# MP 1: Statistische Mechanik

Time: Tuesday 9:30–10:50 Location: HFT-FT 101

MP 1.1 Tue 9:30 HFT-FT 101

**Condensate-induced transitions and critical spin chains: Exactly solvable spin-1/2 chains with $so(N)_1$ critical points** — •Ville Lahtinen[1,2], Teresia Månsson[3], and Eddy Ardonne[4] — [1]FU Berlin, Arnimallee 14, 14195 Berlin, Germany — [2]Institute for Theoretical Physics, University of Amsterdam, Science Park 904, 1090 GL Amsterdam, The Netherlands — [3]Department of Theoretical Physics, School of Engineering Sciences, Royal Institute of Technology (KTH), Roslagstullsbacken 21, SE-106 91 Stockholm, Sweden — [4]Department of Physics, Stockholm University, AlbaNova University Center, SE-106 91 Stockholm, Sweden

We construct a hierarchy of exactly solvable spin-1/2 chains with $so(N)_1$ critical points. Our construction is motivated by the framework of condensate-induced transitions between topological phases. We employ this framework to construct a Hamiltonian term that couples $N$ transverse field Ising chains such that the resulting theory is critical and described by the $so(N)_1$ conformal field theory. By employing spin duality transformations, we then cast these spin chains for arbitrary $N$ into translationally invariant forms that all allow exact solution by the means of a Jordan-Wigner transformation. These models generalize 1D cluster models and show how the exotic $so(N)_1$ criticality can emerge by suitably perturbing symmetry protected topological order.

MP 1.2 Tue 9:50 HFT-FT 101

**Many-body localization and quasi-local integrals of motion** — •Giuseppe de Tomasi, Frank Pollmann, and Jens Bardarson — Max-Planck-Institut für Physik komplexer Systeme, Dresden

Anderson localization of single particle states in the presence of a random potential is a well understood result in theoretical condensed matter theory. Many-body localization (MBL) occurs when the localization remains in the presence of interactions. A defining property of MBL is the breakdown of the "eigenstate thermalization hypothesis" (ETH) and thus the impossibility to thermalize. Moreover it has been conjectured that in the MBL phase an extensive number of quasi-local integrals of motion exists. We will discuss our results on possibilities to numerically obtain these integrals of motion.

MP 1.3 Tue 10:10 HFT-FT 101

**Random-matrix theory of phonon density of states in disordered solids** — •Rico Milkus and Alessio Zaccone — Physics Department, Technische Universität München

The dynamical (Hessian) matrix of solids provides access to the thermal properties of materials, and to the vibrational phonon spectrum (density of states). In ordered crystalline lattices, the lattice periodicity allows for analytical diagonalization in reciprocal space owing to the periodicity and translational-rotational invariance of the lattice. With disordered solids, which lack periodicity, diagonalization can be done only numerically, in real space. We present a new numerical protocol to study the eigenmodes and phonon spectrum of continuous random networks, a realistic model for many amorphous materials. It is shown that the part of the spectrum controlled by randomness, which gives rise to the non-Debye boson peak in the density of states, cannot be described by analytical mean-field models. Yet analytical scaling laws can be extracted, and an analytic representation of the phonon spectrum can be obtained using random matrix theoretical tools. Our results clearly indicate that the origin of the non-Debye boson-peak anomaly in the spectrum is due to the interplay between phonon scattering by the randomness and non-affine elastic response related to connectivity of the network.

MP 1.4 Tue 10:30 HFT-FT 101

**The geometrisation of thermodynamics via contact geometry** — •Christine Gruber[1], Alessandro Bravetti[2], and Hernando Quevedo[2] — [1]Institut für Physik, Carl-v.-Ossietzky-Universität, Oldenburg, Deutschland — [2]Instituto de Ciencias Nucleares, Universidad Nacional Autonoma di Mexico, Mexico D.F., Mexico

We aim at developing a geometrical formulation of thermodynamics by employing contact geometry and associated notions. A geometric formulation of thermodynamics is of interest for several reasons. Firstly, geometry serves as a language in which every physical theory can be formulated, it provides geometric tools and notions which can be employed to infer new principles and ideas, and in general promotes mathematical beauty in physics. Secondly, a geometrisation of thermodynamical theories would help to systemize and unify the phenomenologically orientated formulations and derivations of thermodynamical phenomena and potentially be of great use in the description of non-equilibrium scenarios. And finally, due to the fundamental connection of the laws of black hole thermodynamics with their geometry, there is the hope that a geometric theory of thermodynamics could lead to new insights into black hole thermodynamics and the physical laws governing the physics of black holes.

In this talk, we will focus on the possible application of contact geometry and its geometric flows in non-equilibrium thermodynamics.