GR 9: Kosmologie 1

Zeit: Dienstag 17:25–19:05 Raum: JUR K

GR 9.1 Di 17:25 JUR K

Quartessence Models in Cosmology — •Hermano Velten — Fakultät für Physik, Universität Bielefeld, Bielefeld, Deutschland — Departamento de Física, Universidade Federal do Espírito Santo, Brasil

Two of the major puzzles of modern comsology are the nature of dark energy and dark matter. In this contribution we consider the hypothesis that dark energy and dark matter could be different manifestations, observed at different scales, of the same substance, the unifying dark matter or quartessence. We shall show some recent results of this class of models in the context of structure formation process in the universe.

GR 9.2 Di 17:45 JUR K

Stochastic Inflation and Replica Field Theory — •Florian Kühnel — Bielefeld University

In this talk, I discuss the application of replica field theory to stochastic inflation. After a review of the latter and a basic introduction to the former, I present recent results for the power spectrum. This is done for a minimally-coupled test field in de Sitter space-time. I will comment on the choice of filter functions and discuss the infra-red suppression of the power spectrum as an outcome of this new approach. In particular, I will show how this damping might explain the observed lack of large-angle correlation on the non-Galactic microwave sky.

GR 9.3 Di 18:05 JUR K

Optics in curved space — •Vincent Schultheiss[1,2], Sascha Batz[1,2], and Ulf Peschel[2] — [1]MPI für die Physik des Lichts, Erlangen, Germany — [2]Institut für Optik, Information und Photonik, Universität Erlangen-Nürnberg, Germany

The conventional way of manipulating light propagation is to introduce specific optical elements, which break the homogeneity of the transmitting medium by modulating the refractive index. In this context the underlying space is assumed to be flat. However, Maxwell's equations are not limited to the specific case of Euclidean space, but can be generalized to a covariant form holding also in curved space. It turns out that indeed space influences the evolution of light beyond the ray-optical approximation even without the need of modulating the refractive index. Here we present the very first experimental study of the impact of intrinsic curvature on the evolution of optical waves. While so-called transformation optics proposes the use of metamaterials to mimic non flat space-time, we choose a more direct approach and abandon one spatial dimension to investigate light propagation on specifically shaped two-dimensional curved surfaces embedded in three dimensional space. For positive intrinsic (or Gaussian) curvature as it is modeled by the surface of a sphere we observe periodic refocusing, self-imaging and diffractionless propagation. In contrast light spreads exponentially on hyperbolic surfaces with constant negative Gaussian curvature. The proposed ideas open up new approaches to manipulate light in integrated optical circuits and investigate analogous models of general relativity.

GR 9.4 Di 18:25 JUR K

Variable Speed of Light and its Cosmological Implications — •Alexander Unzicker — Pestalozzi-Gymnasium München

Variable speed of light (VSL) formulations of general relativity have been shown to be in accordance with the four classical tests. The approach presented here combines Dicke's (1953) theory (different from Brans-Dicke) with de Broglies phase velocity formula $c^2 = vV$ in order to obtain equations of motion from a variational principle of minimum phase. This realizes Mach's principle with variable time and lenght scales. The cosmological consequences would explain Dirac's observation on the total number of particles in the universe known as Large Number Hypothesis. Furthermore, it is discussed how small accelerations on the cosmological scale $10^{-10}\,\frac{m}{s^2}$ can appear.

GR 9.5 Di 18:45 JUR K

Physical applications of a natural interpretation of the constant of gravity — •Reinhold Zwickler — Am Trautheim 14, D-64367 Mühltal, Germany

According to Heisenberg and J.D.Barrow progress in physics may require a new system of concepts and/or a revision of constants of nature. In this paper a complete solution of the "cosmologic problem" is presented, based on a generalization of the Newtonian system of concepts and a natural interpretation of the constant of gravity G.The solution unifies two generalized laws of classical physics into one space-time-equation, in which the constant of gravity arises as an initial condition and determines the accelerated expansion of the universe once and for all.The mean density of matter of today is predicted correctly. The new interpretation of G as "specific expansion acceleration" is a necessary completion to the phenomen of attraction in order to avoid a collaps of the galaxies and to provide a state of equilibrium of the universe. It is shown that the cosmic balance can be compared with the phase equilibrium between liquid and gas for water even above the critical point, where the theory of the cosmos can be used as an analoguous solution for the inconsistent definition of "liquid" and "gas" as formulated by Planck with a conceptual paradox in 1897. The principle of equi-librium seems the be a general order principle in nature. A discussion of some rash conclusions about classical physics and of doubtful opinions in today physics is necessary in the interest of progress in science and education.