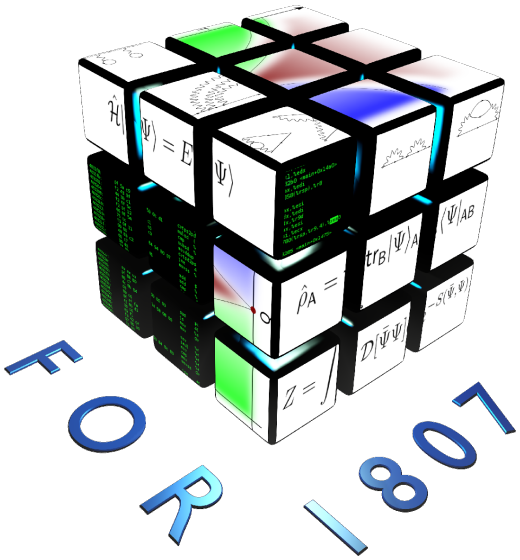
FOR 1807 phd-student meeting 2018

Munich

26. - 27. March



Program

	Monday	Tuesday
9.00 - 10.30	lecture - Martin Eckstein	lecture - Martin Eckstein
10.30 - 11.00	coffee	coffee
11.00 - 12.30	lecture - Martin Eckstein	lecture - Lode Pollet
12.30 - 14.00	lunch	lunch
14.00 - 14.30	talk 1 - Jonas Becker	talk 5 - Francesco Parisen Toldin
14.30 - 15.15	talk 2 - Christoph Brockt/Jan Stolpp	talk 6 - Sebastian Paeckel/Thomas Köhler
15.15 - 15.45	coffee	coffee
15.45 - 16.15	talk 3 - Jonas Schwab	talk 7 - Jonas Heverhagen
16.15 - 16.45	talk 4 - Tibor Rakovszky	talk 8 - Jan Lotze

Talks

talk 1:

Jonas Becker - Spin dynamics of a Z2 spin liquid on the kagome lattice

We study the spin dynamics of a spin-1/2 model on the kagome lattice of Balents, Fischer and Girvin type [Balents et al., Phys. Rev. B, 65, 224412 (2002)]. The model can be driven from a XY-ferromagnetic into a gapped Z2 spin liquid phase that can be described by the occurence of fractionalized excitations, namely spinons and visons. We calculate the dynamic spin-structure factor via a combination of quantum Monte Carlo SSE simulations and the stochastic analytic continuation method. Within those spectra we then aim to find signatures of fractionalized excitations that were proposed earlier.

talk 2:

Christoph Brockt/Jan Stolpp - Nonequilibrium dynamics of 1-D electron-phonon systems

talk 3:

Jonas Schwab - Nematic phase transition of Dirac fermions

We consider Dirac fermions, as realized by a pi-flux tight binding model on a square lattice, coupled to an Ising model in a transverse field. The coupling is chosen such that the ordering of the Ising spins triggers a meandering of the Dirac fermions and thereby a nematic deformation of the "Fermi" surface. The model is amenable to sign-problem free quantum Monte Carlo simulations such that the nature of the transition for various couplings and flavor number of Dirac fermions can be analyzed in detail.

talk 4:

Tibor Rakovszky - Hydrodynamics of operator spreading from random circuits

In this talk we use random local unitary circuits to gain insight into the scrambling of quantum information in many-body systems. For a circuit with no conserved quantities we show that the average spreading of operators obeys an exact "hydrodynamic" description, in terms of a biased diffusion equation, and discuss the consequences for out-of-time ordered correlators (OTOCs) and entanglement growth. We conjecture that a similar effective description should hold in more generic ergodic systems, a claim supported by numerical results. Furthermore, we consider random circuits with a U(1) symmetry and discuss the interplay between the hydrodynamics of the conserved charge and that of operator spreading, leading to the appearance of long-time power law tails in out-of-time-ordered correlators. We also discuss the behavior of OTOCs at different chemical potentials, an analogous quantity to the finite temperature OTOCs discussed in the literature, and find that their initial spreading is slowed down when the chemical potential is large.

talk 5:

Francesco Parisen Toldin - Entanglement Hamiltonian of interacting fermionic models

Recent numerical advances in the field of strongly correlated electron system have allowed the calculation of the correlations of the Entanglement Hamiltonian, and the associated entropies, for interacting fermionic systems [1]. On the other hand, an explicit determination of the Entanglement (modular) Hamiltonian has proven to be a considerably more difficult problem, where only a few results are available. We introduce a technique to directly determine the Entanglement Hamiltonian of interacting fermionic models by means of Auxiliary Field Quantum Monte Carlo simulations. We implement our method in the one-dimensional Hubbard chain model, partitioned into two segments, and in the two-legs Hubbard ladder model, partitioned into two chains.

[1] F. F. Assaad, T. C. Lang, F. Parisen Toldin, Phys. Rev. B 89, 125121 (2014)

[2] F. Parisen Toldin, F. F. Assaad, in preparation

talk 6:

Sebastian Paeckel - Lower harmonics in pre time-crystal regimes

We discuss the existence of a precursor to the time-crystal phase, which shows time translational symmetry breaking with multiple periods. The extend of this precursor region in time and the possible frequencies depend on the specific choice of the disorder distribution. In an analytical treatment of the Floquet-driven transverse-field Ising chain in the presence of disorder we use a transfer matrix ansatz to compute the Loschmidt echo. In this observable-independent quantity, we identify the possible frequencies for the symmetry breaking and the regimes of the time evolution. This is complemented by matrix product state simulations, which indicate that in the presence of interactions this precursor region can be stabilized in time.

talk 7:

Jonas Heverhagen - Flavor-twisted boundary conditions for two-particle spectral functions

Numerical methods are powerful tools for solving problems in the field of strongly correlated materials. Normally, they rely on approximations, perturbation theory or small system sizes. In particular, exact methods such as exact diagonalization (ED) can only treat systems with tens of sites. This complicates comparison with experiment, where normally results in the thermodynamic limit are obtained. One severe effect of the small system sizes is a discrete and coarse momentum resolution, as number of sites and momentum points are equal. We address the latter by leveraging flavor-twisted boundary conditions (FTBC) to get, in principle, continuous momentum resolution for two-particle spectral functions. We use this technique to calculate spin and orbital excitations in a spin-orbital chain and compare the results to spin cluster perturbation theory.

talk 8:

Jan Lotze - The finite-temperature Lanczos method as solver for the variational cluster approximation

The variational cluster approximation (VCA) based on self-energy functional theory (SFT) [1] can be used to study correlated-electron Hamiltonians: Instead of the original systems self-energy, that of a "reference system" is considered. While full diagonalization suffices for small reference systems, larger systems require the Lanczos method or a quantum Monte Carlo method [2] to be tractable. Considering systems at finite temperature increases the numerical burden even further. Demanding on top of this the resolution of degenerate states in the reference system requires to switch from the regular Lanczos method to the Band Lanczos method [3]. Here, thermodynamic and dynamical properties of the one- and two-dimensional Hubbard model at finite temperature are presented to illustrate the finite-temperature Lanczos [4] and Band Lanczos method as solver of the reference system. The effect of degeneracies onto the results is discussed.

[1] M. Potthoff, Self-Energy-Functional Theory in Strongly Correlated Systems - Theoretical Methods (Springer, 2012).

[2] G. Li, W. Hanke, A. N. Rubtsov, S. Bäse and M. Potthoff, Accessing thermodynamics from dynamical cluster-embedding approaches, Phys. Rev. B 80, 195118 (2009).

[3] R.Freund. Band Lanczos Method in Templates for the Solution of Algebraic Eigenvalue Problems: A Practical Guide (SIAM, 2000).

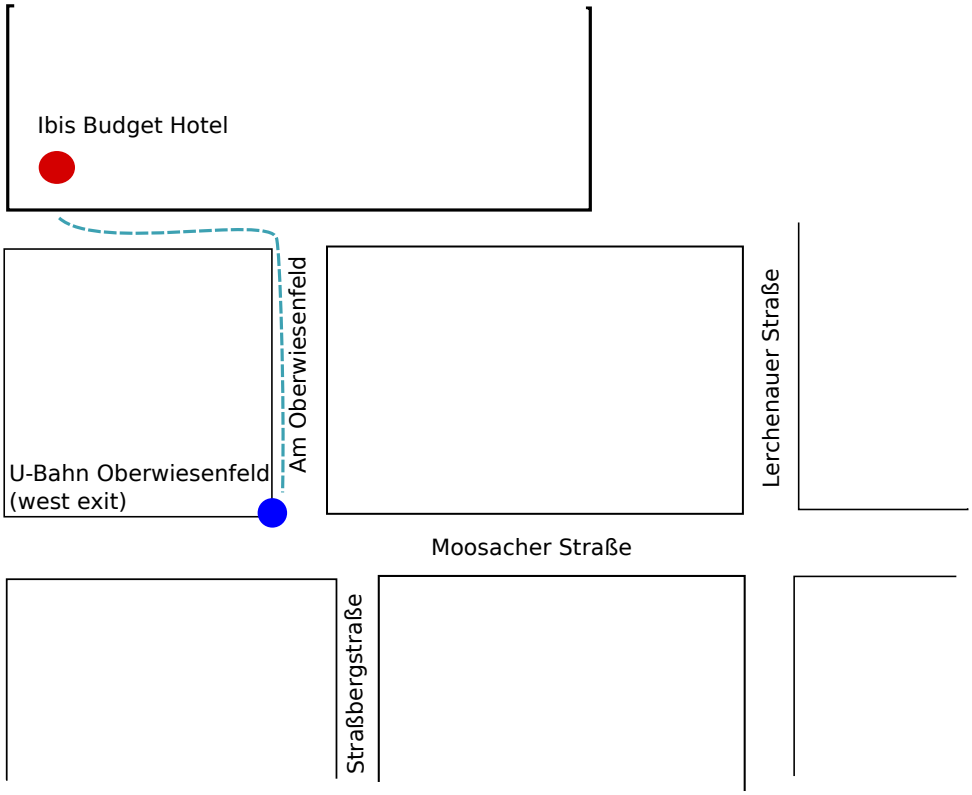
[4] P.Prelovsek, J.Bonca, Ground State and Finite Temperature Lanczos Methods in Strongly Correlated Systems - Numerical Methods (Springer, 2012).

Your Hotel is:

ibis budget München City Olympiapark

Am Oberwiesenfeld 22

to get there from Hauptbahnhof take U2 (Feldmoching) to Scheidplatz. There change to U3 (Moosach) to Oberwiesenfeld.



The meeting will take place in:

Room B 252

Theresienstraße 37

to get there form your Hotel take the U3 (Fürstenried West) from Oberwiesenfeld to Universität. Then it is a 10 minutes walk to Theresienstraße