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Dark matter halos in the multicomponent model. Substructure and density profiles of galactic halos[1] KEITA TODOROKI, KU, MIKHAIL V. MEDVEDEV, KU, MIT — Multicomponent dark matter with inter-conversions of mass eigenstates into one another is known to successfully and simultaneously resolve ΛCDM problems at galactic and sub-galactic scales. Here, we present N-body simulations of the simplest two-component (2cDM) model with large set of velocity-dependent cross-sections, $\sigma(v) \propto v^a$, and compare them with observational data. They show that the 2cDM paradigm with the self-interaction cross-sections $0.01 \leq \sigma_0/m \leq 1$ cm^{2}g^{-1} and the mass degeneracy $\Delta m/m \sim 10^{-7} - 10^{-8}$ robustly resolves the substructure and too-big-to-fail problems by suppressing the substructure with $V_{\rm circ,max}100$ km s^{-1}. Furthermore, 2cDM robustly suppresses central cusps in dwarf halos with $M \sim 4 - 5 \times 10^{11} M_\odot$, thus resolving the core-cusp problem as well. The core radii are controlled by σ_0/m and the DM cross-section's velocity-dependent power-law indices (a_s, a_c), but are largely insensitive to the species' mass degeneracy. Next, there is disagreement between the radial distribution of dwarfs in a host halo observed in the Local Group and simulated with CDM, which poses one more small-scale problem to CDM, which is alleviated by 2cDM.

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