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The Galactic Consequences of Aggressively Dissipative Dark Matter

Dark sector theories naturally lead to multi-component scenarios for dark matter where a sub-component can dissipate energy through self-interactions, allowing efficient dark cooling within galaxies. In this talk, I'll present the first cosmological hydrodynamical simulations of dwarf galaxies and Milky Way-mass galaxies where the majority of the dark matter is collisionless Cold Dark Matter (CDM), but a sub-component (˜5%) is strongly dissipative minimal Atomic Dark Matter (ADM). The simulations demonstrate that the addition of even a small fraction of dissipative dark matter can significantly impact galactic evolution. ADM gas with roughly Standard Model-like masses and couplings can cool efficiently and gravitationally collapse. These effects can radically enhance galactic central densities, altering internal stellar kinematics as well as the properties of satellite galaxies around Milky Way-mass hosts. As a result, upcoming galactic observations with Rubin and other surveys will be extremely sensitive to dissipative dark interactions, helping us understand if dark matter exists in dark sectors with rich particle physics like the Standard Model.

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