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Analysis of the cosmological evolution parameters, energy conditions, and linear matter perturbations of an exponential-type model in f(Q) gravity

We analytically study cosmological evolution in a flat FLRW spacetime in the context of modified STEGR gravity or f(Q), using an exponential two-parameter model which represents a smooth perturbative expansion around the ΛCDM model. The cosmological analysis is carried out by calculating the Hubble parameter as a function of redshift, for selected values of the parameters. The Hubble parameter is obtained analytically by means of several approximations good enough to deviate slightly from the numerical solution. Several late-time cosmological parameters are computed, such as dark energy state parameter, deceleration parameter, and statefinder parameters. Additionally, we analyzed the behavior of the classical energy conditions WEC, SEC, NEC, and DEC for both the combination of matter and geometrical contribution and the geometrical contribution alone. Beyond the background level, linear matter perturbations are studied by calculating parameters relevant to structure growth and formation. The overall results indicate that the model may exhibit quintessence-like and phantom-like behavior and it also impacts the growth of structures in the universe by means of late-time contributions to clustering.

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