GR 14: Kosmologie II

Zeit: Donnerstag 16:30–18:00 Raum: HS 6

GR 14.1 Do 16:30 HS 6

The effects of warm dark matter on the large scale structure in the universe — •Katarina Markovic — University Observatory Munich

Warm Dark Matter (WDM) is a generalisation of the standard Cold Dark Matter model in the sense that it does not assume dark matter particles to be absolutely cold. In the simplest models all dark matter is made of the same particles, which started out in thermal equilibrium and cooled to effectively become cold today. If such particles have masses of the order of a keV or less, they leave an observable imprint on the dark matter density field. At late times, the perturbations in the matter density field become non-linear. This means that they cannot be described perturbatively any longer. For this reason, N-body simulations are a good way to understand the formation of non-linear structure. Simulating WDM can be a challenge, because unlike CDM, it's relatively large thermal velocities can introduce unwanted Poisson noise on small scales. With better computing resources nowadays it has become possible to examine WDM cosmologies with simulations. This talk will present results of such simulations together with the halo model and discuss how to calculate non-linear corrections to the matter power spectrum, which describes the matter density field today. It will also discuss the possibility of constraining the dark matter particle mass using measurements of large scale structure, like cosmic shear or galaxy clustering.

GR 14.2 Do 16:45 HS 6

Newtonian N-body simulations are compatible with cosmological perturbation theory — •Thomas Haugg, Stefan Hofmann, and Michael Kopp — LMU Munich

We elaborate on the recent claim (Flender & Schwarz 2012) that Newtonian N-body simulations of collisionless Dark Matter in a LambdaCDM background are inaccurate on scales larger than 10 Mpc due to general relativistic effects at the linear level. We find that at the 10 Mpc scale these effects are indeed important, however are well known as gravitational lensing. At even larger scales all relativistic corrections can in general become equal in size. Using Bardeen variables we give a dictionary for how to use Newtonian N-body simulation data to correctly evaluate these general relativistic terms at all scales where linear perturbation theory applies, in particular at scales larger than 10 Mpc up to arbitrary large scales.

GR 14.3 Do 17:00 HS 6

The trajectories of photons in an averaged space time — •Samae Bagheri — Uni Bielefeld D6-136, Universitätsstr. 25, 33615 Bielefeld

The present state of the Universe is neither homogeneous nor isotropic on scales smaller than 100 Mps. By taking the principal assumption of spatial homogeneity and isotropy on the largest scales, the averaging of local inhomogeneities can lead to dynamical effects on the evolution of the Universe. There are a number of averaging procedures that have been introduced in order to study this subject. We will describe two of the main schemes that can deal with inhomogeneities. One is Buchert's averaging which only scalar quantities are averaged and second is Zalaletdinov's averaging. The later allows tensor quantities to be averaged, as well as scalars. As the next step, we will discuss about the motion of photons in an averaged geometry within the context of the geodesic equation. All conclusions about cosmological data are based on the trajectories of photons. We consider the case of a null geodesic in the FLRW background space time. After averaging we obtain a smoothed out geometry with averaged metric. By doing so, we aim to pose the question of what trajectories photons follow in the averaged geometry.

GR 14.4 Do 17:15 HS 6

Dark energy emerging from gravitationally effective vacuum fluctuations — •Bruno Deiss — Institut für Theoretische Physik, Universität Frankfurt

In this contribution I present a new model that provides a natural UV cut-off, beyond which vacuum fluctuations decouple from expanding space-time, i.e., decouple from gravity. The model relies on two assumptions: firstly, virtual fluctuations are subjected to the overall expansion of space during their limited lifetime; secondly, space-time has a *process-related* discrete structure, which means that only *changes* of length-scales and time-scales are constraint by a minimal scale. The derived effective vacuum energy density is found to be closely related to the critical cosmic energy density, thus helping to solve the cosmological constant problem as well as the coincidence problem.

GR 14.5 Do 17:30 HS 6

Minkowski functionals of the Sloan Digital Sky Survey — •Alexander Wiegand[1], Thomas Buchert[2], and Matthias Ostermann[3] — [1]Albert Einstein Institut, Golm — [2]CRAL, Lyon — [3]LMU, München

In this talk, we present the results of our analysis of the structure in the Galaxy distribution of the Sloan Digital Sky Survey, that we performed with the help of Minkowski functionals. With the discovery of larger and larger coherent structures, it is worthwhile to test the consistency of the observations with the standard models of structure formation. In particular we use the boolean grain model, that allows a very precise and robust comparison. In addition, the Minkowski functionals in this model may be analytically related to a series of the (higher order) correlation functions of the distribution. This allows us to quantify the influence of higher order clustering beyond the simple two point correlations. Comparing the Minkowski functionals to a set of N-body simulations we find a small, but significant deviation of the observed structure from the simulated one.

GR 14.6 Do 17:45 HS 6

Resimulating the local universe — •Steffen Hess — Leiniz Institut f. Astrophysik Potsdam

Within a Lambda-CDM model we are using a combined approach consisting of an iterative reconstruction based on non-linear Lagrangian Perturbation Theory and a fully non-linear N-body simulation we are able to re-simulate the matter density in the local universe with unprecedented correlation with the galaxy distribution in the 2MASS redshift survey.