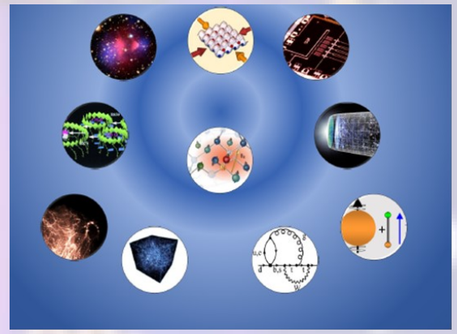
Tata Institute of Fundamental Research

Homi Bhabha Road, Colaba, Mumbai, INDIA, 400005

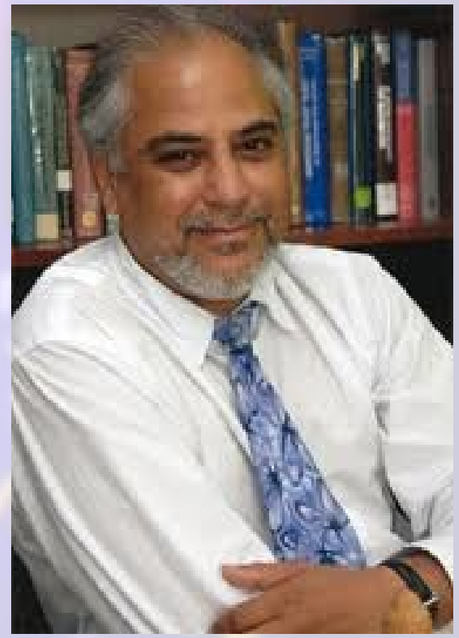
IPA-ASET Colloquium

Quantum Sensors of the Early Dark Universe:

Exploiting Quantum Entanglement and particle/atomic beams in the Laboratory for Detection of Fields and Signals from Very Early Universe



After an introduction of the extraordinary success of large particle accelerators to date in developing the now widely accepted Standard Model (SM) of particle physics, I will introduce and expose the basic concepts and techniques of "quantum sensors", illustrate "quantum entanglement" at work from the microscopic to the macroscopic scale since the "Big bang" 13.8 billion years ago , and its controlled exploitation in the laboratory to probe and detect with high precision very weak signals in nature (exotic particles, fields and space-time distortions) that may exist from the emerging very "early" and "dark" universe, allowing us to be 'cosmic archaeologists'. Today, quantum science and engineering of materials and atomic/molecular beams have progressed to the point that we can contemplate creating such quantum entanglement in our laboratory exhibiting quantum coherence and entanglement on a macroscopic scale. These have extraordinary potential as extremely high precision detectors of weak primordial signals (dark matter, dark energy, cosmic gravitational wave background, etc.).



Prof. Swapan Chattopadhyay received his PhD in Physics from UC Berkeley (1982), following his undergraduate studies as a National Scholar and National Science Talent Scholar at St. Xavier's College and IIT (Kharagpur). After a 2-year tenure as a Scientific Associate at CERN 1982-1984, Chattopadhyay returned to LBL at the University of California at Berkeley where he served as the Founding Director of the Center for Beam Physics and a Professor in the Graduate School (1984-2001). He then served as the Associate Laboratory Director at Jefferson Lab (2001-2007) and after an international search, was appointed Inaugural Director of the Cockcroft Institute, UK (2007-2014) where he also held the Sir John Cockcroft Chair of Physics. Currently Chattopadhyay is a Distinguished Scientist at Fermilab (USA) in a joint appointment with NIU where he holds the President's Chair and Professor/Director of Accelerator Research. In 2021, he will start his 4-year Infosys Chair Visiting Professorship at IISc Bangalore while continuing to hold Visiting Professor appointments at Oxford, Berkeley, Strathclyde, and CERN. Prof. Chattopadhyay is a noted particle / accelerator physicist, with international contributions to innovative particle colliders, synchrotron radiation sources and free electron lasers. In recent years, he helped spearhead the US-DOE initiative in "Quantum Sensors for Fundamental Science, Quantum Information Science and Computing". Prof. Chattopadhyay is a Fellow of the American Physical Society (USA), American Association for the Advancement of Science (USA), Institute of Physics (UK), Royal Society for the encouragement of Arts, Manufacturing and Commerce (UK) and an international Corresponding Fellow of the Royal Society of Edinburg (UK). He received the Berkeley Halbach prize for pioneering ultrafast femtosecond x-ray techniques.

Prof. Swapan Chattopadhyay
Distinguished Scientist, Fermilab

Date & Time: Friday, 15th January 2021, 11am
YouTube live-stream link: https://youtu.be/nh7e2EcE2SE