MP 8: Von der Gravitation zur Quantengravitation

Zeit: Donnerstag 11:00–12:30 Raum: VMP6 HS B

MP 8.1 Do 11:00 VMP6 HS B

Harmonic d-tensors — •Manuel Hohmann — Physikalisches Institut, Universität Tartu, Estland

Tensor harmonics are a useful mathematical tool for finding solutions to differential equations which transform under a particular representation of the rotation group SO(3). In order to make use of this tool also in the setting of Finsler geometry, where the objects of relevance are d-tensors instead of tensors, we construct a set of d-tensor harmonics for both SO(3) and SO(4) symmetries and show how these can be used for calculations in Finsler geometry and gravity.

MP 8.2 Do 11:20 VMP6 HS B

Tetrads and relativistic dynamics in and of spacetime — •David Vasak[1], Jürgen Struckmeier[1,2,3], Matthias Hanauske[1,2], Adrian Königstein[1,2], Johannes Kirsch[1], and Horst Stöcker[1,2,3] — [1]Frankfurt Institute for Advanced Studies, Ruth-Moufang-Str. 1, 60438 Frankfurt am Main — [2]Institut für Theoretische Physik, Goethe Universität, Max-von-Laue-Str. 1, 60438 Frankfurt am Main — [3]Helmholtzzentrum für Schwerionenforschung (GSI), Planckstr. 1, 64291 Darmstadt

The fundamental importance of tetrad fields for the description of observable quantities in curvilinear relativistic spacetime is derived from differential geometry. The relation to affine connections in the Lorentz and coordinate representations and to other derived quantities like torsion or curvature is shown in the tensor calculus. The covariant dynamics in the observer frame will be illustrated with help of the Klein-Gordon and Dirac fields. Implications for the dynamics of spacetime itself are discussed in the framework of canonical transformations.

10 Minuten Pause

MP 8.3 Do 11:50 VMP6 HS B

The Poincaré Symmetric String — Norbert Dragon and •Florian Oppermann — Institut für Theoretische Physik, Leibniz Universität Hannover, Appelstr. 2, 30167 Hannover

Using the toy model of the free bosonic string we discuss Poincaré symmetric quantum theories with maps between massless and massive states.

In String Theory these maps are given by creation and annihilation operators α_n^μ which generate the Fock space and therefore connect states on different mass shells. When examined carefully the commutator relations lead to contradictions in most quantization schemes, namely empty physical Hilbert spaces, negative mass shells and problems with Lorentz generators.

It can be seen that these problems don't occur due to the method of quantization but because of a fundamental difference between massive and massless states. The Mackey theory of unitary representations of the Poincaré group shows that the latter cannot be described by global momentum wave functions (except in $D = 3, 5, 9$) but need local sections in a bundle.

MP 8.4 Do 12:10 VMP6 HS B

Correlation Functions in Quantum Gravity — Holger Gies, •Benjamin Knorr, and Stefan Lippoldt — Theoretisch-Physikalisches Institut, Friedrich-Schiller-Universität Jena

We present some aspects of non-perturbative correlation functions of quantum gravity. In particular, the influence of curvature on gravitational correlations is investigated. Possible future applications of this include, e.g., genuine quantum gravity effects in black hole physics and gravitational waves.