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Scalar field dark matter as an alternative explanation for the anisotropic distribution of satellite galaxies

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The scalar field dark matter also called ultralight bosonic dark matter, has received considerable attention due to the number of problems it might help to solve. Among these are the cusp-core problem and the abundance of small structures of the standard cold dark matter model. In this talk, we show that multi-state solutions of the Gross-Pitaevskii-Poisson equations, interpreted as galactic halo density profiles, can provide a possible explanation to the anisotropic distribution of satellite galaxies observed in the Milky Way, M31 and Centaurus A, where satellites trajectories seem to concentrate on planes close to the poles of the galaxies instead of following homogeneously distributed trajectories. In order to construct a proof of concept, we study the trajectories of a number of test particles traveling on top of the gravitational potential due to a multi-state halo with monopolar and dipolar modes. The result is that particles accumulate asymptotically in time on planes passing close to the poles. Satellite galaxies are not test particles but interpreted as such, our results indicate that in the asymptotic time their trajectories do not distribute isotropically, instead, they prefer to have orbital poles accumulating near the equatorial plane of the multistate halo. The concentration of orbital poles depends on whether the potential is monopolar or dipolar dominated.

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