

Exploring Inelastic Self-Interacting Dark Matter with Linear Cosmology

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Inelastic self-interacting dark matter (iSIDM) provides a well-motivated extension of the cold dark matter paradigm, featuring multiple internal states connected by inelastic conversion processes. In this presentation, I will present a linear-cosmology framework for iSIDM, starting from a model-independent microphysical parameterization of the inelastic cross section and deriving the corresponding background and perturbation equations in an effective Boltzmann-code description. I will then discuss the resulting cosmological evolution, including the homogeneous chemical evolution and thermal history of the dark sector, demonstrating how these dynamics imprint characteristic signatures on the growth of density perturbations and the linear matter power spectrum. Finally, I will illustrate how the linear-theory predictions of iSIDM can be connected to existing data by translating the modified transfer function into two commonly used phenomenological constraints—those derived from the Lyman- α forest and high-redshift UV luminosity functions—thereby obtaining a preliminary mapping of the viable parameter space.

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