T 83: Quantenfeldtheorie 1

Zeit: Mittwoch 16:45–18:50 Raum: P15

T 83.1 Mi 16:45 P15

Revealing the small-scale structure of spacetime with renormalisation group methods — •Christoph Rahmede — KIT, Institute of Theoretical Physics, W.-Gaede-Str. 1, 76128 Karlsruhe

If the renormalisation group flow of gravity has a fixed point with a finite number of attractive directions, gravity is asymptotically safe and is well-defined up to arbitrarily high energies or arbitrarily small length scales. I report on recent progress in testing this idea for different classes of interaction operators.

T 83.2 Mi 17:00 P15

Dilaton Quantum Gravity — •Tobias Henz, Jan Martin Pawlowski, Andreas Rodigast, and Christof Wetterich — Institut für Theoretische Physik, Universität Heidelberg

We propose a simple fixed point scenario in the renormalization flow of a scalar dilaton coupled to gravity. This would render gravity non-perturbatively renormalizable and thus constitute a viable theory of quantum gravity. On the fixed point dilatation symmetry is exact and the quantum effective action takes a very simple form. Realistic gravity with a nonzero Planck mass is obtained through a nonzero expectation value for the scalar field, constituting a spontaneous scale symmetry breaking. Furthermore, relevant couplings for the flow away from the fixed point can be associated with a 'dilatation anomaly' that is responsible for dynamical dark energy. For the proposed fixed point and flow away from it the cosmological 'constant' vanishes for asymptotic time.

T 83.3 Mi 17:15 P15

Dimensional reduction in asymptotically safe gravity — •Natalia Alkofer[1], Daniel F. Litim[2], and Bernd-Jochen Schaefer[3] — [1]Institut fuer Physik, Karl-Franzens Universitaet Graz, Austria — [2]Department of Physics and Astronomy, University of Sussex, U.K. — [3]Institut fuer Theoretische Physik, Justus-Liebig-Universitaet Gießen, Germany

The functional renormalisation group for the Einstein-Hilbert action is investigated for the case of four infinite (or large) and one compact dimensions. Results for the four- to five-dimensional crossover are presented employing two forms of the background field flow. Renormalisation group trajectories allowing for a significant lowering of the true Planck scale to the electroweak scale are identified. The behaviour of the running gravitational coupling at the crossover and the true Planck scale is discussed.

T 83.4 Mi 17:30 P15

Renormalization Group Flow of Asymptotically Safe Gravity with Scalar Fields — •Peter Schuh — TU Dortmund, Deutschland

The Asymptotic Safety Scenario attempts to find a consistent model for gravity as a quantum field theory by proposing a fixed point in the renormalization group flow as a generalization of the concept of perturbative renormalizability. In this talk, the influence of multiple scalar particles on the existence and stability of fixed points is investigated, allowing for mass and interaction terms extending previous calculations.

T 83.5 Mi 17:45 P15

Renormalization group flow of Horava-Lifshitz gravity at low energies — •Adriano Contillo[1], Stefan Rechenberger[2], and Frank Saueressig[1] — [1]Radboud Universiteit, Nijmegen, The Netherlands — [2]Technische Universität, Darmstadt, Germany

The functional renormalization group equation for projectable Horava-Lifshitz gravity is used to derive the non-perturbative beta functions for the Newton's constant, cosmological constant and anisotropy parameter. The resulting coupled differential equations are studied in detail and exemplary RG trajectories are constructed numerically. The beta functions possess a non-Gaussian fixed point and a one-parameter family of Gaussian fixed points. One of the Gaussian fixed points corresponds to the Einstein-Hilbert action with vanishing cosmological constant and constitutes a saddle point with one IR-attractive direction. For RG trajectories dragged into this fixed point at low energies diffeomorphism invariance is restored. The emergence of general relativity from Horava-Lifshitz gravity can thus be understood as a crossover-phenomenon where the IR behavior of the theory is controlled by this Gaussian fixed point. In particular RG trajectories with a tiny positive cosmological constant also come with an anisotropy parameter which is compatible with experimental constraints, providing a mechanism for the approximate restoration of diffeomorphism invariance in the IR. The non-Gaussian fixed point is UV-attractive in all three coupling constants. Most likely, this fixed point is the imprint of Asymptotic Safety at the level of Horava-Lifshitz gravity.

T 83.6 Mi 18:00 P15

Avoidance of a Landau Pole by Flat Contributions in QED — •Lutz Klaczynski — Humboldt Universität Berlin

We consider massless Quantum Electrodynamics in momentum scheme and carry forward an approach based on Dyson–Schwinger equations to approximate both the beta-function and the renormalized photon self-energy. Starting from the Callan-Symanzik equation, we derive a renormalization group (RG) recursion identity which implies a non-linear ODE for the anomalous dimension and extract a sufficient but not necessary criterion for the existence of a Landau pole. This criterion implies a necessary condition for QED to have no such pole. Solving the differential equation exactly for a toy model case, we integrate the corresponding RG equation for the running coupling and find that even though the beta-function entails a Landau pole it exhibits a flat contribution capable of decreasing its growth, in other cases possibly to the extent that such a pole is avoided altogether. Finally, by applying the recursion identity, we compute the photon propagator and investigate the effect of flat contributions on both spacelike and timelike photons.

T 83.7 Mi 18:15 P15

QED-Korrekturen zu Myon-Bremsstrahlung — •Alexander Sandrock — Technische Universität Dortmund

Die systematischen Unsicherheiten des IceCube-Detektors stammen zu einem bedeutenden Teil aus den Unsicherheiten in der Theorie der Myonwirkungsquerschnitte. Zur Berechnung der Beiträge von Korrekturen höherer Ordnung zum Bremsstrahlungswirkungsquerschnitt von Myonen im Feld von Atomkernen wurde ein Modell entwickelt, das die halbautomatische Erzeugung und Berechnung von Feynmandiagrammen für diesen Prozess gestattet. In diesem Vortrag werden die Erstellung des Modells sowie Ergebnisse der Modellrechnungen vorgestellt.

Gruppenbericht T 83.8 Mi 18:30 P15

On the analytic structure of propagators in Landau gauge QCD — Reinhard Alkofer[1], Christian Fischer[2], Markus Q. Huber[3], and •Andreas Windisch[1] — [1]Institut fuer Physik, Karl-Franzens Universitaet Graz, Universitaetsplatz 5, 8010 Graz, Austria — [2]Institut fuer Theoretische Physik, Justus-Liebig Universitaet Giessen, 35392 Giessen, Germany — [3]Institut fuer Kernphysik, Technische Universitaet Darmstadt, Schlossgartenstrasse 2, 64289 Darmstadt, Germany

The analytic structure of Green's functions holds valuable information on the propagating degree of freedom. In particular, the notion of positivity violation of spectral densities establishes a sufficient (though not necessary) criterion to expel the degree of freedom from the space of asymptotic states, serving thus as a simple mechanism of confinement. Here we discuss methods of calculating the analytic properties of the non-perturbative Landau gauge quark propagator by means of Dyson-Schwinger equations.