High Energy Physics - Phenomenology

Higgs-Dilaton Cosmology: From the Early to the Late Universe

Juan García-Bellido, Javier Rubio, Mikhail Shaposhnikov, Daniel Zenhäusern

(Submitted on 11 Jul 2011)

We consider a minimal scale-invariant extension of the Standard Model of particle physics combined with Unimodular Gravity formulated in \cite{Shaposhnikov:2008xb}. This theory is able to describe not only an inflationary stage, related to the Standard Model Higgs field, but also a late period of Dark Energy domination, associated with an almost massless dilaton. A number of parameters can be fixed by inflationary physics, allowing to make specific predictions for any subsequent period. In particular, we derive a relation between the tilt of the primordial spectrum of scalar fluctuations, n_s, and the present value of the equation of state parameter of dark energy, ω_{DE}^0. We find bounds for the scalar tilt, $n_s<0.97$, the associated running, $-0.0006<d\ln n_s/d\ln k\lesssim-0.00015$, and for the scalar-to-tensor ratio, $0.0009\lesssim r<0.0033$, which will be critically tested by the results of the Planck mission. For the equation of state of dark energy, the model predicts $\omega_{DE}^0>-1$. The relation between n_s and ω_{DE}^0 allows us to use the current observational bounds on n_s to further constrain the dark energy equation of state to $0< 1+\omega_{DE}^0< 0.02$, which is to be confronted with future dark energy surveys.

Subjects: **High Energy Physics - Phenomenology (hep-ph)**; Cosmology and Extragalactic Astrophysics (astro-ph.CO); High Energy Physics - Theory (hep-th)

Cite as: **arXiv:1107.2163 [hep-ph]**

(or **arXiv:1107.2163v1 [hep-ph]** for this version)

Submission history

From: Daniel Zenhäusern [view email]

[v1] Mon, 11 Jul 2011 23:11:59 GMT (1235kb,D)

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