

Probing Initial Isocurvature Perturbation with 21-cm One-Point Statistics

Date 11:15 - 12:00, November 7 (Friday), 2025

Place 1131, Building 9 (Zoom ID: 881 5903 1592)

Speaker

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Abstract

Isocurvature perturbations, a natural prediction of multi-field inflation, remain poorly constrained on small scales but are of great importance for understanding early-Universe physics. The Cosmic Dawn (CD) and Epoch of Reionization (EoR) provide unique windows to distinguish isocurvature from adiabatic initial conditions. If the isocurvature spectrum is blue-tilted, its small-scale power can be significantly enhanced, making 21 cm observations an essential complementary probe beyond the CMB.

In my talk, I will present simulations with 21cmFAST to analyze the one-point statistics (variance and skewness) of the 21 cm brightness temperature. I will show how isocurvature perturbations shift the timing of key milestones such as Wouthuysen–Field coupling, X-ray heating, and reionization, and discuss the constraining power of one-point statistics under SKA-like conditions.

Biography

Zhenfei Qin is a Ph.D. student at the South-Western Institute for Astronomy Research (SWIFAR), Yunnan University, under the supervision of Prof. Hayato Shimabukuro. His work focuses on 21 cm cosmology and early-Universe physics, especially on probing cold dark matter isocurvature perturbations during the Cosmic Dawn and Epoch of Reionization. He also investigates the impact of early dark energy on the late-time Universe.