



Prof. Russell Stannard: The questions on everyone's minds

Cosmology

Russell: What kind of world do we live in - what kind of universe? Well, thanks to telescopes well like that one over there, and today especially the Hubble telescope out in space we know a great deal about what's out there, the structure of the universe, how it came into existence, how it got to be the way it is today. Beginning with planet earth, we know it to be part of the solar system. Our sun is a star much like all the other stars. Stars are gathered together into great swirling whirlpools called galaxies. Our galaxy is called the Milky Way Galaxy. Galaxies in their turn are gathered into clusters of galaxies. And these clusters stretch out into space as far as we can see. And when we observe distant galaxy clusters, we find that they are all receding away from us. The further off a galaxy cluster, the faster it's receding into the distance. And all this seems to point to the idea that at some time in the past all the matter of the universe was gathered together at a point. There was a great explosion - the Big Bang - and everything flew apart. The motion of the galaxies we see today is exactly what we would expect if it had resulted from such an explosion.

Not only that, but knowing how fast a galaxy cluster is moving and its distance from us we can work back to when everything must have been together, in other words when the Big Bang occurred. And it turns out that it happened 13.7 billion years ago. Our current thinking about how the Big Bang developed is nothing short of amazing. This is where it all begins. At first there is a brief period of exceedingly rapid expansion. What we call inflation. That then switches off round about here and then we get the normal sort of expansion we see today happening along here. We call that the Hubble expansion. Edwin Hubble was the astronomer who first discovered the universe was expanding. In saying that inflation took place over a brief period, I mean really, really brief! It all happened in the space of a tiny, tiny fraction of a second. That's right. We are talking about what happened a tiny fraction of a second after the instant of the Big Bang. It's a truly mind-blowing achievement. The Big Bang was such a cataclysmic event that we assume it must have marked the point when the universe came into being. In which case it appears natural to ask what caused it, you know what caused the big? And what came before the big bang.

But there's a problem, it's all very well talking about what happened immediately after the instant of the Big Bang, you know inflation, a tiny fraction of a second. there is all the difference in the world between saying what the universe was like a tiny fraction of a second after the instant of the Big Bang, and what it was like at the instant of the Big Bang - let alone what might have happened before that instant. You see, at that instant, all the matter of the universe would have been squashed down to a point, a place of no volume, so the density would be infinite. And there's no way our physics can handle a situation like that. We call it a singularity. We can't handle it, but at least we can give it a name and we call it a singularity. And that means we have no hope of extending our investigation through that instant to what might have preceded it, to what might have caused the Big Bang.

Okay that's one reason why the question 'What caused the Big Bang?' can't be answered. But there might be an even stranger reason. It's currently thought that the Big Bang not only saw the coming into existence of the contents of the universe - everything we see around us, but it also marked the coming into existence of space and of the coming into existence of time. This is all bound up in Einstein's theory of relativity. So, there was no time before the Big Bang.

Now, for those seeking a cause of the Big Bang there's a problem here. Cause is followed by effect. I stir the coffee, that's the cause, and what you see happening there is the effect. First the cause then the effect. The effect here is the Big Bang. So the cause of it must have existed before the Big Bang. But where the Big Bang is concerned, there is no before. So it's not simply a case of us not knowing how to extrapolate through that point of infinite density. No, the problem goes deeper than that. The question: 'What caused the Big Bang?', the question itself probably has no meaning. There is no time to accommodate a cause. So there can't be a cause. St. Augustine was once asked, "What was God doing before he made Heaven and Earth?" Augustine replied, "He was creating Hell for people who ask questions like that." In fact this is a fairly common problem when exploring science at its deepest levels -

when you're right up against the boundaries of the knowable. Are you asking the right question? It might sound a perfectly fair question, you know 'What caused the big bang?' But is it? No. A much better question in this particular instance is this: 'Why is there something rather than nothing?' We're not talking specifically about the mechanism of the Big Bang. No, we're asking the very general question: 'Why does anything exist?' You see, if nothing existed or had ever existed would that call for an explanation? No. Why should anything exist? But as soon as something exists, anything at all, then the questions start. Why does this particular kind of thing exist and not something else? What is responsible for their existence? And once having got something into existence does it need an agency of some kind to sort of keep it in existence? Science does not address questions like that. It takes the world as a given. Its job is to describe the world as it happens to be, without worrying why there should be a world in the first place. Which is not to say that the question 'Why is there something rather than nothing?' can be ignored. It might well be a meaningful question. It simply lies beyond the boundaries of scientific inquiry.

After Piece

Tony: Was that all right for sound? I thought I heard a door bang during that take.

Russell: Ah but was that a meaningful question Tony? What caused the bang?

Tony: Moving on.