GR 7: Cosmology

Time: Tuesday 15:20–16:00 Location: H 2013

GR 7.1 Tue 15:20 H 2013

The question of quantum equivalence between Jordan and Einstein frames in cosmology — •Christian F. Steinwachs[1] and Alexander Yu. Kamenshchik[2,3] — [1]Physikalisches Institut, Albert-Ludwigs-Universität, Freiburg, Germany — [2]Dipartimento di Fisica e Astronomia and INFN, Bologna, Italy — [3]L. D. Landau Institute for Theoretical Physics of the Russian Academy of Sciences, Moscow, Russia

We investigate the equivalence between two different parametrizations of fields in cosmology – the so-called Jordan frame and Einstein frame – in the framework of a general scalar-tensor theory. While it is clear that both parametrizations are mathematically equivalent at the level of the classical action, the question about their mathematical equivalence at the quantum level as well as their physical equivalence is still a matter of debate in cosmology. We analyze whether the mathematical equivalence still holds when the first quantum corrections are taken into account. We explicitly calculate the one-loop divergences in both parametrizations by using the generalized Schwinger-DeWitt algorithm and find that quantum corrections induce an off-shell dependence on the parametrization. An explanation of the origin and a possible resolution of this quantum ambiguity is suggested to be found within a geometric field theoretical approach. Finally, we discuss the physical implications of this analysis and its consequences for cosmology.

GR 7.2 Tue 15:40 H 2013

Coarse-grained cosmological perturbation theory: stirring up the dust model — •Cora Uhlemann[1,2] and Michael Kopp[1,2] — [1]Arnold Sommerfeld Center, LMU Munich — [2]Excellence Cluster Universe, Garching

Analytical methods for the theoretical description of large-scale structure formation are in general based on the dust model which describes cold dark matter as a pressureless fluid. We study the effect of coarse-graining the dynamics of such a pressureless selfgravitating fluid in the context of cosmological perturbation theory. The effect of the smoothing is illustrated by means of power and cross spectra for density and velocity that are computed up to 1-loop order. A prominent consequence of the coarse-graining is the generation of large-scale vorticity which is also observed in N-body simulations and has certain links to the effective field theory of large scale structure.