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Geometric formulation and cosmological dynamics of kinetic k-essence

Tuesday 2 September 2025 15:00 (20 minutes)

We introduce a novel type of (integrable) vectorial nonmetricity, extending the previous literature by the inclusion of a cubic, completely symmetric term, reminiscent of statistical manifolds. The vectorial degree of freedom and three coefficients completely determine the geometric properties of the proposed connection. We find conditions on these coefficients, which guarantee the preservation of lengths, angles and volumes under (auto)parallel transport. Formulating the simplest linear action in this geometry, implemented through Lagrange multipliers, we show that the theory is equivalent to purely kinetic k-essence with quadratic terms. We generalise previous dynamical systems works by allowing for an arbitrary sign dependence in the coefficients, and derive detailed stability conditions for the theory. Using these stability conditions, we conduct and MCMC analysis with well-motivated priors, and find that, contrary to previous claims in the literature, purely kinetic k-essence is a viable candidate to describe late-time data, and is in fact statistically indistinguishable from ΛCDM. However, the scalar field behaves like evolving dark energy, unlike in the standard ΛCDM paradigm.

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