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Fuzzy dark matter confronts rotation curves of nearby dwarf irregular galaxies

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The Fuzzy Dark Matter (FDM) model predicts that dark matter is composed of ultralight scalar field particles which possess macroscopic de Broglie wavelengths in the kpc scale. The wave behaviour of FDM erases structure formation on small scales and leads to the formation of galactic cores or solitons. This has been a subject of great interest in addressing challenges of the ΛCDM model, where simulations have been found to overpredict the number of observed satellite galaxies and generically predict cuspy density profiles, in tension with observations. We test FDM against a set of high-quality rotation curves from a robust sample of nearby isolated dwarf galaxies in the LITTLE THINGS survey, probing whether it can resolve these issues. We also examine the effects of baryonic physics and test against a number of astrophysical scaling relations predicted by the model, as well as the stellar-to-halo and concentration mass relations. We find that fits of cored density profiles show close agreement with the rotation-curve data, but that the particle masses needed to form those cores lead to a much too strong suppression in halo formation to account for observations and are in tension with an independent lower bound on the particle mass. Lastly, we find that that the scaling relations predicted by the model are significantly disfavoured by the data. Our conclusion is that the cores observed in this sample of dwarf galaxies are not consistent with the standard solitons predicted by FDM.

Primary authors: BAÑARES HERNÁNDEZ, Andrés (Instituto de Astrofísica de Canarias, Universidad de La Laguna); Dr CASTILLO, Andrés (Instituto de Astrofísica de Canarias, Universidad de La Laguna); IORIO, Giuliano (Istituto Nazionale di Fisica Nucleare); Dr MARTIN CAMALICH, Jorge (Instituto de Astrofísica de Canarias, Universidad de La Laguna)

Presenter: BAÑARES HERNÁNDEZ, Andrés (Instituto de Astrofísica de Canarias, Universidad de La Laguna)

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