

“The Nature of Space and Time”, by Stephen Hawking and Roger Penrose, Oxford University Press, (1996), ISBN 019564211-2, Rs. 175.

In 1928 the Fifth Solvay Congress in Brussels was witness to a historic debate between two giants of twentieth century science, Albert Einstein and Niels Bohr. The debate, which continued for many years without either side conceding was over the foundation of quantum mechanics. Though Bohr and Einstein were among the founders of quantum mechanics (alongwith Heisenberg, Schrodinger, Born and others) both of them had very different views on the interpretation of the mathematics involved in the formulation. Einstein was of the opinion that quantum mechanics though extremely successful in understanding the microscopic realm was only a working prescription and not a complete theory of the subatomic domain. Bohr, on the other hand was a strong votary, indeed one of the propounders of what has come to be known as the Copenhagen Interpretation of quantum mechanics. He stressed that the uncertainties and probabilities in quantum mechanics were inherent in nature. Though most scientists accept Bohr’s point of view, Einstein steadfastly looked for loopholes in the Copenhagen Interpretation, a point of view succinctly summed up in his famous quotation, “God does not play dice”.

In 1994, another debate, reminiscent of the Einstein- Bohr controversy was held at Cambridge on the fundamental nature of the universe. The protagonists were Stephen Hawking and Roger Penrose. The book under review presents the debate which was about the correct approach to combining quantum mechanics and general relativity.

Twentieth century has seen the birth of two revolutionary theories in Physics. Quantum Mechanics and Einstein’s general theory of relativity are not only immensely successful theories but in certain fundamental sense have changed the way we look at and try to make sense of the physical universe around us. While quantum mechanics seeks to explain the behavior of the matter in the microscopic realm, general theory of relativity is a theory of gravity and space-time itself. Both the theories are remarkably accurate and have been tested extensively by experiments. Nevertheless, there is still some philosophical skepticism about quantum mechanics and some technical problems with general relativity regarding the nature of black holes and singularities.

There is however a more serious problem. While each of them is by itself is an extraordinary achievement of the human intellect, their combination has so far been unsuccessful. Many great physicists(including Einstein) have battled and continue to battle with the formidable task of combining these two theories in to a consistent theory of quantum gravity without any success. The different approaches to combining the two forms the substance of the debate.

The contestants in the debate are certainly well qualified. The wheelchair ridden "black hole cosmonaut", Stephen Hawking is arguably the dominant image of late twentieth century science much like Einstein was of the Atomic Age. A Cambridge don who is fascinated with Marilyn Monroe; a theoretical physicist par excellence; a patient of a rare and incurable motor neuron disease; the best-selling author of 'A Brief History of Time', a book which broke several records in its sales. All this and much more is Stephen Hawking. On the other hand is Roger Penrose; mathematician, author of the monumental “The Emperor’s New Mind” (in some ways a much better and thorough book than Hawking’s “pop” science book) and considered by most of his peers to be a much deeper thinker than Hawking.

In the current debate, both of them lay down their positions regarding how best to understand the domain of quantum gravity. Their positions are very different and both of them present their case forcefully. Hawking is of the opinion that the way to attack the problem is to use his “no-boundary “proposal and not worry about the issue of interpretation of the

quantum theory. Penrose on the other hand is concerned about deeper philosophical issues in quantum mechanics and proposes that gravity will play an essential role in sorting out the philosophical conundrums associated with the quantum theory. In some ways, Hawking takes the positivist position of Bohr while Penrose argues for a more Platonist (or realist) position, much like Einstein.

Oxford needs to be congratulated for starting to bring out serious science books (like Dawkins' "The Selfish Gene" and Kaku's "Hyperspace") at affordable prices. This book, though well written is NOT a popular science book. It is a highly technical account of front-line research in one of the most challenging area of physics. It is not meant for the lay reader (the blurb on the jacket notwithstanding). The best that she could do would be to flip through the book and get an idea of how messy and contentious the subject really is. In fact, unless one is familiar with the literature in the field it is heavy reading even for a physicist. But then the subject itself is so fluid and changing at a rapid pace that it is difficult and even dangerous to put forth a complete and comprehensive picture. In this way, the book accurately reflects the state of the subject itself.