T 25: Quantenfeldtheorie

Convenor: Stefan Weinzierl

Zeit: Freitag 14:00–16:10 Raum: M010

T 25.1 Fr 14:00 M010

Quantum fields far from equilibrium: instabilities and non-thermal fixed points — Jürgen Berges[1], •Jens Pruschke[1], and Alexander Rothkopf[2] — [1]Institute for Nuclear Physics, Darmstadt University of Technology, Schlossgartenstr. 9, 64285 Darmstadt, Germany — [2]Department of Physics, University of Tokyo, Tokyo 113-0033, Japan

Quantum field theoretical studies of bosonic systems far from equilibrium show a slow evolution after an instability took place. This prevents a fast thermalization. Scattering between bosons and fermions might lead to an acceleration of the evolution towards equilibrium.

We investigate the interaction of fermionic and bosonic quantum fields out of equilibrium in a Yukawa type model. A spinodal/tachyonic instability in the bosonic sector induces an unstable evolution in the fermionic sector too. In a certain parameter regime the influence of the fermionic fields on the boson sector is negligible. Instead of an acceleration of the evolution the emergence of non-thermal fixed points is observed. The results have important consequences, for example in reheating the universe after inflation.

T 25.2 Fr 14:15 M010

Electroweak Sphaleron with Spin and Charge — •Burkhard Kleihaus, Jutta Kunz, and Michael Leissner — Universität Oldenburg

The Klinkhamer-Manton sphaleron of the electroweak interaction is a static classical saddlepoint of the energy functional, representing the top of the energy barrier between topologically inequivalent vacua. The rate of baryon number violating processes is largely determined by the Boltzmann factor, containing the energy of the sphaleron. We show that, at finite weak mixing angle the sphaleron solution of Weinberg-Salam theory can be endowed with angular momentum proportional to the electric charge. Carrying baryon number 1/2 these sphalerons with spin and charge may contribute to baryon number violating processes.

T 25.3 Fr 14:30 M010

Is vacuum stability UV sensitive? — •Charlotte Hellmann, Stefano Actis, and Martin Beneke — Institut für Theoretische Physik E, RWTH Aachen

An upper and lower bound on the Higgs mass can be derived from the requirement that the Standard Model is perturbative and the electroweak vacuum is stable up to a certain scale.

In recent work Fodor et al. raise the issue that vacuum stability can only be addressed with non-perturbative methods and is sensitive to physics at the cut-off such that vacuum instability is absent when ultraviolet effects are correctly accounted for.

We discuss these issues in an toy model with an additional heavy scalar and find that UV physics decouples and does not change the conclusions on instability of the electroweak vacuum, if the scale of UV physics is above the scale, where the electroweak vacuum becomes unstable according to the standard perturbative calculation. We also investigate the effect of higher-dimensional operators.

T 25.4 Fr 14:45 M010

Feynman graph polynomials and iterative algorithms — •Christian Bogner — Johannes Gutenberg-Universität Mainz

I briefly report on recent work with Stefan Weinzierl, where we have proven a theorem, stating that the Laurent coefficients of scalar Feynman integrals are periods in the sense of Kontsevich and Zagier, if they are evaluated at kinematical invariants taking rational values in Euclidean momentum space. Our proof uses the (extended) sector decomposition algorithm by Binoth and Heinrich. Our result is related to the appearance of multiple zeta values in coefficients of Feynman integrals which has recently been investigated by Francis Brown, using another iterative algorithm.

Both of these algorithms apply to the Feynman parametric representation of the integral and perform iterative manipulations of the polynomials in the integrand, which originate from the Symanzik polynomials. Motivated by the success of these methods I give a brief review on some more and some less well-known combinatorial properties of Symanzik polynomials. I focus on their accessibility to generalized theorems of the matrix-tree type and their relation to the multivariate Tutte polynomial.

T 25.5 Fr 15:00 M010

AdS/QCD at the correlator level — •Hilmar Forkel — Institut für Physik, Humboldt-Universität zu Berlin, Germany

We derive and analyze predictions of both the hard-wall and dilaton soft-wall approximations to AdS/QCD for the scalar glueball correlator and decay constants. We confront the results with QCD information from the lattice, the operator product expansion (OPE), a hypothetical UV gluon mass associated with the short-distance behavior of the heavy-quark potential, and a low-energy theorem based on the anomalous dilatational Ward identity. Both duals turn out to encode complementary aspects of the above, nonperturbative QCD physics. The OPE Wilson coefficients, in particular, are shown to provide a challenging testing ground for the impact of the strongly coupled holographic UV dynamics on dual gravity predictions.

Gruppenbericht T 25.6 Fr 15:15 M010

Randall Sundrum Modelle: Kaluza-Klein Zerlegung mit elektroschwacher Symmetriebrechung — •Torsten Pfoh — Institut für Physik, Johannes-Gutenberg-Universität Mainz

Wenn man aus einer fünfdimensionalen Feldtheorie mit kompaktifizierter Extradimension eine effektive vierdimensionale Theorie extrahieren will, so ist die Kaluza-Klein(KK)-Zerlegung der 5D-Bulkfelder die meist praktizierte Methode. Koppeln die Bulkfelder nun an ein Higgsfeld, welches auf einer 3-Brane (also auf einem vierdim. Unterraum) fixiert ist, so ändert dies die Randbedingung an die Profile der KK-Felder in der Zerlegung. Es gibt nun zwei Möglichkeiten diese Korrekturen zu berücksichtigen. 1. Der perturbative Ansatz: Hierbei wird die Wechselwirkung mit dem Higgs bei der Berechnung der Profile vernachlässigt und im nachhinein als Störung eingeführt. Dies führt zu einer Mischung der ungestörten KK-Moden beim Wechsel in die Massenbasis. Um das Spektrum zu berechnen ist hierbei jedoch eine Trunkierung der KK-Summe von Nöten. 2. Die exakte Methode: Die modifizierten Randbedingungen werden bereits bei der Berechnung der Profile durch einen modifizierten Ansatz der KK-Zerlegung berücksichtigt. Die zugehörige Bulkbewegungsgleichung liefert direkt das Spektrum. Eine numerische Analyse belegt, dass die Eigenwerte des pertubativen Ansatz rasch konvergieren und dieser daher für Abschätzungen bestens geeignet ist.

T 25.7 Fr 15:35 M010

Elektroschwache Präzisionstests in Randall-Sundrum-Modellen — •Florian Goertz — Institut fur Physik, Johannes-Gutenberg-Universität, Staudingerweg 7, D-55099 Mainz

Randall-Sundrum-Modelle bieten einen eleganten Ansatz zur Lösung des Hierarchieproblems. Zudem ermöglichen sie durch Bulk-Fermionen eine Erklärung der hierarchischen Flavor-Struktur des Standard Modells. Ohne zusätzliche Erweiterungen scheinen jedoch elektroschwache Präzisionstests eine Masse der ersten Eichboson-Anregungen im Bereich von mindestens 10 TeV zu verlangen, was eine neue (kleine) Hierarchie erzeugen würde. Dies soll hier näher beleuchtet werden. Es wird eine Alternative zu solchen Erweiterungen aufgezeigt, sodass auch das einfachste Randall-Sundrum Modell mit Bulk Feldern ernstzunehmen bleibt.

Gruppenbericht T 25.8 Fr 15:50 M010

Diquark correlations in baryon spectroscopy and holographic QCD — •Hilmar Forkel[1] and Eberhard Klempt[2] — [1]Institut für Physik, Humboldt-Universität zu Berlin, Germany — [2]Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, Germany

We improve upon recent holographic predictions for the nucleon and delta resonance spectra and show how they emerge from a straightforward extension of the "metric soft wall" AdS/QCD dual. The resulting mass formula depends on a single adjustable parameter, characterizing confinement-induced IR deformations of the anti-de Sitter metric, and on the fraction of "good" (i.e. maximally attractive) diquarks in the baryon's quark model wave function. Despite their remarkable simplicity, the predicted spectra describe the masses of all 48 observed light-quark baryon states and the underlying, linear trajectory struc-

ture with unprecedented accuracy.