proved. It wasn't really even black holes. Now it's accepted that we have singularities. They're very much central to cosmology at the time when you were looking at that, was it an odd thing to be looking into? At the time, the quasars had been observed, and the strength of the signal indicated that they must be enormously large, but also small, because the variations in signals. So they must be small, large and small indicated that something like what we now call a black hole. So it did suggest that we had, out there these

quasars were things that were very compressed, concentrated bodies down to the sort of level where you would see this kind of problem arising. I just didn't think the arguments were that likely to prove convincingly that you didn't have singularities. So I thought about it my own way, which was certainly very different from the way other people were thinking about it. Yeah. See what people were thinking about were either looking at exact models, and the Schwarzschild solution, which is the spherically symmetrical one known very early on, and the Kerr solution, which is now believed to represent a rotating black hole. The exact solutions have a role to play, but they don't tell you what's going to happen in general complicated collapse. Or you could look at complicated computer calculations. Computer calculations were very much in the rudimentary form at the time. Yes, of course, yeah. But even so, they don't tell you that singularities are coming up. They really say, Well, look, with a computer program, everything's broken down. Is that because it's sort of run out of memory, or calculations have given up all this time later, you get the Nobel Prize in 2020 did that come as a surprise to you? And has it made any difference to how you work or or the opportunities you have? No I didn't expect it at all. 2020 it was a good thing and a bad thing. Because of the lockdown, I was able to sort of work out certain ideas that had been buzzing around in my head and I hadn't had a chance to work, and I wrote down some notes and sent them around to colleagues and and this did end up being a paper. This was, I would say, the good thing. The bad thing was getting the Nobel Prize, because it stopped the whole thing dead. I'm being unfair. Really, it wasn't entirely that. What the citation said was black holes are a robust prediction of Einstein's general theory of relativity. What I really showed was singularities a robust prediction of general relativity. See, the thing that we don't know is whether you get singularities that are hidden behind horizons, which is the black hole, and that's what we believe, or whether you could get naked ones. It's the singularities which are just there, and information could come out of them. And I, in a sort of way, were either hoped, in my wild sort of view that maybe naked singularities might occur. But as far as I'm aware, there is still no proof. The general community sort of resigned to the ideas what you get this black hole, which in a sense of a more boring situation.

M Michael Brooks 04:57

Obviously you've got decades of work behind you. You, but presumably you're still active and interested in stuff now and working on things now. So what are you currently interested in? Well,

R Roger Penrose 05:07

conformal cyclic cosmology. Oh, yes, which is the view that the Big Bang was not actually the origin of the universe? Yeah, that the Big Bang was the conformal continuation of the remote future of a previous eon. You see in this theory, there are cycles. Begins with a big bang. Each one has its own big bang. It continues. The Universe expands and expands and then indulges in this exponential expansion, which we now see for our own eon.

M Michael Brooks 05:40

So the conformal cyclic universe idea has been around a long time, and as far as I can tell, it doesn't get a lot of pickup from the rest of the physics community. Is that fair to say?

R Roger Penrose 05:50

You're absolutely right. It does not get a lot of pickup. I find that when I give talks to people who are not physicists, there could be scientists, then they latch onto it much more easily than the people who are conventional cosmologists. Very few of them, I would say, take me seriously. I don't fully understand the conformal cycle of cosmology is an idea which does have observational implications. Think people should worry about science in a way, I hate to say this, because the evidence for it is really quite strong. The strength of the signal we see is a 99.98% confidence level, which is pretty strong. What we've claimed to see in this paper is what I call Hawking points. Now, what is a Hawking point? One thing, single black hole, gradually swallows most of the cluster until the universe gets colder, colder than the black hole's Hawking temperature. That temperature becomes the hottest thing around when the universe gets colder than it, and then it radiates away. All that radiation carries away the entire mass pretty well of that black hole. That radiation is concentrated in one tiny little point. All that energy bursts through onto the other side. It takes 380,000 years before light can escape. Finally, the photons can escape, and that's the microwave background. That's the earliest thing you actually see.

M Michael Brooks 07:24

Can I move on to another of your controversial ideas, which is the idea that consciousness involves quantum effect. Is that something that you still believe in and are working towards?

R Roger Penrose 07:38

I'd written my book The Emperor's New mind, thinking that it might stimulate young people to do physics. All the letters, pretty well, all the letters I got for old retired people, which come down, but I got a letter from this crazy person, I thought at first, and this is Stuart Hameroff. This was Stuart Hameroff, and he was had the view that consciousness had to do with not with nerve transmission, as everybody else seemed to think, but as in terms of microtubules, these little, tiny structures much, much smaller than nerves. So we got together and did things we didn't quite know what we were doing. There are certain rough edges to that argument which need to be thought about. But the general argument is still what I believe whatever understanding is is something which must be beyond computable physics.

M Michael Brooks 08:27

And if you think consciousness is non computable, does that mean that you think it's beyond what science can no discern, not

R Roger Penrose 08:34

necessarily beyond science. No, it's just not beyond. It's beyond current science, my claim is much worse, much more serious, much more outrageous than that. It's quantum mechanics in the brain. People say, Oh, quantum mechanics in the brain. Can't be that. That's worse. I'm saying, No, it's not quantum mechanics. It's where quantum mechanics goes wrong. It's where

it's a theory which we don't know yet, right? I would say that of the main mainstream views about what consciousness is, I don't know. There are about four of them, and one of them is us. That's a bit of a shift. There are also experiments now looking at effects, to do with quantum effects and to do with effects of general anesthetics. And there do seem to be some connections there. So it's, it's, it's coming into the area of experimental conformational refractation. So I find that exciting.

M Michael Brooks 09:39

You've spent decades, obviously, thinking about the structure of the universe, thinking about consciousness, and really, you know, I guess, in that respect, you know what it means to be human and to think about the universe. So I was wondering whether any of this sort of comes together and gives you any sense of whether there's inherent meaning in the. Universe for you, does it make you, in some sense, spiritual to think about those kinds of things? Well,

R Roger Penrose 10:04

it's a difficult question to answer, mainly because I don't know the answer. I don't believe in any religion I've seen. So in that sense, I'm an atheist. However, I would say that there is something going on which might resonate with a religious perspective, but I think the presence of consciousness, put it like that, is not an accident in a certain sense, and it certainly has connections with the view that people often have, that you've got these constants of nature, and nobody knows where they come from, and if they didn't have the particular values that they have, then we wouldn't have maybe interesting chemistry, we wouldn't have life. I find that a little bit of a difficult argument to make clear, because we don't know what kind of if the numbers were different, what kind of a thing might call life. There is that question about CCC. Do the not constant in nature get jumbled up each time you go around? It's the next eon. It's an interesting question, which relates to a paper which I did write with one of my collaborators, vahi gozajan, where we look for signals coming from the previous eon, mainly the collision between supermassive black holes and they produce gravitational wave signals, which we should be able to see the implications of in our eon. And the claim is we do. Again, people dispute this very much, but I think they're pretty strong arguments. There's something going on there. So

M Michael Brooks 11:35

in some ways, the purpose of physics is to be able to communicate with the next generation of universes and warn them to behave better than

R Roger Penrose 11:43

we have, better than we have. Yeah, that might be it. Yes, sure, take our civilization. I'm not all that optimistic that we're going to go on for a huge length of time. I mean, the probability that something will trigger a nuclear catastrophe is not that tiny. In fact, I think we're pretty lucky to be around now, but maybe other civilizations will be more sensible than us settle down. But I think some version of Seti looking for different civilizations, maybe we should look at the really

successful ones, which would be they were very late in the previous year. That's maybe more promising in some respects, maybe we, maybe others, produce a very, very advanced civilization which will learn how to send signals into the next eon. Probably gravitational wave signals are the best bet. I had thought in terms of very, very low frequency electromagnetic signals which might get through too it might be there. Don't know, you stupid idiots, that's what we're doing. Oh yes, yeah, it's quite possible.

M Michael Brooks 12:49

So I think we can conclude that physics is far from Finnish, it's far from finished. Absolutely right, Roger. Thank you so much for your time. It's been a fascinating conversation. Yeah.