

Axion-Like Dark Matter Feedback from Subgalactic Baryon Redistribution

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We investigate the hydrodynamic and quantum evolution of dark matter (DM) modeled as a Bose–Einstein condensate (BEC) with axion-like self-interaction within dwarf galaxies. The periodic nature of the interaction induces a multiphase halo structure with alternating stability zones, where low-density spatial tails undergo spinodal decomposition and fragment into clump- and foam-like structures [1]. While a massive solitonic core (~12% of total mass) provides local gravitational shielding, subgalactic structures remain highly susceptible to perturbations driven by baryonic redistribution. Focusing on the core boundary of NGC 2366, we show that baryonic variations induce a DM gravitational trap that enables long-term gas cooling and collapse, predicting the formation of a $10^6 M_\odot$ star cluster over 50 Myr. Conversely, linearized simulations of localized feedback scenarios (shell dynamics and dynamical friction) reveal highly suppressed DM winds (~several m/s), challenging direct observational detection. To address the long-term cumulative impact of multiple baryonic events, we develop a quantum excitation framework. We demonstrate that the lowest long-wavelength radial mode acts as a false vacuum state, undergoing non-viscous quantum relaxation with a characteristic decay lifetime of 68 Myr [2]. This mechanism drives a universal exponential damping of the system's evolution, while a nonlinear three-mode parametric energy exchange governs the subsequent redistribution of stable quasiparticle excitations.

[1] A. Nazarenko, Macroscopic states in Bose–Einstein condensate dark matter model with axionlike interaction, *Eur. Phys. J. C* 85 (2025) 1171.

[2] A. Nazarenko, Axionlike dark-matter winds driven by galactic baryon redistribution, arXiv:2603.22234 [astro-ph.GA].

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