ICTS Astrophysics & Relativity Seminar

Title : Dark Secrets of Baryons: Illuminating Dark Matter-Baryon Interactions with JWST

Speaker : Ranjini Mondol (Saha Institute of Nuclear Physics, Kolkata)

Date : Friday, 06 March 2026

Time : 2:00 PM (IST)

Abstract : The James Webb Space Telescope (JWST) has discovered numerous bright galaxies at high redshifts ($z\approx 10-14$). Many astrophysical models and beyond the Standard Model physics scenarios have been proposed to explain these observations. We investigate, for the first time, the implications of dark matter (DM) scattering with baryons (protons and electrons) in light of the JWST UV luminosity function (UVLF) observations. These interactions suppress structure formation on galactic scales, which may have an observable effect on the UVLF measurements at high redshifts. Using a recent galaxy formation model designed to explain high redshift observations, we obtain strong upper limits on DM-baryon scattering cross-sections and explore new regions of the parameter space. For DM-proton scattering with cross-section $\propto v^{-2}$ velocity dependence, we obtain the strongest limit for DM masses of $\sim$ 1 -- 500 MeV. For other cases that we study (DM-proton scattering cross-section $\propto v^{0},\,v^{-4}$ and DM-electron scattering cross-section $\propto v^{0},\,v^{-2},\,v^{-4}$, our limits are competitive with those obtained from other cosmological observables. Our study highlights the potential of JWST observations as a novel and powerful probe of non-gravitational interactions of DM.

Venue : Madhava Lecture Hall
Zoom Link: https://icts-res-in.zoom.us/j/96811724934?pwd=1xrQtNaTSuMsy5xc1E0hSwXiDUjqQD.1
Meeting ID: 968 1172 4934
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