High Energy Physics - Theory

The No-Boundary Measure in the Regime of Eternal Inflation

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(Submitted on 1 Jan 2010)

The no-boundary wave function (NBWF) specifies a measure for prediction in cosmology that selects inflationary histories and remains well behaved for spatially large or infinite universes. This paper explores the predictions of the NBWF for linear scalar fluctuations about homogeneous and isotropic backgrounds in models with a single scalar field moving in a quadratic potential. We treat both the space-time geometry of the universe and the observers inhabiting it quantum mechanically. We evaluate top-down probabilities for local observations that are conditioned on the NBWF and on part of our data as observers of the universe. For models where the most probable histories do not have a regime of eternal inflation, the NBWF predicts homogeneity on large scales, a specific non-Gaussian spectrum of observable fluctuations, and a small amount of inflation in our past. By contrast, for models where the dominant histories have a regime of eternal inflation, the NBWF predicts significant inhomogeneity on scales much larger than the present horizon, a Gaussian spectrum of observable fluctuations, and a long period of inflation in our past. The absence or presence of local non-Gaussianity therefore provides information about the global structure of the universe, assuming the NBWF.

Comments:	29 pages, 8 figures
Subjects:	**High Energy Physics - Theory (hep-th)**; Cosmology and Extragalactic Astrophysics (astro-ph.CO); General Relativity and Quantum Cosmology (gr-qc)
Cite as:	**arXiv:1001.0262v1 [hep-th]**

Submission history

From: Thomas Hertog [view email]
[v1] Fri, 1 Jan 2010 22:21:42 GMT (680kb)

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