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Self-interactions of ULDM to the rescue?

Recently Ultra Light Dark Matter (ULDM), where DM is described by a scalar field with $m \sim 10^{-22}$ eV has emerged as a promising alternative to the standard Cold Dark Matter (CDM) model. However, viability of models with no self-interactions (also called Fuzzy Dark Matter), is under question as relevant masses are increasingly constrained using various astrophysical and cosmological observations. It is then interesting to consider the effects of self-interactions on such constraints. We look at two observables that can potentially constrain self-interactions: (1) amount of mass contained within some region around the galactic centre, (2) galactic rotation curves of dwarf galaxies. We find that for the former, using an example of the M87 halo, attractive self-interactions are more constrained than repulsive self-interactions. For the latter, we find that ULDM with repulsive self-interactions of strength $\sim \mathcal{O}(10^{-90})$ are allowed by the rotation curve data of Low Surface Brightness dwarf galaxies (from the SPARC catalogue) while simultaneously satisfying an empirical Soliton-Halo relation.

Email

bdave18@gmail.com

Affiliation

Ahmedabad University

Author: DAVE, Bihag (Ahmedabad University)

Presenter: DAVE, Bihag (Ahmedabad University)

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