The Big Bang – Fine in Theory Robert Hollingworth

Recently, American astronomers using a radio telescope at the South Pole announced that they had detected specific patterns of light, known as B-modes. These, they believe, were almost certainly caused by gravitational waves, the result of cosmic inflation. Cosmic inflation is a theory, based on other hypothetical propositions, that explains the rapid expansion of the universe. There are dozens of versions of this concept, but the newly discovered faint spiral patterns narrows the field and helps to validate one of astronomy's most cherished theories, the Big Bang.

Does the new data now tell us that the Big Bang actually happened? No, it does not, it simply reinforces the theory. And, as Stephen Hawking explains in *A Brief History of Time*, "In order to talk about the nature of the universe… you have to be clear about what a scientific theory is… A theory is just a model of the universe… It exists only in our minds and does not have any other reality."

Astrophysics and cosmology are intriguing fields of human inquiry, among the last genuine excursions into the unknown. But, as most astronomers would willingly attest, when it comes to the origins of the universe, we are far from knowing anything for sure. What we have instead, are very good theories. One of these is quantum mechanics, another is the general theory of relativity, but so far, these two ideas are to some degree, inconsistent with one another. Regardless, they help to build a pattern of what might have happened billions of years in the past. But we are not dealing with certainties.

Why then, are we so ready to accept as factual, a concept like the Big Bang? One reason is that theories, while abstract and conceptual, are regarded as "true" until proven otherwise. Another is that we trust science; we have faith in it. Science has made remarkable advancements in many fields of earthly research and established incontrovertible facts. So why should astrophysics be any different?

The answer is simple. Astrophysics (the physics of the universe), differs from all the other natural sciences in one crucial way: experiments cannot be carried out. As soon as we leave the planet, we are obliged to employ mathematical frameworks. We do not have a laboratory in which to contain, observe and test material substances. Scientists must rely on particle physics, a discipline that delves into the innermost structures of matter. Answers there, it is hoped, will help explain basic laws for the universe's fundamental forces. In Geneva, the Large Hadron Collider attempts to verify measurements established by the standard model of particle physics. But the LHC, while potentially making ground-breaking discoveries, cannot provide physical evidence of the universe's origin.

In truth – in essence – all of our theories in regard to origins are simply our best attempts to make sense of something that is beyond us. In the Western World we initially established the idea that God brought the universe into being: “In the beginning… the earth was formless and void, and darkness was upon the face of the deep.” Now we have a theory that everything was created in a sudden explosion approximately 13.8 billion years ago: At first there was nothing; then time, space and matter all came instantaneously into being.

These two concepts of creation, the biblical and the scientific, seem remarkably similar. If religion was the basis of recognised principles for earlier centuries, science can be seen as fulfilling the same role today. Yet our newest explanations still leave vital questions unanswered. If there was a Big Bang, what precipitated it? In what “situation” did it incubate? How can there be such a thing as a “first” phenomenon? Is the expanding universe now dying? If so, what comes after?

Science has vastly improved our lives and raised us out of uncertainty, superstition and ignorance. But this should not be extrapolated to mean that theories proposed in the unprovable arena of the blinding past, necessarily equate to reality. The Big Bang is one of the best theories we have at present, based on other theories. But in time, as always, some of these will be revised, while others may be abandoned altogether. To quote Hawking again, “Any physical theory is always provisional, in the sense that it is only a hypothesis: you can never prove it.” On the other hand, Hawking says, theories can be disproved.

So what will be the final, ultimate truth about the origin of the universe? It’s more than likely that we will never know. Can we accept that we may not acquire the answer to everything? Can we accept the prospect that there may not even be such things as “answers” or “origins”? This is a possibility that exceeds our ability to think, that goes far beyond the capacity of the primitive electrical neurons pulsing within an organism that has only arisen during the last fractional moment of our young planet’s history, a planet that has been biologically active for the past 3.6 billion years.

We will continue to speculate, we will keep exploring, testing new theories. But final proof of a “first” phenomenon like the Big Bang is not for us. All we know is what our feeble five senses allow us to know and we may never escape the emphatic limitations of our consciousness. We must not assume that our young, slowly evolving brains have the potential – now or ever – to arrive at some ultimate solution. Instead, let’s just revel in the mystery and accept that we are not in control. We have always harboured fears of the unknown. Every tribe of humans that ever was, has felt compelled to construct explanations for existence; it seems to go with self-consciousness. And science placates our angst and uncertainty. Yet one vital question persists: how has there come to be “existence” at all? It is something that astrophysics – along with every other discipline – is incapable of answering. Can we live with that?