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How do stars affect ψDM?

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Wave dark matter, ψDM, has recently been gaining attention as a dark matter candidate. This is due in part to the model's ability to predict, thus a falsifiable model. Noticeably it predicts a central prominent core, dubbed as the soliton, in every galaxy and large-amplitude density fluctuations in galaxy halos dubbed as halo granules. In this work we conduct the first ψDM halo simulations that include stars in the inner halo. The results show that the soliton becomes ever stronger in the presence of stars, and the soliton slowly grows by absorbing mass from its host halo to maintain the soliton scaling relation. Moreover, halo granules become "non-isothermal"after stars have thoroughly interacted with the inner halo, a situation unlike isothermal granules in halos of pure ψDM cosmological simulations. We find that the composite (dark matter+stars) mass density can locally follow the isothermal profile near the stellar half-light radius in most cases. Phase separation that segregates a uniform population of stars into two distinct populations of high and very low velocity dispersions stars is also found in some situations. While halo stars have high velocity dispersion, the cold component is bound inside the soliton resembling stars residing in faint dwarf spheroidal galaxies. The most striking result of this study is that the velocity dispersion of halo stars increases rapidly toward the galactic center by a factor of at least 2 or so inside the half-light radius caused by the deepened soliton potential, a result that compares favorably with observations of elliptical galaxies and bulges in spiral galaxies. Finally, we find that the inner halo follows the same self-similar relation as the soliton does within the mass range of dwarf to small galaxies.

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