

# Aktuelle Veranstaltungen

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## Kolloquium

**Thema:** [Soft Pions and the Dynamics of the Chiral Phase Transition](#)

**Datum:** 11.07.22

**Uhrzeit:** 16:15

**Ort:** Y0-111

**Vortragender:** [Derek Teaney](#)

Stony Brook University

**Inhalt:**

I will first review lattice simulations of the QCD phase diagram, focusing on chiral symmetry and chiral symmetry breaking. In the limit of two massless quark flavors (up and down) the chiral phase transition is second order and is in the  $O(4)$  universality class. The fingerprints of this critical point are seen in lattice simulations of real world QCD. Next I will review heavy ion experiments, presenting an overview of some of the most important measurements from heavy ion collisions. These measurements provide compelling evidence that classical hydrodynamics is an appropriate effective theory for understanding these collisions. In current hydrodynamic simulations of these events, chiral symmetry breaking and its consequences are largely ignored. However, if the quark mass is small enough, one would expect that the pattern of chiral symmetry breaking seen on the lattice could provide a useful organizing principle for hydrodynamics, increasing its predictive power. I describe our efforts to simulate the real time dynamics of the  $O(4)$  critical point using hydrodynamics. Then I point out some discrepancies between the measured yields of soft pions and current hydrodynamic simulations. I suggest that incorporating the chiral phase transition into the hydrodynamic description could fix the discrepancies.

**Ansprechpartner:** [S. Schlichting / TR211](#)

## Kolloquium Mathematische Physik

**Thema:** [Vertex Algebras for 2- and 4-Dimensional Conformal Field Theories](#)

**Datum:** 01.07.22

**Uhrzeit:** 16:15

**Ort:** D5-153

**Vortragender:** [Sven Möller](#)

Universität Hamburg

**Inhalt:** Vertex (operator) algebras axiomatise 2-dimensional conformal field theories in physics. They were introduced in the 1980s to explain mysterious connections between number and representation theory (monstrous moonshine). Not long ago, they were also shown to capture certain aspects of 4-dimensional superconformal field theories. In this talk I will describe recent classification results for holomorphic vertex algebras of central charge 24 by means of certain modular forms (vector-valued Eisenstein series). Moreover, I will sketch classification problems arising in the context of 4-dimensional field theories.

**Ansprechpartner:** [G. Akemann](#)

## Seminar Hochenergiephysik

**Thema:** [Medium-enhanced Production of C-cbar Pairs in Jets](#)

**Datum:** 05.07.22

**Uhrzeit:** 14:15

**Ort:** D6-135

**Vortragender:** [Jasmine Brewer](#)

CERN

The degrees of freedom of the high temperature phase of QCD matter produced in heavy-ion collisions can be studied through its interactions with high-energy partons that are also produced in these collisions. The medium broadens the momentum and

**Inhalt:** degrades the energy of these partons, which is observed as a suppression of the yield of high-energy jets and hadrons in heavy-ion collisions compared to a proton-proton baseline. These interactions can be characterized by medium-modification of the QCD splitting functions. We study the modification of the  $g \rightarrow c\bar{c}$  splitting function in the kinematic range accessible at the LHC. In addition to characterizing the momentum broadening of the  $c\bar{c}$  pair, we find that interactions with the medium also enhance the rate of  $c\bar{c}$  production. We also propose an experimental signature of this enhancement through the rate of jets containing two  $D0$  mesons in heavy-ion collisions.

**Ansprechpartner:** [S. Schlichting](#)

## Seminar Kondensierte Materie

**Thema:** **Das Perzeptron: Grundbaustein neuronaler Netze und kuenstlicher Intelligenz**

**Datum:** 07.07.22

**Uhrzeit:** 14:15

**Ort:** D5-153

**Vortragender:** [Paul Angelike](#)

Universität Bielefeld

**Inhalt:**

**Ansprechpartner:** [Peter Reimann](#)

## Seminar Mathematische Physik

**Thema:** [Many-particles diffusing with resetting: study of the large-deviation properties of the flux distribution](#)

**Datum:** 05.05.22

**Uhrzeit:** 16:00

**Ort:** D5-153

**Vortragender:** Costantino Di Bello

**Inhalt:**

In this paper we studied a model of noninteracting particles moving on a line following a common dynamics. In particular we considered either a diffusive motion with Poissonian resetting, and a run-and-tumble motion with Poissonian resetting. We were interested in studying the distribution of the random variable  $Q_t$  defined as the flux of particles through origin up to time  $t$ . We used the notation  $P(Q,t)$  to identify the probability  $\mathbb{P}\{Q_t=Q\}$ . We considered particles initially located on the negative half line with a fixed density  $\rho$ . In fully analogy with disordered systems, we studied both the annealed and the quenched case for initial conditions. In the former case we found that, independently from the specific dynamics,  $P_{\text{an}}(Q,t)$  has a Poissonian shape; while in the latter case, for what concerns the diffusive dynamics with resetting, the large deviation form of the quenched distribution reads  $P_{\text{qu}}(Q,t) \sim \exp\left[-r^2 t^2 \Psi_{\text{diff}}\left(\frac{Q}{\rho t}\right)\right]$  with the large deviation function  $\Psi_{\text{diff}}(x)$  exhibiting a discontinuity in the third derivative, hence aiming, despite the simplicity of the model, at the existence of a dynamical phase transition. The quenched distribution for the run-and-tumble dynamics, instead, does not exhibit any kind of phase transition. Importance sampling Monte Carlo simulations were performed to prove the analytical results. References: Current fluctuations in noninteracting run-and-tumble particles in one dimension Tirthankar Banerjee, Satya N. Majumdar, Alberto Rosso, and Grégory Schehr, Phys. Rev. E 101, 052101 <https://doi.org/10.1103/PhysRevE.101.052101> Current Fluctuations in One Dimensional Diffusive Systems with a Step Initial Density Profile B. Derrida and A. Gerschenfeld, J. Stat. Phys. 137, 978 (2009) <https://doi.org/10.1007/s10955-009-9830-1>

**Ansprechpartner:** [Gernot Akemann](#)

## Seminar Bielefeld-Melbourne Zufallsmatrizen

**Thema:** [Determinants with Circular Root- and Jump-type Singularities](#)

**Datum:** 06.07.22

**Uhrzeit:** 09:00

**Ort:** ZOOM / Konferenzschaltung

**Vortragender:** [Christophe Charlier](#)

Lund University

**Inhalt:**

Determinants with circular root- and jump-type singularities are of interest in the study of the eigenvalue moduli of random normal matrices. So far determinants with circular root-type singularities have been unexplored. In the first part of this talk, I will show that such singular determinants have a novel type of asymptotic behavior described in terms of the so-called associated Hermite polynomials. In the second part, I will focus on determinants with pure jump-type singularities, in the regime where they approach a hard edge. Such determinants give information about the disk counting statistics of coulomb gases near a hard edge and have been unexplored up to now. I will show that the counting statistics in the hard edge regime is considerably wilder than in all previously studied regimes. The first part of the talk is joint work with S.-S. Byun, and the second part is work in progress with Y. Ameur, J. Cronvall and J. Lenells.

**Ansprechpartner:** [Gernot Akemann](#)