Abstract

Cosmologists are struggling to understand why the expansion rate of our Universe is now accelerating. There are two sets of explanations for this remarkable observation: dark energy fills space or General Relativity fails on large scales. We study a rather general class of f(R) theories whose expansion history is compatible with cosmological observations, and show that the growth of structure D is scale-dependent, and systematically enhanced on all scales with respect to a smooth dark energy model with the same expansion history, H(z). We build a null test parameter $\epsilon(k, a)$, and show that it is identically zero on all scales in GR, contrary to the modified gravity case. Such parameter can be written in terms of the combination $\Omega_m h^2$ probed by the CMB, the linear galaxy bias b, and the linear redshift distortion parameter β. We show how redshift surveys in combination with CMB experiments can measure b and β, allowing precise determination of ϵ and thus a precision test of GR. We forecast that an experiment like ADEPT could measure ϵ to the percent level.