DY 15: ISPS Intersectional Poster Session

Time: Tuesday 18:00–20:00 Location: P1

DY 15.1 Tue 18:00 P1

Wave packet spreading in strongly disordered nonlinear lattices — Mikhail Ivanchenko[1,2], •Tetyana Laptyeva[2], and Sergej Flach[2] — [1]Theory of Oscillations Department, University of Nizhniy Novgorod, Russia — [2]Max Planck Institute for the Physics of Complex Systems, Noethnitzer Str. 38, 01187 Dresden, Germany

Localization of eigenmodes and halt of wave propagation in linear lattices by disorder, the famous Anderson localization, underpins a set of fundamental physical phenomena. To mention are electrical and thermal conductivities, localization of light and matter waves in optical lattices. Nonlinearity induces interaction between eigenmodes and the question of whether it destroys Anderson localization or not is under hot debate in the fields of nonlinear science and condensed matter.

We achieve a progress there by studying analytically and computationally the limit of strongly disordered nonlinear lattices characterized by compactly localized eigenmodes. Employing perturbation theory techniques we demonstrate that even in this case there is always a finite probability for a wave packet to spread that decreases linearly with the energy. Moreover, we show that the same holds in the limit of infinitely small energy density too, the full energy being the only control parameter. Above a certain threshold in energy finite-size excitations will spread with probability 1. Infinitely small energy density limit gives an exponentially small probability of localization in this case. Numerics confirm the predictions above, revealing, in addition, intermittent and not diffusive type of spreading in this strong disorder limit.

DY 15.2 Tue 18:00 P1

Interaction-induced fractional Bloch and tunneling oscillations — •Dmitry Krimer[1,2], Ramaz Khomeriki[1,3], Masudul Haque[1], and Sergej Flach[1] — [1]Max Planck Institute for the Physics of Complex Systems, 01189 Dresden, Germany — [2]Institute for Theoretical Physics, University of Tuebingen, 72076 Tübingen — [3]Physics Department, Tbilisi State University, 0128 Tbilisi, Georgia

We study the dynamics of few interacting bosons in a one-dimensional lattice with dc bias in the framework of Bose-Hubbard model [1]. The resulting dynamics turned out to be substantially different than that obtained within the mean-field approximation valid for the description of Bose-Einstein condensates [2]. In particular, for strong interaction the Bloch oscillation regime reemerges with fractional Bloch periods, which are inversely proportional to the number of bosons clustered into a bound state. The interaction strength is affecting the oscillation amplitude. Excellent agreement is found between numerical data and a composite particle dynamics approach. For specific values of the interaction strength a particle tunnels from the interacting cloud to a well defined distant lattice location. This is in contrast to the case of the mean-field approach, where any nonlinearity destroys integrability, introduces chaos, and ultimately leads to a destruction of localization [2].

[1] R. Khomeriki, D.O. Krimer, M. Haque, S. Flach, Phys. Rev. A 81, 065601 (2010)

[2] D.O. Krimer, R. Khomeriki, S. Flach, Phys. Rev. E 80, 036201 (2009)

DY 15.3 Tue 18:00 P1

Juggling with geological time scales! — •Philipp Aurin[1], Cornelius Fischer[1], Julie Murison[2], and Matthias Schröter[2] — [1]Department of Geoscience, Georg-August-University, Göttingen, DE — [2]Max Planck Institute for Dynamics and Self-Organization, Göttingen, DE

The investigation of fluid flow through porous media is of great interest to, among others, the petroleum industry. We want to create a model sandstone with selectable but well controlled fluid flow parameters such as porosity and permeability. In this way we can monitor the main steps of diagenesis, compaction and cementation, allowing systematic testing and characterisation of parameters with reduced complexity, all on laboratory time scales.

Compaction - the physical process by which sediments are compressed - is obtained by using water flow pulses and by vertical shaking. Both methods result in the reduction of pore space as grains (soda-lime glass beads) are packed closer together.

The second phase of our experimental protocol consists of calcium carbonate precipitation, which acts as cement between the compacted grains. In-situ observation of the cementation process is obtained using x-ray radiograms. After cementation thin sections of the sample are prepared and lithification quantified using polarizing petrographic microscopy.

DY 15.4 Tue 18:00 P1

Influence of Superconductivity on the Phonon in $BaFe_{1.8}Co_{0.2}As_2$ — •Daniel Lamago[1,2], Lothar Pintschovius[1], Dmitry Reznik[3], Rolf Heid[1], and Thomas Wolf[1] — [1]Karslruhe Institut für Technologie (KIT), Institut fuer Festkoerperphysik, P.O.B. 3640, 76021 Karlsruhe, Germany — [2]Laboratoire Leon Brillouin, CEA Saclay, 91191 Gif sur Yvette Cedex, France — [3]Department of Physics, University of Colorado-Boulder, CO 80309 Boulder, USA

We used inelastic neutron scattering technique to investigate the role of electron-phonon coupling in the mechanism of high-Tc superconductivity in the iron arsenides. Density functional theory predicts only a weak electron-phonon coupling but theory might underestimate the coupling strength. One way to obtain experimantally information on the electron-phonon coupling strength is to measure superconductivity-induced phonon frequency shifts. Such shifts have been observed not only in conventional superconductors but also in cuprates, i.e. in compounds in which electron-phonon coupling is probably not the main driving mechanism for superconductivity. We have measured phonon modes with an energy close to the superconducting energy gap, because it is known from theory that such phonons will respond most strongly to the opening of the superconducting gap. The gap energy was estimated to be about 6 meV for the overdoped sample and about 8 meV for the optimally doped one. We could not detect any influence of superconductivity on the phonons, neither on the linewidth nor on the frequencies.

DY 15.5 Tue 18:00 P1

Extreme value statistics in the solar wind: an application to correlated Levy processes — •Nicholas Moloney — Max Planck Institute for the Physics of Complex Systems, Noethnitzer Str. 38, 01187 Dresden, Germany

We analyze the block maxima of solar wind power bursts during 2000 – 2007. Extreme values over time windows of about 18 hours and longer can be accurately described by parametric generalized extreme value statistics. These models predict that significantly larger values can be expected during any 50-year period than observed to date.

DY 15.6 Tue 18:00 P1

Stochastically driven Preisach models of hysteresis — •Sven Schubert and Günter Radons — Chemnitz University of Technology, 09107 Chemnitz, Germany

Hysteresis is a ubiquitous phenomenon. It is observed in physics (ferromagnetic materials), chemistry (catalysis), and mechanics (friction), to name same branches of science and examples therein. The most prominent and often successfully applied model is the so-called Preisach model of hysteresis. Its phenomenological character allows the simulation of the response of hysteretic systems from different scientific fields to external driving. We consider stochastic external driving fields and derive properties of the system's response using rigorous methods and simulations.

The development of a hysteresis memory is reflected in the possibility of long-time tails in the autocorrelation of the system's response even for uncorrelated external driving fields. Hence hysteresis is a mechanism for the generation of $1/f$-noise [1]. These rigorous results are extended by simulations to driving fields showing long-term correlations themselves. One observes that the autocorrelation of the response does not decay faster than the autocorrelation of the external driving. But the picture is more complicated; there is a possibility that long-term memory in the hysteretic response is more pronounced in the case of uncorrelated driving than for correlated driving.

[1] G. Radons, Phys. Rev. Lett. **100**, 240602 (2008).

DY 15.7 Tue 18:00 P1

Monte Carlo study of the evaporation/condensation transition of Ising droplets — •Micha Wiedenmann, Andreas Nussbaumer, Elmar Bittner, and Wolfhard Janke — Institut

für Theoretische Physik, Universität Leipzig, Postfach 100920, 04009 Leipzig

This work builds on recent work of A. Nußbaumer *et al.* [*Europhys. Lett.* **75** (2006) 716] and studies the evaporation/condensation transition of Ising droplets in three dimensions. We performed Monte Carlo simulations of the Ising model with nearest-neighbor couplings on a simple cubic lattice with periodic boundary conditions at a fixed magnetization, corresponding to a certain amount v_L of overturned spins. The volume v_d of the largest droplet was measured at constant magnetization employing a flood-fill algorithm. For values of the magnetization $m < m_c$ there exists no droplet in the system and the fraction of overturned spins above the equilibrium magnetization m_0 in the largest droplet $\lambda = v_d/v_L$ is zero. At $m = m_c$ one half of the overturned spins form a droplet which grows for larger values of the magnetization. This behavior can be compared to analytical results given by Biskup *et al.* [*Europhys. Lett.* **60** (2002) 21]. In order to do so we measured the spontaneous magnetization m_0, the magnetic susceptibility χ and the planar surface tension τ (which is a good approximation of a Wulff shaped droplet). Rescaling the magnetization to a dimensionless parameter $\Delta = \Delta(m, \chi, \tau, m_0)$, our measured results are in good agreement with the theoretical predictions.

DY 15.8 Tue 18:00 P1

Structure of the Tip4p water model in the ice I_h phase — •Johannes Zierenberg[1], Bernd A. Berg[2], and Wolfhard Janke[1] — [1]Institut für Theoretische Physik, Universität Leipzig, Germany — [2]Dept. of Physics, Florida State University, Tallahassee, USA

Potential water models have been widely used throughout the last decades in a variety of computer simulations. Especially in the simulations of processes where water is used as a solvent, the influence of the model is easily underestimated and can provide a large source of error. We investigated the behavior of the Tip4p model with different parametrizations in the hexagonal, ordinary ice phase. To this end random spherical nanosized water clusters were arranged in the experimentally determined tetrahedral structure. These configurations were minimized in energy with a semi-dynamic technique, resulting in local energy minimium configurations of the specific water model. Important to notice is the necessity to correctly consider the involved long-range interactions, especially the electrostatic one which cannot be handled trivially by a cutoff. This process revealed insight into the properties of the model near and in the ice phase, confirming the stability of the hexagonal structure with multiple local minima, with almost identical energies. That way the principle structure of the unit cell was obtained and compared for the different parameterizations.

DY 15.9 Tue 18:00 P1

Rounding Effects Influencing the Quality of Heuristic Optimization Algorithms — •Martin Ransberger[1], Ingo Morgenstern[1], and Johannes Josef Schneider[2] — [1]Faculty of Physics, University of Regensburg, 93040 Regensburg, Germany — [2]Department of Physics, Mathematics, and Computer Science, Johannes Gutenberg University of Mainz, Staudinger Weg 7, 55099 Mainz, Germany

Search space smoothing and related heuristic optimization algorithms provide an alternative approach to simulated annealing and its variants: while simulated annealing overcomes barriers in the energy landscape at finite temperatures, search space smoothing intends to remove these barriers, such that a greedy algorithm is sufficient to find the global minimum. Several formulas for smoothing the energy landscape have already been applied, one of them making use of the finite numerical precision on a computer. In this presentation, we thoroughly investigate the effect rounding errors have on the quality of results achieved with heuristic optimization algorithms. We present computational results for the traveling salesman problem.

DY 15.10 Tue 18:00 P1

Magic Squares in a Heatbath — •Christoph Schuster and Johannes Josef Schneider — Department of Physics, Mathematics, and Computer Science, Johannes Gutenberg University of Mainz, Staudinger Weg 7, 55099 Mainz, Germany

Magic squares are fascinating objects with interesting properties. In this presentation, we demonstrate how simulated annealing is applied to the problem of ordering integer numbers on a square lattice in order to create a magic square. We show that the cooling process exhibits interesting properties including power laws and that the usage of simulated annealing allows a straightforward extension of this approach to magic squares with constraints, like the retaining water problem.

DY 15.11 Tue 18:00 P1

Investigation of a highly frustrated point packing problem — Frederic Alexander Stein[1], Sebiha Sahin[1], Andre Müller[1], Michael Kwasnicki[1], Tobias Preis[1], Elmar Schömer[1], Ingo Morgenstern[2], and •Johannes Josef Schneider[1] — [1]Department of Physics, Mathematics, and Computer Science, Johannes Gutenberg University of Mainz, Staudinger Weg 7, 55099 Mainz, Germany — [2]Faculty of Physics, University of Regensburg, 93040 Regensburg, Germany

We consider a highly frustrated point packing problem. The task of this problem is to place a proposed number of points on the nodes of a square lattice in the way that the radius of the circumcircle around the points is minimized and that each Euclidean distance value between each pair of points only occurs once. We show that this latter constraint leads to a large frustration effect by comparison with the corresponding un-frustrated system. We solve this problem by using simulated annealing, study the dynamics of the cooling process, and demonstrate that this problem exhibits interesting features, including scaling laws for the radius of the circumcircle and for the distribution of points [1].

[1] Frédéric Alexander Stein, Sebiha Sahin, André Müller, Michael Kwaśnicki, Tobias Preis, Elmar Schömer, Ingo Morgenstern, and Johannes Josef Schneider, *Investigation of a highly frustrated point packing problem*, submitted to Physical Review E, 2010.

DY 15.12 Tue 18:00 P1

Quantum properties of 4D area preserving maps — Arnd Bäcker, Roland Ketzmerick, and •Martin Richter — Institut für Theoretische Physik, Technische Universität Dresden, 01062 Dresden, Germany

We investigate quantum mechanical properties of 4D area preserving maps in the presence of nonlinear resonances. The focus is on regular-to-chaotic tunneling rates for designed models. For maps without resonances a prediction using the fictitious integrable system approach developed for lower dimensional systems is given. Adding nonlinearities leads to prominent peaks in the tunneling rates γ vs. $1/h$ which can be explained qualitatively by an examination of the structure in the frequency plane. A visualization of these resonances is provided by sections through the 4D phase space which show complex regular regions interwoven with the chaotic sea. We present eigenfunctions concentrating in the chaotic sea in between resonance regions.

DY 15.13 Tue 18:00 P1

Is there universality in the quantum transport of partial barriers? — Arnd Bäcker[1,2], Roland Ketzmerick[1,2], and •Matthias Michler[1] — [1]Institut für Theoretische Physik, Technische Universität Dresden, 01062 Dresden, Germany — [2]MPI für Physik komplexer Systeme, 01187 Dresden

In generic Hamiltonian systems classical transport in the chaotic sea is limited by partial barriers, which allow a flux Φ given by the turnstile area. Quantum mechanically they are even more restrictive for Planck's constant $h \gg \Phi$, while for $h \ll \Phi$ classical transport is recovered. This transition is qualitatively well understood, however, many quantitative questions are still open.

We study the standard map and a designed kicked system, where both have two chaotic regions separated by one dominant partial barrier. We find scaling with the single parameter Φ/h, however with different functional dependence. The origin of the different scaling behavior is an open problem.

DY 15.14 Tue 18:00 P1

Power–Law Level–Statistics due to Dynamical Tunneling — Arnd Bäcker[1,2], Roland Ketzmerick[1,2], Steffen Löck[1], and •Normann Mertig[1] — [1]Institut für Theoretische Physik, Technische Universität Dresden, 01062 Dresden — [2]MPI für Physik komplexer Systeme, 01187 Dresden

For systems with a mixed phase space we demonstrate that dynamical tunneling universally leads to a fractional power-law of the nearest-neighbor level-spacing distribution $P(s)$ at small spacings s. Going beyond Berry-Robnik statistics, we take into account that dynamical tunneling rates between the regular and the chaotic region vary over many orders of magnitude. This results in a prediction of the level-spacing distribution which excellently describes the spectral data of the standard map. Moreover, we show that the fractional power-law expo-

nent is proportional to the effective Planck constant h and discuss the emergence of Berry-Robnik statistics in the semiclassical limit $h \to 0$.

DY 15.15 Tue 18:00 P1

Integrable Approximation for Regular Islands in Billiards — Arnd Bäcker[1,2], Roland Ketzmerick[1,2], •Clemens Löbner[1], and Steffen Löck[1] — [1]Technische Universität Dresden, Institut für Theoretische Physik, 01062 Dresden — [2]MPI für Physik komplexer Systeme, 01187 Dresden

Our aim is to approximate the dynamics of a regular island in a non-integrable billiard by an integrable Hamiltonian. For this purpose we use canonical transformations and interpolation techniques in the 4D phase space such that the regular tori of both systems and their dynamics agree as closely as possible. The resulting integrable Hamiltonian describes a billiard with the same boundary, but a nontrivial time evolution. We present the application of this method for the cosine billiard. This provides a basis for the determination of regular-to-chaotic tunneling rates with the fictitious integrable system approach.

DY 15.16 Tue 18:00 P1

Singularities in the delay-time distribution of 2D scattering systems — •Stefan Majewsky[1] and Holger Schanz[2,3] — [1]Computational Physics Group, Technische Universität Dresden, Institut für Theoretische Physik, 01062 Dresden — [2]Institut für Maschinenbau, Hochschule Magdeburg-Stendal, 39114 Magdeburg — [3]Max-Planck-Institut für Physik komplexer Systeme, Nöthnitzer Straße 38, 01187 Dresden

We investigate scattering systems where the probability distribution of the time delay shows logarithmic singularities and thus a clustering of delay times near some system-specific values. The effect can be understood as a generalization of caustics to the time domain. Its dynamical origin are saddle points in the time delay function. They arise either due to the details of the dynamics in the scattering region or, in some trivial cases, as a side-effect of a coordinate transformation. We use small clusters of non-overlapping potentials as model systems and study both, the classical and the quantum time delay.

DY 15.17 Tue 18:00 P1

Stability induced by chaos and disorder in the time reversal focalization — •Hernan L. Calvo[1,2] and Horacio M. Pastawski[1] — [1]Instituto de Fisica Enrique Gaviola and FaMAF UNC, 5000 Cordoba, Argentina — [2]Institut für Theoretische Physik A, RWTH Aachen University, D-52056 Aachen, Germany

The experimental procedure known as the time reversal mirror successfully achieves the focusing of a local excitation after its propagation through a chaotic or disordered medium. An initially localized pulse that becomes in a series of low amplitude reverberations is registered by a transducer that re-injects the signal in the reverse temporal order. This enables the focalization of the original pulse whose quality increases with the level of disorder in the system. We study the stability of this phenomenon against two irreversible processes: the escape in an open cavity, and a closed cavity under the effects of an external perturbation. Within a semiclassical approach in terms of time-dependent trajectories, the multiple reflections of the redundant registration yield a focalization signal that can be related with the Loschmidt echo amplitude. Both situations describe a Fermi Golden Rule regime, where the decay of the focalization is dominated by the perturbation strength. However, in the closed cavity this decay diminishes with the Lyapunov exponent of the system. This counter-intuitive result is a form of the quantum Zeno effect, which provides a new interpretation of the remarkable stability of the experiments.

DY 15.18 Tue 18:00 P1

Trace Formula for Three-dimensional Dielectric Resonators — •Stefan Bittner[1], Barbara Dietz[1], Maksim Miski-Oglu[1], and Achim Richter[1,2] — [1]Institut für Kernphysik Darmstadt — [2]ECT* Trento

Microlasers and dielectric microcavities have gained great interest due to possible applications in e.g. telecommunications and as a new type of wave-dynamical billiards. Especially the correspondence between ray and wave-optics is intensely studied for these systems. Trace formulas provide a connection between the density of states of the cavity and the periodic orbits of the corresponding billiard. A trace formula for two-dimensional dielectric resonators has been proposed [1] and successfully tested [2] in recent experiments. Typically microcavities, however, are three-dimensional flat disks which can only be approximated as two-dimensional objects with the help of a so-called effective index of refraction. We investigate 3d dielectric microwave resonators with the shape of circular flat disks. The experimental length spectra are analyzed with a combination of the trace formula for 2d dielectric resonators and the effective index of refraction model. The positions of the peaks in the length spectra can be successfully assigned to the lengths of periodic orbits when taking into account the dispersion of the effective index of refraction and the systematic inaccuracy of the effective index of refraction model. The work presented on this poster was supported by the DFG within SFB 634.

[1] Bogomolny *et al.*, Phys. Rev. E **78**, 056202 (2008).
[2] Bittner *et al.*, Phys. Rev. E **81**, 066215 (2010).

DY 15.19 Tue 18:00 P1

Equilibration of the harmonic oscillator from non-thermal initial states — •Daniel Pagel[1], Andreas Alvermann[2], and Holger Fehske[1] — [1]Institut für Physik, Universität Greifswald, Deutschland — [2]Cavendish Laboratory, University of Cambridge, United Kingdom

Quantum dissipation can be studied in a microscopic setting with the well known model of a central oscillator coupled linearly to a bath of harmonic oscillators. By making use of operator equations of motion we study the long time behaviour of the central oscillator density matrix. Applying general non-thermal initial states we show that only weak conditions on the initial preparation are necessary for the central oscillator to equilibrate. The stationary density matrix in the long time limit is then characterized by a parameter which can be identified as the 'temperature' of the central oscillator. We thus provide an example of how the thermodynamics of the canonical ensemble can be obtained from a purely microcanonical description.

DY 15.20 Tue 18:00 P1

Directed excitation transfer in non-equilibrium networks — •Maximilian Bauer and Oliver Mülken — Physikalisches Institut, Albert-Ludwigs Universität Freiburg, Freiburg, Germany

In the framework of continuous-time quantum walks (CTQW), the coherent dynamics of excitations is usually studied on static networks. We consider a CTQW on a dynamically varying structure, namely a vibrating chain. By applying an external field and matching the field strength with the oscillation frequency of the chain it is possible to obtain an (average) transport of an initial Gaussian wave packet. We distinguish between a uniform oscillation of all nodes of the chain and the chain being in its lowest eigenmode. Both cases can lead to directed transport. Furthermore, the coupling of these systems to an environment by Lindblad operators and the generalization to interacting particles is investigated.

Reference: [1] O. Mülken and M. Bauer, submitted (2010)

DY 15.21 Tue 18:00 P1

Generalized Master Equation Approach to Excitation Transport and Trapping on Networks — •Benjamin Berger and Oliver Mülken — Physikalisches Institut, Albert-Ludwigs-Universität Freiburg, Germany

Due to the recent interest in excitation dynamics in light-harvesting complexes, we present a Generalized Master Equation (GME) Model for coherent and incoherent transport on networks. For small networks, the focus is on the phenomenological incorporation of both, a heat bath causing decoherence and an exciton trap. Under certain conditions the solutions of the usual GME approaches become unphysical because of, say, negative probabilities. Here, we show how one can circumvent these difficulties.

DY 15.22 Tue 18:00 P1

Discrete Wigner function dynamics on rings — •Per Liebermann and Oliver Mülken — Physikalisches Institut, Universität Freiburg, 79104 Freiburg, Germany

The Wigner function provides a representation of quantum mechanics in phase space in terms of a real-valued distribution function. Calculating the Wigner function for a continuous-time quantum walk on a discrete ring for different initial conditions analytically enables us to investigate the dynamics in phase space. Starting with a Gaussian distribution, the dynamics are similar to the case of a coherent state of the harmonic oscillator. Namely, we obtain revivals of the Wigner function at the initial position as well as at the opposite one, i.e. the wave packet oscillates back and forth.

DY 15.23 Tue 18:00 P1

Dissipative exciton dynamics on small networks — •Johannes Kohlberger and Oliver Mülken — Albert-Ludwigs-Universität Freiburg, Germany

Excitation transfer through networks coupled to an environment plays an important role in many areas of physics and biology. We would like to understand the fundamental transport phenomena of different kinds of networks like the Fenna-Matthews-Olson (FMO) complex. For this purpose we consider small networks like dimers and trimers and use different approaches of the Lindblad-Master equation to couple them to an environment. With this approach it is possible to connect the network to different kinds of reservoirs like a trap or a source to get a more realistic coupling from the FMO-complex to the chlorosomes and the reaction centre. The advantage of studying those small networks is, that it is partly possible to solve them analytically and therefore get some fundamental insights in such transport processes, which can be used to understand transport phenomena in larger networks.

DY 15.24 Tue 18:00 P1

Projection operator approach to spin diffusion in the anisotropic Heisenberg chain at high temperatures — •Robin Steinigeweg[1] and Roman Schnalle[2] — [1]Institut für theoretische Physik, Technische Universität Braunschweig, D-38106 Braunschweig — [2]Fakultät für Physik, Universität Bielefeld, D-33615 Bielefeld

Spin transport in the anisotropic Heisenberg chain is typically investigated theoretically w.r.t. the finiteness of transport coefficients only. Assuming their finiteness at high temperatures, we develop a concrete quantitative picture of the diffusion constant/(dc-)conductivity as a function of both the anisotropy parameter Δ and the spin quantum number s, going beyond the most commonly considered case $s = 1/2$. Using this picture, we enable the comparison of finite transport coefficients from complementary theoretical methods on a quantitative level, having more significance than the finiteness alone. Our method is essentially based on an application of the time-convolutionless projection operator technique to current autocorrelations. This technique, although being a perturbation theory in Δ, is found to be applicable, even if Δ is not small. This finding supports the applicability to a wider class of strongly interacting many-particle quantum systems.

DY 15.25 Tue 18:00 P1

Boltzmann approach to transport in weakly interacting fermionic 1-d systems — •Christian Bartsch and Jochen Gemmer — Fachbereich Physik, Universität Osnabrück, Barbarastrasse 7, D-49069 Osnabrück, Germany

We investigate the transport behavior of a system of weakly interacting 1-d (spinless) fermions featuring nearest and next nearest neighbor hopping and nearest neighbor interaction. By means of a leading order TCL (time-convolutionless) projection operator approach we set up a master equation for certain momentum mode occupation numbers and interpret the resulting rate matrix as scattering term of a linear(ized) quantum Boltzmann equation, from which one may extract a diffusion coefficient. One numerically finds that both the diffusion coefficient itself and the time scale, on which the diffusion coefficient becomes constant, are larger for smaller next nearest neighbor hoppings. In the absence of next nearest neighbor hopping (, in this case the model corresponds to an anisotropic Heisenberg spin chain in terms of a Jordan-Wigner-transformation,) this time scale diverges, which may indicate ballistic transport or a diffusion coefficient scaling in higher orders of the interaction strength that are beyond this leading order approach.

DY 15.26 Tue 18:00 P1

Absorption and energy transfer of molecular aggregates — •Gerhard Ritschel, Jan Roden, and Alexander Eisfeld — MPI-PKS Dresden

The coupling of electronic excitation to vibrational degrees of freedom strongly influences characteristic properties of molecular aggregates such as optical properties and energy transfer dynamics. We treat this complicated exciton-phonon coupling using a non-Markovian stochastic Schrödinger equation. Solving a Holstein-type model, we calculate spectra and energy transfer for a coupling to a realistic, complex phonon bath such that energy dissipation to the phonons is fully included. Our approach captures uniformly the transition from fully coherent to incoherent excitation transfer. Using this new method we are able to investigate decoherence and entanglement in mesoscopic molecular aggregates.

On the other hand, we compare experimental spectra of such molecular aggregates, that are obtained by helium nanodroplet isolation spectroscopy and resolve individual vibrational lines, with full quantum calculations. Here we are able to explain the effect of the many vibrational modes of the molecules on the aggregate absorption.

DY 15.27 Tue 18:00 P1

Quantum Correlations in Disordered Systems — •Dominik Hörndlein, Vivian França, and Andreas Buchleitner — Physikalisches Institut, Universität Freiburg, Hermann-Herder-Str. 3, 79104 Freiburg im Breisgau, Germany

In recent years, quantum correlations and entanglement in solid state systems have been examined with respect to their influence on the system's properties, as for example on charge transport. In this context, the impact of disorder in real-life solids is still an unclear issue. Therefore, we investigate the electronic correlations in one-dimensional atomic systems in the presence of disordered impurities. Our numerical studies are based on the Hubbard model, which is a standard model for describing electronic interactions in solids. Considering different probability distributions for the impurities, ranging from total order to total randomness, we analyse the usefulness of various types of quantum correlations for quantifying and characterizing the entanglement in these differently disordered systems.

DY 15.28 Tue 18:00 P1

Thermopower in Bilayer Graphene — •Aleksander Hinz — School of Engineering and Science, Jacobs University Bremen, Bremen 28759, Germany

In this work we present our theoretical approach to investigate Thermopower in Bilayer Graphene. Inspired by Seoung-Geol Nam's experimental work in late 2009 [1] as a member of the group of Hu-Jong Lee at Postech University, S.Korea, we seek to provide a theorecical underpinning for the observed phenomena concerning Bilayer Graphene.

Since our theoretical framework for Monolayer Graphene, which is based upon the description of conductivity including diffusion on impurities by using the linear response theory within the diagrammatic description, is in good accordance with experimental data only for Monolayer and not for Bilayer Graphene, we devise a modification of this framework, taking into account additional physical effects beyond impurity diffusion.

The effect investigated in this work is the electron-phonon interaction, that leads to a Phonondrag component in Thermopower at low temperature, while at higher temperature this effect is suppressed by phonon-phonon interaction. In contrast to the diffusive part we here apply the Boltzmann equation description as well as the balance-equation-based examination, which appreas to be sufficient for our case. This serves as an approach to explain the observed disagreement between experimental results and corresponding calculations using the classical Mott formula in Seoung-Geol Nam's work [1].

[1] S. Nam, D. Ki, and H. Lee, arXiv:1005.4739

DY 15.29 Tue 18:00 P1

The density of Stone-Wales defects in a graphene nano-ribbon in terms of a Potts-like model — •Jaime E. Santos — Max Planck Institute for the Physics of Complex Systems, Noethnitzer Str. 38, 01187 Dresden

We will discuss a 1d Potts-like model that accounts for the density of Stone-Wales defects along a zig-zag edge of a graphene nano-ribbon. The couplings of the model can be extracted from DFT, both in the case of H-passivated and non-passivated edges. Given that the couplings only involve nearest neighbouring sites, we can write the partition function of the model in terms of a transfer matrix that is easily diagonalisable, yielding the thermodynamics of the model.

DY 15.30 Tue 18:00 P1

Parity detection and entanglement with a Mach-Zehnder interferometer — •Géraldine Haack[1], Heidi Förster[2], and Markus Büttiker[1] — [1]University of Geneva, Geneva, Switzerland — [2]United Nations University, Bonn, Germany

A parity meter projects the state of two qubits onto two subspaces with different parities, the states in each parity class being indistinguishable. It has application in quantum information for its entanglement properties. In our work we consider the electronic Mach-Zehnder interferometer (MZI) coupled capacitively to two double quantum dots (DQDs), one on each arm of the MZI. These charge qubits couple linearly to the charge in the arms of the MZI. A key advantage of an MZI is that the qubits are well separated in distance so that mutual in-

teraction between them is avoided. Assuming equal coupling between both DQDs and the arms and the same bias for each DQD, this setup usually detects three different currents, one for the odd states and two for each even state. Controlling the magnetic flux of the MZI, we can operate the MZI as a parity meter: only two currents are measured at the output, one for each parity class. In this configuration, the MZI acts as an ideal detector, its Heisenberg efficiency being maximal. For a class of initial states, the initially unentangled DQDs become entangled through the parity measurement process with probability one.