High Energy Physics - Theory

Asymptotically safe gravity as a scalar-tensor theory and its cosmological implications

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We study asymptotically safe gravity with Einstein-Hilbert truncation taking into account the renormalization group running of both gravitational and cosmological constants. We show the classical behavior of the theory is equivalent to a specific class of Jordan-Brans-Dicke theories with vanishing Brans-Dicke parameter, and potential determined by the renormalization group equation. The theory may be reformulated as an $f(R)$ theory. In the simplest cosmological scenario, we find large--field inflationary solutions near the Planck scale where the effective field theory description breaks down. Finally, we discuss the implications of a running gravitational constant to background dynamics via cosmological perturbation theory. We show that compatibility with General Relativity requires contributions from the running gravitational constant to the stress energy tensor to be taken into account in the perturbation analysis.

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