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Not Really Quantum Cosmology: How far can we get by treating a dark matter halo like an atom?

Wednesday 29 May 2024 16:30 (30 minutes)

Axion-like particles have been gaining popularity recently as potential solutions to dark matter with fascinating wave-like dynamics. In this talk, I will specifically consider fuzzy or ultralight dark matter (FDM/ULDM): a candidate that keeps the successes of CDM on large scales but alleviates tensions on small scales. This small-scale behavior is due to characteristic observable cores in ULDM called solitons, which also correspond to the ground state of the equations governing ULDM. On the other hand, this same signature makes ULDM halos expensive and onerous to simulate by demanding very high resolution. One promising avenue for computationally studying ULDM dynamics is by treating individual halos as hydrogen atoms and calculating the full spectrum of their eigenstates instead; individual eigenstates can then be linked to the qualitative behavior of the halo. In this talk, I will outline how and why this approach is useful, as well as show its applications to observationally relevant phenomena, including the formation of halos, the core-halo mass relation of ULDM, and the effects of supernovae feedback on spherically symmetric halos.

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computational physics

Keyword-2

dark matter

Keyword-3

axions

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