

Dynamical dark energy from exponential $f(R)$ gravity: cosmological tensions and neutrino mass after DESI DR2

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The latest DESI DR2 BAO data favor a dynamical dark energy equation of state, reviving the question of whether late-time modifications of gravity can ease the tensions of the standard model. We test a generalized exponential $f(R)$ model with massive neutrinos, which produces an effective dynamical dark energy at low redshift while recovering Λ CDM at early times. Through a Bayesian MCMC analysis combining cosmic chronometers, DESI DR2 BAO, the CMB acoustic scale, and Pantheon+ supernovae, we constrain the model jointly with the total neutrino mass and compare it with Λ CDM and w_0w_a CDM. The exponential $f(R)$ model is statistically favored over Λ CDM, partially alleviates the Hubble tension, and mildly relaxes the cosmological neutrino mass bound, while retaining the theoretical foundation that the phenomenological CPL parameterization lacks. These results show how the interplay between modified gravity and neutrino physics offers a viable route to addressing cosmological tensions.

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