

[online] Kinematic Probes of Type-II Minimally Modified Gravity

We study the late-time expansion history of the Universe within the VCDM model, a Type-II MMG realization that preserves the successes of General Relativity while extending beyond constant vacuum energy through a minimal Hamiltonian modification, generating a time-dependent vacuum sector without introducing additional degrees of freedom. We investigate this framework within a cosmographic approach by employing a Pad e $P_{(2,1)}$ approximation for the Hubble parameter and luminosity distance, allowing the cosmographic parameters to be expressed directly in terms of the underlying VCDM model parameters and enabling a data-driven reconstruction of the expansion history. The model is constrained within a Bayesian framework using the MCMC technique, implemented via the affine-invariant ensemble sampler, with a joint analysis of cosmic chronometers, DESI BAO, and Type Ia supernova datasets (Union3, Pantheon+, and DESY5). We find that the model parameters are tightly constrained and consistent across different dataset combinations, with the jerk parameter remaining very close to its Λ CDM value, $j_0 \simeq 1$, indicating no significant deviation at the level of higher-order cosmography. Furthermore, the transition feature previously reported in VCDM is not observed within the Pad e $P_{(2,1)}$ cosmographic reconstruction, suggesting that it is not a robust requirement of current observational data but is sensitive to the choice of parametrization. Overall, our results indicate that the VCDM model effectively mimics Λ CDM at the background level when constrained through a cosmographic approach, underscoring the importance of model-independent reconstructions in assessing alternative cosmological scenarios.

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Session Classification : Parallel-Cosmology