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Constraining Interacting Dark Energy Model with Cosmological Data

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We study the observational signature of non-gravitational interaction between the dark components of the cosmic fluids. We explore a phenomenological model of interacting dark energy and dark matter, characterised by a non-linear coupling term of the form $Q = 3H\xi\left(\frac{\rho_{dm}\rho_{de}}{\rho_{dm}+\rho_{de}}\right)$. This form of interaction naturally interpolates between linear regimes at early and late times, while avoiding divergences in the energy exchange term. We derive the background cosmological evolution equations and analyse the impact of the interaction on key observables, including the expansion history, the growth rate of structure, and the cosmic microwave background anisotropies. Using recent observational data sets including Planck CMB measurements, Type Ia supernovae, and BAO data, we constrain the interaction parameter and assess the model's potential to alleviate cosmological tensions.

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