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Explaining Diverse Rotation Curves of Spiral Galaxies with Self-Interacting Dark Matter

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Self-interacting dark matter (SIDM) is a simple and well motivated scenario that demonstrates great potential to solve small scale issues. One recent example is the diversity problem due to the failure of the lambda cold dark matter (LambdaCDM) paradigm to explain the diverse behavior in observed rotation curves, especially for dwarf galaxies. To address this issue in SIDM paradigm, we follow our previous work and fit 120 galaxy velocity rotation curves from SPARC dataset using SIDM model with a fixed value of self-interaction cross section and only assuming the halo concentration-mass relation predicted by the LambdaCDM model. Our result shows SIDM dramatically improves the ability to fit the rotation curve comparing to CDM. Discrepancy in halo masses corresponding to the same disk mass between result from fitting and expectation from abundance matching may indicate the “too-big-to-fail” problem still exist with current SIDM. Radial acceleration relation and baryonic Tully-Fisher relation are closely reproduced though with a bit large reasonable scatter. In addition, SIDM direct detection will be briefly discussed.

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