

Department of Physics  
Jamia Millia Islamia  
New Delhi

**XVII Abdus Salam Memorial Lecture 2019-20**

**Bosons and Fermions, their Spin, and our World**

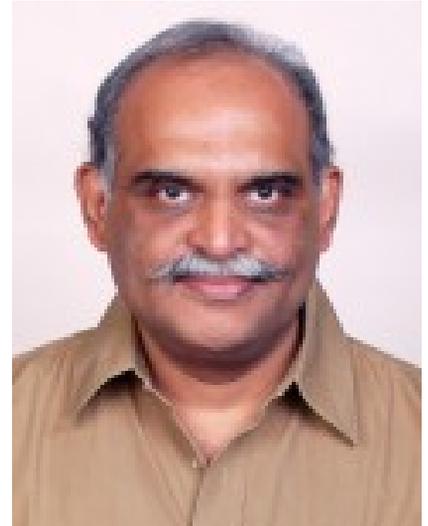
**Basking in the Gravity of the Universe**

by

**Prof. C.S. Unnikrishnan**

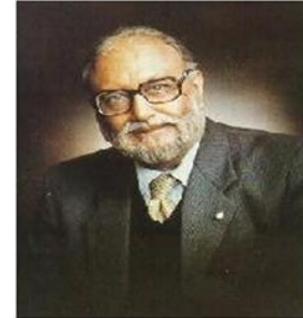
**Tata Institute of Fundamental Research, Mumbai**

*Prof. C. S. Unnikrishnan's research interests are experimental and theoretical aspects of fundamental issues in gravity and quantum physics. He set up the laser-cooling laboratory at TIFR, where the first Bose-Einstein condensate in India was produced. Major theoretical contributions are the theory of Cosmic Relativity, based on the gravity of the matter in the universe and recently, the formulation of a universal action-mechanics, solving the widely debated foundational problems of quantum mechanics. He is a proposer-scientist of the LIGO-India project and a member of the LIGO Scientific Collaboration that detected gravitational waves. Interests outside research are music and films, especially the process of their creation and structure.*



**Abstract:** Satyendra Nath Bose's refreshing work on the quantum statistical aspects of light, and Einstein's generalisation to atoms, led to the concept of Bosons as a class of quanta obeying the cooperative 'Bose-Einstein statistics'. Their identity as a class came in sharp contrast when the Pauli exclusion principle and the Dirac equation revealed the other class called Fermions, obeying the exclusionary 'Fermi-Dirac statistics'. Spin, and spin alone, is the determining factor of the Spin-Statistics Connection - the tight relation between the spin and the collective behaviour of identical particles. Spectacular Bosonic examples are lasers, superconductivity, and the Bose-Einstein condensation, and Fermionic examples range from the most common phenomena in solid state physics to neutron stars. In spite of obsessive attempts, like the one W. Pauli pursued, the physical reason for the connection remains unknown. Can we grasp the true reason behind the difference in the behaviour of Bosons and Fermions? An explorer's journey demanding logical and physical consistency takes us to a surprising answer in the domain of gravity, on the cosmic scale of the entire Universe.

**Thursday, 12<sup>th</sup> March, 2020 at 3.:30 P.M**  
**Auditorium, Faculty of Engineering, JMI**



**Department of Physics,  
Jamia Millia Islamia,**  
cordially invites you

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