Contribution ID: **120** Type: **not specified**

Simulating Free Streaming in Warm Wave Dark Matter

Thursday 10 July 2025 14:30 (20 minutes)

We provide a framework for numerically computing the effects of free-streaming in scalar fields produced after inflation. First, we provide a detailed prescription for setting up initial conditions in the field. This prescription allows us to specify the power spectra of the fields (peaked on subhorizon length scales and without a homogeneous field mode), and importantly, also correctly reproduces the behaviour of density perturbations on large length scales consistent with superhorizon adiabatic perturbations. We then evolve the fields using a spatially inhomogeneous Klein-Gordon equation, including the effects of expansion and radiation-sourced metric perturbations. We show how gravity enhances, and how free streaming erases the initially adiabatic density perturbations of the field, revealing more of the underlying, non-evolving, white-noise isocurvature density contrast. Furthermore, we explore the effect of non-gravitational self-interactions of the field, including oscillon formation, on the suppression dynamics. As part of this paper, we make our code, Cosmic–Fields–Lite (CFL), publicly available. For observationally accessible signatures, our work is particularly relevant for structure formation in light/ultralight dark matter fields.

Authors: LING, Siyang (City University of Hong Kong); Prof. AMIN, Mustafa A. (Rice University)

Presenter: LING, Siyang (City University of Hong Kong)

Session Classification: Parallel 2