



Contribution ID: 17

Type: Long talk (20 mins)

The complexity of cosmic large-scale structure encoded in a single wavefunction

Friday, December 16, 2022 9:40 AM (30 minutes)

On large scales, the dark matter distribution can be treated as a perfect fluid. On small scales, gravitationally bound structures form through nonlinear clustering. Capturing the resulting cascade of multiple fluid streams in 6d phase space is challenging. We approximate the time evolution of this complex phase-space dynamics using a wavefunction, in the spirit of the quantum-classical correspondence. This method is a tool both for modelling the phase-space dynamics of cold dark matter in position-space, and is the fundamental description of ultralight dark matter candidates such as axions. In a simple dynamical model for the evolution of this dark matter wavefunction, I will demonstrate how the rapid oscillations from wave interference automatically encode information beyond perfect fluid models and how the classical streams are recovered from “unweaving” the interference. This description, together with connections to optical caustics and diffraction integrals, presents rich universal features that can unlock new ways of modelling and probing both wavelike and cold dark matter on the scales of the cosmic web.

Type of presentation

20 minute talk

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