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Core Collapse in Self-Interacting Dark Matter Halos

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Self-interacting dark matter (SIDM) is compelling because it could solve the small-scale structure formation problems and it arises generically in new physics models with dark sectors. Using simulations of the Milky Way with moderate cross sections, we motivate velocity-dependent cross sections with large values for the cross section at the velocities relevant for dwarf halos. These cross section values would allow core collapse to occur in some Milky Way subhalos such that they would be dense enough to match the densest ultra-faint and classical dwarf spheroidal galaxies in the Milky Way. Some of these halos may also be driven into the short-mean-free-path (SMFP) regime. We discuss the structure of the SMFP core, the relevant scaling relations, and how they depend on the particle physics model. We show a new approximate universality for the first time that improves predictions of the SMFP evolution and the mass of the black hole likely to be left behind.

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