Cosmological consequences of non-standard gravitational interactions

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Abstract

Theoretical efforts to explain many of the cosmological and astronomical observations commonly require to postulate the existence of new particles. However, no degrees of freedom beyond those of the standard model of particle physics have been unveiled so far on cutting edge experiments such as ATLAS/CMS at the LHC. Although new fields might still exist at very high energies, it would be possible that the new physics which is needed to explain cosmological and astrophysical phenomena, mainly lies in novel gravity- particles' interactions. In this talk I will discuss this minimalistic possibility and I will point out that interesting new physical effects can emerge if the strong equivalence principle is abandoned at high energies. In particular, I will show that recent BICEP2 and Planck data are compatible with the minimal scenario of a Higgs boson inflaton and a QCD axion dark matter only in the case in which both fields are non-minimally kinetically coupled to gravity.