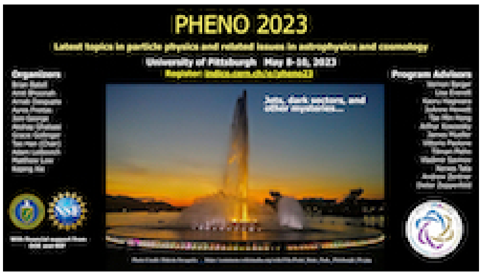

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Simulating Atomic Dark Matter in Milky Way Analogues

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Dark sector theories naturally lead to multi-component scenarios for dark matter where a sub-component can dissipate energy through self-interactions, allowing it to efficiently cool inside galaxies. We present the first cosmological hydrodynamical simulations of Milky Way analogues where the majority of dark matter is collisionless Cold Dark Matter (CDM), but a sub-component (6%) is strongly dissipative minimal Atomic Dark Matter (ADM). The simulations, implemented in GIZMO and utilizing FIRE-2 galaxy formation physics to model the standard baryonic sector, demonstrate that the addition of even a small fraction of dissipative dark matter can significantly impact galactic evolution despite being consistent with current cosmological constraints. We show that ADM gas with roughly Standard-Model-like masses and couplings can cool to form a rotating “dark disk” with angular momentum closely aligned with the visible stellar disk. The morphology of the disk depends sensitively on the parameters of the ADM model, which affect the cooling rates in the dark sector. The majority of the ADM gas gravitationally collapses into dark “clumps” (regions of black hole or mirror star formation), which form a prominent bulge and a rotating thick disk in the central galaxy. These clumps form early and quickly sink to the inner ˜kpc of the galaxy, affecting the galaxy’s star-formation history and present-day baryonic and CDM distributions.

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