



“To fulfil the basic human need to understand the universe and its workings, to understand how it all began, how it may end, what lies in the future for us... it is in understanding these basic kind of questions that I think my work can contribute, and these questions are of importance or of interest to common people.”

Sandip Trivedi

*Professor, Theoretical Physics Department,
Tata Institute of Fundamental Research, Mumbai*

- M.Sc. in Integrated Physics from the Indian Institute of Technology, Kanpur
- Ph.D. in Theoretical Physics from the California Institute of Technology, Pasadena
- Post Doctoral Research Associate at the Institute for Advanced Study, Princeton, New Jersey

In recent years, physicists have pursued the possibility of achieving a unified account of all the known forces of physics using concepts of Superstring Theory. It was difficult to construct solutions of the equations of Superstring Theory that did not contain massless particles of a kind not observed in nature, and that describes an accelerating or inflating universe, which seem to be required by cosmological observations. Through an ingenious construction that introduced several theoretical innovations, Prof. Sandip Trivedi showed that these difficulties are connected, and can be overcome simultaneously.



Tackling the mysteries of Superstring Theory

How did our universe begin? How does it work? Over the years, scientists have put forward many theories that attempt to answer these questions. In recent years, String Theory has been a much studied field and is a promising attempt in this direction. Superstring Theory or Supersymmetric String Theory is an attempt to define all the particles and fundamental forces in nature as the vibrations of microscopic supersymmetric strings.

Superstring Theory is different from other versions of String Theory because it includes fermions and the concept of supersymmetry. Fermions include particles such as quarks and leptons. Bosons are another kind of particle which include the photon and the recently discovered Higgs Boson. Supersymmetry is a symmetry that relates fermions and bosons.

In recent years, physicists around the world have been pursuing the possibility of achieving a unified theory of all the known forces of nature including gravity, strong forces, weak forces and electromagnetic interactions. They have been trying to achieve this using the concepts of Superstring Theory.

However, this has proved difficult to do and so far the only solutions to the equations of Superstring Theory that physicists have constructed involve massless particles of the kind not seen in nature. Prof. Trivedi, with collaborators, has shown a way of overcoming this problem by using an ingenious construction that introduced several theoretical innovations.

Through his work, Trivedi has also been able to find a way of solving an outstanding puzzle in Superstring Theory regarding the origin of dark energy in the universe. In cosmology and astronomy there is increasing evidence that the universe is dominated by a form of dark energy which is thought to contribute to its expansion.

Trivedi's work helps to make important links between the fields of Superstring Theory, cosmology and particle physics. His research has made important contributions to the study of superstring cosmology, flux compactifications (a particular way to deal with the additional dimensions required by string theory), black hole physics and supersymmetry breaking.