Cosmological consequences of non-standard gravitational interactions

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February 21st, 2014

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. As a worked out example, I will show how cosmic Inflation, and the consequent generation of primordial anisotropies, can be naturally accommodated within the standard model of particle physics non-minimally coupled to gravity. In addition, in the same framework, I will show that a minimal extension of the standard model with the QCD axion can also account for the observed missing Dark Matter, without any clash with Planck observations