GR 102 Mathematische Methoden

Zeit: Montag 16:30–17:50 Raum: K

GR 102.1 Mo 16:30 K

The change of differential structure and the resolution of singularities — •Torsten Asselmeyer-Maluga — FhG FIRST, Kekulestr. 7, 12489 Berlin

The space-time seen as 4-dimensional manifold can admit a varity of different differential structures or non-equivalent reference frames by a fixed topology. By the general formalism of singular connections, developed by Harvey and Lawson, it is shown that a singularity in Einsteins general relativity theory can be resolved by using the change of the differential structure. The consequences are discussed.

GR 102.2 Mo 16:50 K

A Relativistic Fluctuation Theorem — •Axel Fingerle — Max Planck Institute for Dynamics and Self-Organization, Bunsenstrasse 10, 37073 Goettingen

In the description of nonequilibrium systems, powerful general statements on the entropy production have become known as Fluctuation Theorems within the last ten years. Based on recent results of P. Hänggi and J. Dunkel [Phys. Rev. E, **71** 016124; Phys. Rev. E, **72** 036106 (2005)], a Fluctuation Theorem for special-relativistic Brownian motion is proven that remains valid in the high temperature limit. Beyond special relativity, the Fluctuation Theorem is stated for cosmological standard models. Since the Fluctuation Theorem establishes the existence of a thermodynamic arrow of time, two formulations are given: one for a time reversion map Π inverting the cosmic expansion, and one for Π acting only locally.

GR 102.3 Mo 17:10 K

The Averaging Problem in General Relativity — •Juliane Behrend[1], Otto Nachtmann[1], and Thomas Richter[2] — [1]Institut für Theoretische Physik, Universität Heidelberg, Philosophenweg 16 — [2]Institut für Angewandte Mathematik, Universität Heidelberg, INF 293

We present a generally covariant averaging process which provides a possible way of smoothing spacetime geometry within the framework of general relativity. Such an averaging process is primarily needed for a correct description of the average dynamics of matter inhomogeneities in the universe. The process is visualized on the specific example of a perturbed two sphere, which involves the numerical solution of a partial differential equation by the aid of the simulation toolkit Gascoigne. The results are discussed particularly with regard to their possible cosmic relevance.

GR 102.4 Mo 17:30 K

Puzzles of isotropic and anisotropic conformal cosmologies. — •Tomasz Denkiewicz[1], David Blaschke[2], and Mariusz Dabrowski[3] — [1]Institut für Physik, Universitätsplatz 3, D-18051 Rostock, Germany — [2]Gesellschaft für Schwerionenforschung (GSI) mbH, Planckstrasse 1,D-64291 Darmstadt, Germany — [3]Instytut fizyki, 70-451 Szczecin, ul. Wielkopolska 15, Poland

Conformal relativity is the theory which allows the invariance with respect to conformal transformations of the metric. It is shown that in the vacuum conformal relativity there are no isotropic Friedmann solutions of non-zero spatial curvature. Only flat isotropic models are consistent with the field equations. On the other hand, it is shown explicitly that the anisotropic non-zero spatial curvature models of Kantowski-Sachs type are admissible in vacuum conformal relativity. It then seems that an additional scale factor which appears in anisotropic models gives an extra deegre of freedom to the theory and makes it less restrictive than in an isotropic Friedmann case.

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