



Contribution ID: 10

Type: Oral presentation

Contributory: Background and Perturbation Constraints on Spinor Field Dark Energy from Recent Cosmological Observations

Monday, 16 November 2026 14:00 (15 minutes)

We investigate a nonlinear self-interacting spinor field as a dynamical dark-energy candidate capable of driving the late-time accelerated expansion of the Universe. The model is formulated within a spatially flat Friedmann–Lemaître–Robertson–Walker framework, where the spinor field is minimally coupled to gravity and generates an effective dark-energy equation of state through its self-interaction potential. We study both the background and perturbation dynamics of the model, deriving the evolution of the Hubble parameter ($H(z)$), equation-of-state parameter ($w(z)$), deceleration parameter ($q(z)$), and the growth of matter density perturbations. The background parameters are constrained through a Markov Chain Monte Carlo (MCMC) analysis using recent observational datasets, including cosmic chronometers, Pantheon supernovae, and baryon acoustic oscillation measurements. To assess the impact on structure formation, we implement the model at the perturbation level and examine its predictions for the growth rate ($f\sigma_8(z)$), matter power spectrum, and the evolution of density fluctuations. We find that the spinor dark-energy scenario successfully reproduces the observed expansion history while remaining compatible with current large-scale structure measurements. The effective equation of state evolves dynamically and approaches the cosmological-constant limit at late times, while allowing mild deviations at intermediate redshifts. Statistical model comparison shows that the spinor-field framework provides a viable and competitive alternative to the standard Λ CDM cosmology, motivating further investigation with forthcoming high-precision surveys such as DESI, Euclid, and Rubin Observatory.

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