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Modeling Dark Matter Self-Interactions Involving an Excited State

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Discrepancies between N-body dark matter simulations and the observed distribution of dark matter on galactic and sub-galactic scales have been advanced as evidence of a complex dark sector. Dark matter self-interactions can flatten density cusps and reduce halo concentrations, and the down-scattering of a relic population of dark matter particles in a nearly-degenerate excited state could have similar effects via the ejection of dark matter particles from halo cores. I will present a new semi-analytic approximation for dark matter self-scattering in such a multi-state model, at low velocities and force carrier masses where the Born approximation does not apply, allowing analytic study of the behavior of the inelastic scattering cross sections and the effects of the presence of the excited state on elastic scattering.

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