MP 2: Quanten-Information II

Time: Monday 16:30–17:30 Location: SPA SR125

MP 2.1 Mon 16:30 SPA SR125

Tomography beyond observable phenomena — •Adrian Steffens, Carlos Riofrío, Robert Hübener, and Jens Eisert — Dahlem Center for Complex Quantum Systems, Freie Universität Berlin, 14195 Berlin, Germany

Recent advances in the tomography of one dimensional quantum fields make it possible to reconstruct all n-point functions from lowest order correlations provided that certain requirements are fulfilled ["Wick's theorem for matrix product states", R. Hübener, A.Mari, J. Eisert, Phys. Rev. Lett. 110, 040401 (2013)]. The algorithms employed in the tomographic process even allow to extract the Hamiltonian behind the observed correlations, leading to a picture of a finite dimensional system interacting with the observed field. We will demonstrate—using the example of the Lieb-Liniger model—how structures of another, underlying model can be recovered from the correlations. Such a resulting model can be useful if, for example, not all phenomena or particles of a model are accessible to measurement or to 'give back' details to an effective model.

MP 2.2 Mon 16:50 SPA SR125

Tomography of Quantum Fields — •Carlos Riofrío, Adrian Steffens, Robert Hübener, and Jens Eisert — Freie Universität Berlin, Germany

Understanding the fundamental interactions in many-body physical systems is of great interest in current theoretical and experimental efforts. Of particular recent interest are quantum simulations of processes of non-equilibrium, equilibration and thermalization. In this context, the problem of developing tools for identifying and reconstructing the state of such systems has become interesting on a practical level. We will present a novel approach in that direction and discuss an application for reconstructing quantum field states from low order correlation functions measured in current atom chip experiments. We concentrate on one dimensional systems with spatially limited entanglement which are well described by the continuous matrix product state (cMPS) formalism, and employ recent mathematical theorems concerning their structure for tomographic access.

MP 2.3 Mon 17:10 SPA SR125

An improved Landauer Principle with finite-size corrections and applications to statistical physics — •David Reeb and Michael Marc Wolf — Department of Mathematics, Technische Universität München, 85748 Garching, Germany

Landauer's Principle necessitates a fundamental energy cost for the erasure of data in the form of heat dissipation. Theoretical justifications of this limit rely so far on specific models based on arguable assumptions and are often confined to classical physics. In this work, we clarify the minimal setup to formulate Landauer's Principle in precise terms, and provide a rigorous proof of an improved version of the Principle, which is formulated in terms of an equality rather than an inequality. The proof is based on quantum statistical physics concepts instead of thermodynamic reasoning. From this equality version we obtain explicit improvements of Landauer's bound that depend on the effective size of the reservoir. For this, we employ new entropy inequalities which also give energy-time tradeoffs in thermodynamic situations such as the Clausius Theorem and are of independent interest in information theory. Our treatment of Landauer's Principle furthermore implies a generalized Carnot efficiency bound.