

Scalar Dark Fifth Force with Induced Mass

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We propose a fifth force model in which dark matter (DM) couples to a scalar field, leading to deviations from standard cosmology.

The scalar field acquires an effective mass through its quadratic coupling to DM, which screens the fifth force on large scales and in the early universe. At late times, the scalar field evolves into two components: an attractor tightly coupled to DM and an oscillator that decouples and behaves like axion-like dark matter. The quadratic coupling strength determines the relative contributions of these components, with the attractor enhancing the matter power spectrum on small scales and the oscillator suppressing it. To resolve the rapid oscillations of the scalar field, we develop a modified effective fluid approximation and present numerical results for the matter power spectrum (and the MCMC results in the future). Our model provides a framework for exploring non-gravitational interactions in the dark sector and their observable imprints on cosmological structure.

Authors: CLINE, James (McGill University, (CA)); Dr SIBIRYAKOV, Sergey (McMaster U. & Perimeter Inst.); XIE, Tianyi (McGill University)

Presenter: XIE, Tianyi (McGill University)

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