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Beyond collisionless dark matter

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Although collisionless dark matter (CDM) has been highly successful in explaining the large scale structure of the Universe, its success remains unclear on smaller scales. Observations of dwarf galaxies and Milky Way satellites show notable and long-standing disagreements compared to predictions from numerical CDM simulations. This discrepancy can be solved if dark matter is not collisionless, but possesses a large selfinteraction cross section. In this talk, I discuss the particle physics dynamics of self-interacting dark matter. Even within a minimal model, self-interactions can exhibit a rich structure, with different behaviors on small vs large scales. I show how considerations from astrophysical observations of structure, dark matter relic density, and indirect detection can map out the underlying particle physics parameter space of self-interacting dark matter.

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