MP 9: AdS/CFT Correspondence and Hydrodynamic Transport

Time: Thursday 11:00–12:30 Location: ZEU/0250

MP 9.1 Thu 11:00 ZEU/0250

Ultraviolet-regulated theory of non-linear diffusion — •Matthias Kaminski[1] and Navid Abbasi[2] — [1]University of Alabama, Tuscaloosa, AL, U.S.A. — [2]School of Nuclear Science and Technology, Lanzhou University, Lanzhou, China

In a system with a single conservation law the inverse relaxation time plays the role of an ultraviolet (UV) regulator for the low energy diffusion of the conserved charge. In order to calculate renormalization effects through self-interactions stemming from fluctuations in such a system, we include the slowest non-conserved UV mode which relaxes at a system-specific relaxation time. Quantum fluctuations are computed in addition to statistical fluctuations for the first time in this framework. We show that the relaxation time is protected from renormalization while the diffusion constant is renormalized independent of the UV mode. Furthermore, the retarded Green*s function acquires four branch points, corresponding to threshold energies for generation of double-mode states from single diffusion or single UV modes. We report on the fate of long time tails in the current-current correlator, the dynamic susceptibility, and the conductivity. These results are relevant for the high temperature Hubbard model and also for the quark gluon plasma droplet near the critical point of quantum chromodynamics.

MP 9.2 Thu 11:30 ZEU/0250

Obtaining Transport Coefficients from Functional Renormalization Group Methods — •Tim Stötzel[1], Lars Heyen[2], and Stefan Flörchinger[1] — [1]Theoretisch-Physikalisches Institut, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena, Germany — [2]Institut für Theoretische Physik, Universität Heidelberg, Philosophenweg 16, 69120 Heidelberg, Germany

The description of transport processes requires knowledge of their respective transport coefficients like viscosities or conductivities. Determining these quantities from a first principle approach can be done by the use of quantum field theories.

We make use of the well known Kubo formulas and apply them to a field theory at finite temperature in a non-perturbative approach. The transport coefficients can be derived by the use of renormalization group flow equations resulting in a flow equation for the near-equilibrium coefficients.

The method is applied to a massive, self-interacting scalar field and the shear viscosity is calculated for this toy model at finite temperature. We show a possible truncation ansatz for the Wetterich equation that generates a flow of the shear viscosity coefficient and comment on its relation to the properties of the microscopic theory.

MP 9.3 Thu 11:50 ZEU/0250

Critical and near-critical relaxation of holographic superfluids — •Mario Flory[1], Sebastian Grieninger[2], and Sergio Morales-Tejera[3] — [1]Institute of Theoretical Physics, Jagiellonian University, Lojasiewicza 11, 30-348 Krakow, Poland — [2]Center for Nuclear Theory, Department of Physics and Astronomy, Stony Brook University, NY 11794-3800, USA — [3]Instituto de Fisica Teorica UAM-CSIC, c/ Nicolas Cabrera 13-15, 28049, Madrid, Spain

We investigate the relaxation of holographic superfluids after quenches, when the end state is either tuned to be exactly at the critical point, or very close to it. By solving the bulk equations of motion numerically, we demonstrate that in the former case the system exhibits a power law falloff as well as an emergent discrete scale invariance. The later case is in the regime dominated by critical slowing down, and we show that there is an intermediate time-range before the onset of late time exponential falloff, where the system behaves similarly to the critical point with its power law falloff. We further postulate a phenomenological Gross-Pitaevskii-like equation that is able to make quantitative predictions for the behaviour of the holographic superfluid after near-critical quenches.

MP 9.4 Thu 12:10 ZEU/0250

Towards Explicit Discrete Holography: Aperiodic Spin Chains from Hyperbolic Tilings — Pablo Basteiro, Rathindra Nath Das, •Giuseppe Di Giulio, Johanna Erdmenger, Jonathan Karl, René Meyer, and Zhuo-Yu Xian — Julius-Maximilians-Universität Würzburg

The AdS/CFT correspondence is one of the most important breakthroughs of the last decades in theoretical physics. A recently proposed way to get insights on various features of this duality is achieved by discretizing the Anti-de Sitter spacetime. Within this program, we consider the Poincaré disk and we discretize it by introducing a regular hyperbolic tiling on it. The features of this discretization are expected to be identified in the quantum theory living on the boundary of the hyperbolic tiling. In this talk, we discuss how a class of boundary Hamiltonians can be naturally obtained in this discrete geometry via an inflation rule that allows constructing the tiling using concentric layers of tiles. The models in this class are aperiodic spin chains. Using strong-disorder renormalization group techniques, we study the entanglement entropy of these boundary theories, identifying a logarithmic growth in the subsystem size, with a coefficient depending on the bulk discretization parameters.