

## T 21: Quantenfeldtheorie I

Zeit: Donnerstag 16:45–19:05

Raum: KGI-HS 1016

**Gruppenbericht** T 21.1 Do 16:45 KGI-HS 1016  
**Cosmic topology and fundamental forces** — ●JOCHUM VAN DER BIJ — Inst. für Physik, Albert-Ludwigs Universität Freiburg

I present an attempt to derive the fundamental particles and forces from first principles. The argument gives a possible explanation why there are three generations of fermions.

T 21.2 Do 17:05 KGI-HS 1016  
**Wilson loops and the static quark antiquark potential in the AdS/CFT correspondence** — ●HAI NGO THANH — Humboldt Universität, Berlin, Deutschland

The proposal for evaluating the expectation value of Wilson loops in the AdS/CFT correspondence will be considered. Many physical observables related to the quarks depend on how the strings, whose end-points on some probe branes represent the quarks, are embedded in certain backgrounds. Two backgrounds are of special interest in this talk, one background dual to  $N=2$  SYM and the Lorentz-boosted AdS black hole background dual to  $N=4$  SYM at finite temperatures. The latter background is used as an approximation to explore some interesting properties of the Quark-Gluon-Plasma.

This talk primarily concerns the possible dependence of physical observables related to the quarks, e.g. static potential, confinement behavior, screening length and drag force, on various quark orientations inside the internal space (the five-sphere). For comparison with QCD a method to average over all relative quarks orientations is proposed.

T 21.3 Do 17:20 KGI-HS 1016  
**AdS/CFT with Flavour in Electric and Magnetic Kalb-Ramond Fields** — ●RENÉ MEYER<sup>1</sup>, JOHANNA ERDMENGER<sup>1</sup>, and JONATHAN P. SHOCK<sup>2,3</sup> — <sup>1</sup>Max-Planck-Institute für Physik, München, Deutschland — <sup>2</sup>Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing, People's Republic of China — <sup>3</sup>Departamento de Física de Partículas, Universidade de Santiago de Compostela, Santiago de Compostela, Spain

We investigate gauge/gravity duals with flavour and at finite temperature for which pure-gauge Kalb-Ramond B fields are turned on in the background, into which a D7 brane probe is embedded. Supersymmetry is broken for the fundamental matter in the dual gauge theory. We consider two cases: A magnetic B field in two spatial directions of four-dimensional Minkowski space, and an electric one, with B field in the time direction and one spatial Minkowski direction. In the former case, we find that the B field has a stabilizing effect on the mesons, a chiral phase transition, and that spontaneous chiral symmetry breaking occurs for a sufficiently large value of the B field. In the electric case, it is necessary to switch on a gauge field on the D7 brane to ensure stability of the system, corresponding to finite baryon number density and chemical potential. We find that the D7 branes undergo a topological transition, which we interpret as a chiral transition from a mesonic phase to a phase in which the mesons dissociate. The electric B field has a destabilizing effect on the mesons, but no spontaneous chiral symmetry breaking occurs in this case. For weak fields and at zero temperature, we find a mass shift similar to the Stark effect.

T 21.4 Do 17:35 KGI-HS 1016  
**Thermal spectral functions and diffusion from AdS/CFT** — ●MATTHIAS KAMINSKI, JOHANNA ERDMENGER, and FELIX RUST — Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), Föhringer Ring 6, 80805 München, Germany

We utilize the AdS/CFT duality to examine thermal spectral functions of vector mesons at strong coupling in the deconfined phase having survived the deconfinement transition. We work at finite baryon or isospin density. The gauge/gravity duality relates strongly coupled super-Yang-Mills theory (CFT) at finite temperature to supergravity at weak coupling in a space with Anti-de Sitter (AdS) black hole metric. After reviewing the holographic methods developed in this context, we show results on the spectra and diffusion properties comparing to lattice data and effective theories of QCD. Spectra show meson-mass-peaks at distinct resonance frequencies corresponding to the meson

masses. The location of the resonances has a minimum as a function of temperature. Furthermore, the diffusion coefficient exhibits a first order phase transition. Features of the spectra and diffusion are related to the phase diagram of this theory.

T 21.5 Do 17:50 KGI-HS 1016  
**Multiloop vacuum bubbles for hot QCD** — ●ERVIN BEJDAKIC — Faculty of Physics, Bielefeld, Germany

We present some methods used to compute vacuum bubbles needed for the perturbative computation of the pressure of hot QCD. First we introduce the difficulties of doing perturbative calculations in hot QCD, present a general strategy for separating the scales of hot QCD in effective theories and show how to compute analytically (some) four-loops scalar "master"-integrals of that effective theory.

T 21.6 Do 18:05 KGI-HS 1016  
**Sector decomposition and Hironaka's polyhedra game** — ●CHRISTIAN BOGNER — Institut fuer Physik, Universitaet Mainz

Sector decomposition is a method to compute numerically the Laurent expansion of divergent multi-loop Feynman integrals. In this talk we point out, that winning strategies for Hironaka's polyhedra game, encoding the combinatorics of resolutions of singularities by a blow-up sequence, can be applied to this method. We indicate how these strategies are used to guarantee for the termination of the sector decomposition algorithm by Binoth and Heinrich.

T 21.7 Do 18:20 KGI-HS 1016  
**Resummationseffekte an der Higgs-Schwelle am LHC.** — ●VALENTIN AHRENS — Gutenberg Universität Mainz

Betrachtet wird die Higgs-Produktion am LHC durch Gluonfusion mit Mitteln der effektiven Feldtheorie. Die Beiträge durch Abstrahlung weicher Gluonen an der Produktionsschwelle werden resummiert. Analysiert wird die Skalenabhängigkeit des resummierten Wirkungsquerschnitts im Vergleich zur Berechnung bei fester Skala. Die Berechnungen wurden bis NNLO ausgeführt.

T 21.8 Do 18:35 KGI-HS 1016  
**Reparameterization invariance of NRQED self-energy corrections and improved theory for excited D states in hydrogen-like systems** — ●BENEDIKT J. WUNDT and ULRICH D. JENTSCHURA — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg

We verify the reparameterization invariance of nonrelativistic quantum electrodynamics by way of somewhat nontrivial example, given by the higher-order binding corrections to the one-photon self-energy for a bound state which we calculate with three different overlapping parameters (photon energy, photon mass and dimensional regularization). The overlapping parameter is necessary to separate the relativistic scales of the virtual photons from the nonrelativistic ones. We show that all three reparameterizations commonly used in the literature (photon mass, photon energy and dimensional) give the same result as the canonical choice for this separation which is given by a noncovariant photon-energy cutoff. Further, we present a numerical method where we use a discrete complete set of basis on a lattice which allows us to avoid the problems encountered in the previous methods in the evaluation of the bound-spectrum part of the radiative correction. We obtain results for the Lamb-Shift of highly excited states that are important for high-precision spectroscopy.

[1] B. J. Wundt, and U. D. Jentschura, Phys. Lett. B, in press (2007).

T 21.9 Do 18:50 KGI-HS 1016  
**Parton showers from the dipole formalism** — ●MARKO TERNICK — Johannes Gutenberg-Universität Mainz

We present an implementation of a parton shower algorithm for hadron colliders and electron-positron colliders based on the dipole factorisation formulae. The algorithm treats initial-state partons on equal footing with final-state partons. We implemented the algorithm for massless and massive partons.