

## GR 3: Cosmology II

Time: Tuesday 11:00–12:25

Location: HSZ/0401

**Invited Talk**

GR 3.1 Tue 11:00 HSZ/0401

**Scalaron-Higgs inflation** — •CHRISTIAN STEINWACHS — University of Freiburg, Germany

After discussing various theoretical properties of scalar field theories in curved spacetime from an effective field theory point of view, I propose a concrete model that offers a unified description of inflationary cosmology, dark matter, and elementary particle physics at the electroweak scale. Except for a non-minimal coupling of the Standard Model Higgs boson to a modified gravitational sector, no new physics is required.

GR 3.2 Tue 11:45 HSZ/0401

**Universality in cosmic structures** — •MATTHIAS BARTELMANN — Institut für Theoretische Physik, Universität Heidelberg

Kinetic field theory allows describing cosmic structure formation analytically quite deeply into the non-linear regime of density fluctuations. We have used this theory to investigate several questions concerning the universality of cosmic structures. This talk will focus on three main results, partly obtained within a suitable mean-field approximation: (1) the universality of cosmic structures in the asymptotic small-scale limit; (2) generic effects of modified gravity theories on cosmic structure formation; and (3) possible imprints of the dark-matter model on

small-scale cosmic structures.

GR 3.3 Tue 12:05 HSZ/0401

**Inflation and its Discontents** — •MARC HOLMAN — Utrecht University, Utrecht, The Netherlands

Since their basic inception in the early 1980s, inflationary models have been shown to exhibit various physical and conceptual deficits. The main purpose of the present talk is to provide a systematic review of these deficits. One well-known issue, for instance, is that of initial conditions: originally invoked to address a very specific perceived fine-tuning in initial conditions, inflation inevitably seems to lead to fine-tuning problems of its own. Other problems include the transition to classicality, the spontaneous breaking of symmetry and crucially, as I will argue, the “multiverse” and the very rationale for inflation in the first place. A feature that is often claimed as a major success of inflationary models is their generic prediction of a (nearly) scale invariant, Gaussian spectrum of CMB density perturbations. As is less commonly emphasized however, effectively such a prediction was already made well before the entire notion of inflation even existed and, more importantly, is not unique to the specific inflationary mechanism of exponential primordial expansion. Time permitting, routes for viable alternatives to inflation are briefly discussed, emphasizing their key challenges.