Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Seminar

Insights from data-driven techniques from the distant cosmos to pre-historic Earth

Hamsa Padmanabhan

The Green Concept, Pune

Hydrogen is the most abundant element in the Universe, and as such, mapping its evolution across cosmic time promises deep insights into cosmology and — in the future — theories of physics. Intensity mapping (IM) is an emerging technique that measures the integrated emission of radiation over cosmological volumes, and has the potential to unlock significantly more information than we presently have from galaxy surveys. I will describe a novel, data-driven framework which utilises our current astrophysical knowledge to interpret future IM observations of cosmological hydrogen. It readily enables synergies with other line-intensity mapping surveys and traditional galaxy observations. Extending this approach allows insights into the properties of the earliest black holes, using multi-messenger observations from the James Webb Space Telescope (JWST) and gravitational waves from Pulsar Timing Arrays (PTAs). I will briefly describe how these methods find applications to several unsolved issues in the Earth's paleo-climate, such as modelling the carbon dioxide content of the Earth across the most destructive extinction event in geological history (called the Permian Triassic Mass Extinction (PTME), which took place around 252 million years ago and destroyed about 96% of all marine and 70% of all terrestrial species). This extinction is believed to have been triggered by a runaway greenhouse effect, and relating it to the current global warming scenario promises invaluable lessons for the tackling of our climate crisis.

Tuesday, Sep 23rd 2025

16:00 Hrs (Tea / Coffee 15:45 Hrs)

Auditorium, TIFRH