Kolloquium

**Quantum optics and information science in multi-dimensional photonics networks**

**Thema:** Quantum optics and information science in multi-dimensional photonics networks

**Datum:** 14.10.19

**Uhrzeit:** 16:15

** Ort:** H6

**Vortragender:** Prof. Dr. Christine Silberhorn

Integrated Quantum Optics, Department Physics, Paderborn University

Classical optical networks have been widely used to explore a broad range of transfer phenomena based on coherent interference of waves, which relate to different disciplines in physics, information science, and even biological systems. At the quantum level, the quantized nature of light, this means the existence of photons and entangled states, gives rise to genuine quantum effects that can appear completely counter-intuitive. Yet, to date, quantum network experiments typically still remain rather limited in terms of the number of photons, reconfigurability and, maybe most importantly, network size and dimensionality. Photonic quantum systems, which comprise multiple optical modes as well as highly non-classical and sophisticated quantum states of light, have been investigated intensively in various theoretical proposals over the last decades. However, their implementation requires advanced setups of high complexity, which poses a considerable challenge on the experimental side. The successful realization of controlled quantum network structures is key for many applications in quantum optics and quantum information science. Here we present three different approaches to overcome current limitations for the experimental implementation of multi-dimensional quantum networks: non-linear integrated quantum optics, pulsed temporal modes and time-multiplexing. We present their applications in the framework of today’s quantum technologies.

**Ansprechpartner:** J. Schnack
Kolloquium Mathematische Physik

Thema: Relativistic hydrodynamics, heavy-ion collisions, dynamical black holes and resurgent series

Datum: 18.10.19

Uhrzeit: 16:15

Ort: V3-201

Vortragender: Michal P. Heller

Max-Planck-Institute for Gravitational Physics, Potsdam

Inhalt:
The past 12 years has constituted the golden age for theoretical studies of relativistic hydrodynamics. The experimental motivation for these developments came from ultra-relativistic heavy-ion collision at RHIC and LHC accelerators in which the paradigm of strongly-interacting medium modelled hydrodynamically became the working horse for explaining the data. These experimental and phenomenological developments have come hand-in-hand with theoretical progress in understanding relativistic hydrodynamics as an effective description embedded in quantum field theory. In my colloquium I will review the line of thought based on AdS/CFT (holography), an approach to study strongly-coupled quantum field theories using gravitational techniques, focusing on understanding the limits of applicability of relativistic hydrodynamics in far-from-equilibrium quantum field theory. A beautiful spin-off of this analysis is understanding hydrodynamic gradient expansion as a part of a trans-series, which encodes, through resurgence, information about genuinely non-equilibrium excitations of a collective state of matter. Based on a series of works reviewed in arXiv:1610.02023 and arXiv:1707.02282, as well as some later / ongoing work.

Ansprechpartner: S. Schlichting

Seminar Hochenergiephysik

Thema: Heavy quark momentum diffusion coefficient in 3D gluon plasma and gluon spectral function in 2D gluon plasma

Datum: 10.10.19
We study the heavy-quark momentum diffusion coefficient in far from equilibrium gluon plasma in a self-similar regime using real-time lattice techniques. We use 3 methods for the extraction: an unequal time electric field 2-point correlator integrated over the time difference, hard loop (HTL) perturbation theory and a kinetic theory formula, both using our recently acquired data on the gluon spectral function. The time-evolution of the momentum diffusion coefficient extracted from all three methods is consistent with an approximate t^-1/2 power law. We also study the extracted diffusion coefficient as a function of the upper limit of the time integration. We find that combining HTL expressions with the infrared enhancement of the equal-time correlation function that we have observed improves the agreement with the data for transient time behavior considerably. This is a gauge invariant confirmation of the infrared enhancement previously observed only in gauge fixed correlation functions.
Critical behaviour and characteristic polynomials of non-Hermitian random matrices

Datum: 23.05.19
Uhrzeit: 16:15
Ort: D5-153
Vortragender: Nicholas Simm
University of Sussex

I will discuss some recent developments regarding the normal matrix model. In particular my interest will be in certain critical models where the limiting support of the eigenvalues can radically change its topology by slightly adjusting an external parameter. I will discuss how aspects of the model can be explicitly mapped to the study of expectations of characteristic polynomials of non-Hermitian random matrices (e.g. Ginibre or truncated unitary). Many of these averages are related to Painlevé transcendents, and by exploiting this, a precise and non-trivial asymptotic expansion of partition functions can be calculated in the critical models. This is joint work with Alfredo Deaño (University of Kent).

Ansprechpartner: Gernot Akemann

Spectral radius of random matrices with independent entries

Datum: 23.10.19
Uhrzeit: 16:15
Ort: V3-201
Vortragender: Johannes Alt
We consider random $n \times n$ matrices $X$ with independent and centered entries and a general variance profile. We show that the spectral radius of $X$ converges with very high probability to the square root of the spectral radius of the variance matrix of $X$ when $n$ tends to infinity. We also establish the optimal rate of convergence, that is a new result even for general i.i.d. matrices beyond the explicitly solvable Gaussian cases. The main ingredient is the proof of the local inhomogeneous circular law [arXiv:1612.07776] at the spectral edge. This is joint work with László Erdős and Torben Krüger.

Ansprechpartner: Gernot Akemann