

Wave dark matter structures

Monday 8 August 2022 14:48 (3 minutes)

We analyze the dynamics of cosmological perturbations in models of dark matter based on ultralight coherent bosons. We discuss two different regimes in evolution, which distinguish between a particle-like behavior and a wave-like behavior. For different spins of this bosonic dark matter, the background evolution can contain non-vanishing vector and tensor modes. The evolution of scalar, vector and tensor perturbations can no longer be decoupled at the linear level in the wave regime. Therefore, small-scale density perturbations are necessarily associated with the presence of gravity waves. On the other hand, we also discuss the formation of clumps within the nonlinear regime. In this case, the self-interactions play a fundamental role. Depending on them, the clumps span a wide range of scales and masses, running from the size of atoms to that of galactic molecular clouds, and from milligrams to thousands of solar masses.

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Session Classification: Poster Lightning Talks