भारतीय ताराभौतिकी संस्थान

INDIAN INSTITUTE OF ASTROPHYSICS

कोरमंगला Koramangala, बेंगलूरु Bengaluru – 560034.

THESIS COLLOQUIUM.

Name : Ms. Akanksha Kapahtia, JAP - Student

Title : "Morphology and topology of Cosmological fields during the Epoch of Reionization ".

Research Supervisor : Prof. Pravabati Chingangbam, IIA
Prof. Tarun Deep Saini, IISc.

सार Abstract

Neutral hydrogen is the dominant component of the universe post matter radiation decoupling, 380000 years after the big bang. Spatially it follows the tiny fluctuations in the energy density, set during inflation. These fluctuations grow with time as the universe expands, making denser regions more dense. At about 100 million years after the big bang, these highest density regions harbour the first luminous objects. The radiation from these first luminous objects changes the thermal and ionization state of the intergalactic medium leading to a major transition in the history of the universe called the Epoch of Reionization (EoR). The EoR is marked by the appearance of ionized regions around these collapsed objects which grow and merge until the entire universe is ionized. The growth and topology of these ionized regions depends upon the properties and evolution of these first luminous sources. One important observational probe of the EoR is the 21cm spin flip hyperfine transition of the neutral hydrogen. The brightness temperature of this transition encodes the ionization and heating history of the IGM. We introduce real space morphological descriptors, called Minkowski Tensors (MTs) and topological quantities Betti numbers, to probe the morphology of 21cm brightness temperature field. We use them to track the redshift evolution of the shape anisotropy, size information and number counts of ionized bubbles and neutral regions of the field. From this information we gain insights into the different regimes of morphological evolution of the brightness temperature and it's dependence upon globally defined astrophysical parameters. This understanding enables us to reconstruct the ionization history of the IGM. Lastly, we use size, shape and number count statistics of ionized regions to forecast constraints on model parameters of the EoR using mock observations from upcoming radio interferometers such as the Square Kilometre Array.

Date : 21.02.2020

Time : 4.00 PM

Venue : Auditorium,
New Physical Sciences Building,
DEPARTMENT OF PHYSICS,
INDIAN INSTITUTE OF SCIENCE,
BANGALORE.

ALL ARE WELCOME