Q 39: Quanteninformation: Konzepte V

Zeit: Mittwoch 16:30–18:00 Raum: VMP 6 HS-D

Q 39.1 Mi 16:30 VMP 6 HS-D

Evolution of entanglement entropy in disordered quantum spin chains after a local quench — •Zoltán Zimborás and Heiko Rieger — Institut für Theoretische Physik, Universität des Saarlandes, Saarbrücken, Germany

It is by now rather well-known how the entanglement entropy of a segment of spins in a homogeneous chain evolves after a global or local quench,i.e., after an instantaneous (global or local) change of parameters in the Hamiltonian. In this talk we report on results about the evolution of entanglement entropy in disordered spin chains after a local quench. We will present both analytical and numerical results, which show that there is a noticable difference between the homogeneous and disordered cases.

Q 39.2 Mi 16:45 VMP 6 HS-D

Entanglement entropy in quantum spin chains with finite range interaction — •Zoltan Kadar[1] and Zoltan Zimboras[2] — [1]ISI Foundation, Torino, Italy — [2]Universität des Saarlandes, Saarbrücken, Germany

Translation invariant spin chains with finite range interaction are of great interest, because they both model magnetic properties of solids and their pure states are sufficiently simple to study entanglement. The von Neumann entropy of the bipartite case has been computed for a large class of models with reflection invariant spectrum and their behaviour at the critical points were analysed in the literature. We relax the symmetry property of the interaction and provide results in the general case motivated by several concrete models currently under study.

Q 39.3 Mi 17:00 VMP 6 HS-D

Critical exponents of quantum critical models by means of a QuMERA channel — •Simone Montangero — Institut für Quanteninformationsverarbeitung Albert-Einstein-Allee 11 D-89069 Ulm Deutschland

We discuss an iterative method for the optimization of a tensor network based on the Multiscale Entanglement Renormalization Ansatz (MERA) which is suited for quantum critical systems in the thermodynamic limit. We test this technique to compute the critical exponents of the Ising and XXZ model where we can compare the method with the exact values. The agreement is typically of the order of few % already for moderate dimensions of the tensor indices.

Q 39.4 Mi 17:15 VMP 6 HS-D

Coupling strength estimation for spin chains despite restricted access — •Daniel Burgarth[1], Koji Maruyama[2], and Franco Nori[2] — [1]Imperial College, London, England — [2]RIKEN, Wako-Shi, Japan

Quantum control requires full knowledge of the system many-body Hamiltonian. In many cases this information is not directly available due to restricted access to the system. Here, we show how all coupling strengths in a spin chain can be indirectly estimated by measuring *one spin at the end of the chain*. The Hamiltonian we study is given by $H = \sum_n c_n \vec{\sigma}_n \cdot \vec{\sigma}_{n+1}$ where the c_n are arbitrary nearest-neighbor coupling strengths to be estimated. We also discuss the efficiency of the estimation and give a numerical example.

Q 39.5 Mi 17:30 VMP 6 HS-D

Unifying all classical spin models in a Lattice Gauge Theory — •Gemma De las Cuevas[1,2], Wolfgang Duer[1,2], Hans J. Briegel[1,2], and Miguel Angel Martin-Delgado[3] — [1]Institut für Theoretische Physik, Universität Innsbruck, Technikerstraße 25, A-6020 Innsbruck, Austria — [2]Institut für Quantenoptik und Quanteninformation der Österreichischen Akademie der Wissenschaften, Innsbruck, Austria — [3]Departamento de Física Teórica I, Universidad Complutense, 28040. Madrid, Spain

We show that the partition function of all classical spin models, including all discrete Standard Statistical Models and all abelian discrete Lattice Gauge Theories (LGTs), can be expressed as a special instance of the partition function of the 4D $\mathbb{Z}_2$ LGT. In this way, all classical spin models with apparently very different features are unified in a single complete model, and a physical relation between all models is established. As applications of this result, we present a new method to do mean field theory for abelian discrete LGTs with $d \geq 4$, and we show that the computation of the partition function of the 4D $\mathbb{Z}_2$ LGT is a computationally hard (#P-hard) problem. We also extend our results to abelian continuous models, where we show the approximate completeness of the 4D $\mathbb{Z}_2$ LGT. All results are proven using quantum information techniques.

Q 39.6 Mi 17:45 VMP 6 HS-D

A Unified View on Controllability of Spin Chains — •Uwe Sander, Andreas Spörl, and Thomas Schulte-Herbrüggen — Technische Universität München, Department Chemie, Lichtenbergstr. 4, 85747 Garching

Lie theory provides a powerful tool for addressing controllability of quantum systems such as spin-chains with nearest-neighbour Ising or Heisenberg interactions. In a unified picture, we describe the family of fully controllable spin chains as well as chains whose controllability is restricted by symmetry. Even in these restricted cases Lie-algebraic tools allow one to assess whether special tasks like transferring qubit-packages from one end to the other are feasible. The results can be generalised to arbitrary spin topologies.