SPECTRAL DAYS 2017

Stuttgart, Germany | April 3 - 7, 2017

Scientific Program and Abstracts

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Scientific Program

Venue
Building Department of Computer Science / Informatik
Lecture Hall 38.04,
Universitätsstraße 38
70569 Stuttgart

Monday, 03.04.2017

8:00 - 9:00	Registration
9:00 – 9:30	Opening: Prof. Thomas Ertl, Universität Stuttgart
9:30 – 10:15	**Benjamin Schlein**: *Condensation and Excitation Spectrum of Bose Gases*
10:15 – 11:00	**Simona Rota Nodari**: *Orbital stability in Hamiltonian PDEs with symmetries*
11:00 – 11:45	Coffee Break - Registration
11:45 – 12:30	**Jürg Fröhlich:** *Quantum Dynamics of Systems Under Repeated Observation*
12:30 – 14:30	Lunch Break
14:30 – 15:15	**Laurent Thomann**: *On the Lowest Landau Level equation*
15:15 – 16:00	**Nicolas Rougerie:** *Localized Regime for Mean-Field Bosons in a Double-Well Potential*
16:00 – 16:30	Coffee Break
16:30 – 17:15	**Phan Thành Nam:** *Binding energy of weakly interacting Bose gases*
17:15 – 18:00	**Marcello Porta:** *Mean field evolution of fermionic systems*

18:00 **Welcome Reception**

at Commundo Hotel (Campus Vaihingen)
sponsored by

AIP | Journal of Mathematical Physics

International Association of Mathematical Physics

Tuesday, 04.04.2017

9:00 – 9:45	**Simone Warzel:** *Low-energy Fock-space localization for attractive hard-core particles in disorder*
9:45 – 10:30	**Stéphane Nonnenmacher:** *Spectral correlations for randomly perturbed nonselfadjoint operators*
10:30 – 11:00	Coffee Break
11:00 – 11:45	**Stefano Olla:** *Entropic hypocoercivity and hydrodynamic limits*
11:45 – 12:30	**Gianluca Panati:** *The Localization Dichotomy for gapped periodic quantum systems*
12:30 – 14:00	Lunch Break
14:00 – 14:30	Poster Presentation
14:30 – 15:15	**Renato Renner:** *The quantum conditional mutual information*
15:15 – 16:00	**Katya Krupchyk:** L^p *resolvent estimates for elliptic operators on compact manifolds and applications*
16:00 – 16:30	Coffee Break
16:30 – 17:15	**Anna Vershynina:** *Quantum analogues of geometric inequalities in Infor-mation Theory*
17:15 – 18:00	**Rafael Tiedra de Aldecoa:** *Spectral analysis of quantum walks with an aniso-tropic coin*

Wednesday, 05.04.2017

Contributed Talks

9:00 – 9:30	**Sabine Bögli:** *Schrödinger operator with non-zero accumulation points of complex eigenvalues*
9:30 – 10:00	**Magda Khalile:** *Eigenvalues of a Robin Laplacian on infinite sectors*
10:00 – 10:30	**Alissa Geisinger:** *Persistence of Translational Symmetry in the BCS Model with radial pair interaction*
10:30 – 11:00	Coffee Break
11:00 – 11:30	**Niels Benedikter:** *On the Geometric Approach to Effective Evolution Equations*
11:30 – 12:00	**Marco Falconi:** External Potentials Generated by the Interaction with a Semiclassical Field
12:00 – 12:30	**Hans-Konrad Knörr:** On the adiabatic theorem when eigenvalues dive into the continuum
12:30	Lunch Break

19:00 **Conference Dinner**
Restaurant "Amadeus"

City Center Stuttgart near Schlossplatz
U-Bahn station "Charlottenplatz"
Map: amadeus-stuttgart.de/anfahrt/

Thursday, 06.04.2017

9:00 – 9:45	**Virginie Bonnaillie-Noël:** *Ground state energy of the magnetic Laplacian on corner domains*
9:45 – 10:30	**Rupert Frank:** *A non-linear adiabatic theorem for the one-dimensional Landau-Pekar system*
10:30 – 11:00	Coffee Break
11:00 – 11:45	**Enno Lenzmann:** *Spectral problems for half-harmonic maps*
11:45 – 12:30	**Fritz Gesztesy:** *On factorizations of differential operators and Hardy-Rellich-type inequalities*
12:30 – 14:00	Lunch Break
14:00 – 14:30	Poster Presentation
14:30 – 15:15	**David Krejčiřík:** *Absence of eigenvalues of Schrödinger operators with complex potentials*
15:15 – 16:00	**Douglas Lundholm:** *A Thomas-Fermi model for magnetically self-interacting bosons*
16:00 – 16:30	Coffee Break
16:30 – 17:15	**Richard Laugesen:** *Asymptotically optimal shapes: drums with least n-th frequency, and generalized ellipses enclosing most lattice points*
17:15 – 18:00	**Jean Dolbeault:** *Symmetrization based on entropy methods and nonlinear flows*

Friday, 07.04.2017

9:00 – 9:45	**Heinz Siedentop:** *From Excess Charge of Atoms to Blow-Up of the Patlak-Keller-Segel System*
9:45 – 10:30	**Fernando Brandão:** *TBA*
10:30 – 11:00	Coffee Break
11:00 – 11:45	**Jacob Schach Møller:** *The discrete Laplacian: A Bessel function approach*
11:45 – 12:30	**Hynek Kovařík:** *On the first eigenvalue of the p-Laplacian with Robin boundary conditions*
12:30 – 13:15	**Daniel Grieser:** *The spectrum of the Laplacian on polygonal domains*
13:15	Lunch Break

Invited speakers

Virginie Bonnaillie-Noël
Fernando G.S.L. Brandão
Jean Dolbeault
Rupert Frank
Jürg Fröhlich
Fritz Gesztesy
Daniel Grieser
Hynek Kovařík
David Krejčiřík
Katya Krupchyk
Richard S. Laugesen
Enno Lenzmann
Douglas Lundholm
Jacob Schach Møller
Phan Thành Nam
Stéphane Nonnenmacher
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Marcello Porta
Renato Renner
Simona Rota Nodari
Nicolas Rougerie
Benjamin Schlein
Heinz Siedentop
Rafael Tiedra de Aldecoa
Laurent Thomann
Anna Vershynina
Simone Warzel

Contributing speakers

Sabine Bögli
Magda Khalile
Alissa Geisinger
Niels Benedikter
Marco Falconi
Hans-Konrad Knörr

Posters

Hanne van den Bosch	Spectral gaps of Dirac operators for graphene quantum dots
Emanuela Laura Giacomelli	Surface Superconductivity in Presence of Corners
Daniele Dimonte	Vortices Dynamics in a Bose-Einstein Condensate starting from the Many Body Theory
Per von Soosten	Optimal Stability under Dyson Brownian Motion
Giulia Basti	Efimov effect for a three-particle system with two identical fermions
Maximilian Duell	Scattering of Atoms in Relativistic QED without Herbst-type Spectral Conditions
Lucrezia Cossetti	Spectral stability of Lamé operators with subordinated complex potentials
Andreas Deuchert	A lower bound for the BCS functional with boundary conditions at infinity
Malte Behr	Singularities of the wave trace for manifolds with gliding rays
Thomas Moser	Stability of a fermionic N+1 particle system with point interactions

Invited Talks

Virginie Bonnaillie-Noël (CNRS, ENS Paris)

Ground state energy of the magnetic Laplacian on corner domains

Abstract: The asymptotic behavior of the first eigenvalues of magnetic Laplacian operators with large magnetic fields and Neumann realization in smooth three-dimensional domains is characterized by model problems inside the domain or on its boundary. In two-dimensional polygonal domains, a new set of model problems on sectors has to be taken into account. In this talk, we consider the class of general corner domains. In dimension 3, they include as particular cases polyhedra and axisymmetric cones. We attach model problems not only to each point of the closure of the domain, but also to a hierarchy of "tangent substructures"' associated with singular chains. We investigate spectral properties of these model problems, namely semicontinuity and existence of bounded generalized eigenfunctions. We prove estimates for the remainders of our asymptotic formula. Lower bounds are obtained with the help of an IMS type partition based on adequate two-scale coverings of the corner domain, whereas upper bounds are established by a novel construction of quasimodes, qualified as sitting or sliding according to spectral properties of local model problems. A part of our analysis extends to any dimension. - This is a joint work with M. Dauge and N. Popoff.

Jean Dolbeault (CNRS & Université Paris-Dauphine)

Symmetrization based on entropy methods and nonlinear flows

Abstract: Some Gagliardo-Nirenberg inequalities are equivalent to entropy - entropy production inequalities and can be established by the Bakry-Emery, or carré du champ, method applied to fast diffusion equations. In presence of weights, adapted nonlinear flows can also be used as tools to study symmetry and symmetry breaking issues in Caffarelli-Kohn-Nirenberg inequalities. Large time asymptotics determine which regime of symmetry has to be considered. This lecture will emphasize the role of the linearized inequalities in the study of the nonlinear evolution equations and the consequences for nonlinear interpolation inequalities and the determination of the corresponding optimal constants.

Rupert Frank (LMU München)

A non-linear adiabatic theorem for the one-dimensional Landau-Pekar system

Abstract: The Landau-Pekar equations are a system of two coupled non-linear equations that describe the effective motion of a strongly coupled electron and its polarization field. The two equations have different time scales. We show that, if the electron is initially in the ground state of the effective Schrodinger operator generated by the field, then it (almost) remains in the ground state up to times of order one on the slow time scale. In contrast to a linear adiabatic theorem, the mechanism of this non-linear result is dispersion. - The talk is based on joint work with Gang Zhou.

Jürg Fröhlich (ETH Zürich)

Quantum Dynamics of Systems Under Repeated Observation

Abstract: We start by presenting a short summary of examples of "effective dynamics" in quantum theory. We then study more closely the effective quantum dynamics of systems interacting with a long sequence of independent probes, one after another, which, afterwards, are subject to a projective measurement and are then lost. This leads us to develop a theory of indirect measurements of time-independent quantities (non-demolition measurements). Next, the theory of indirect measurements of time-dependent quantities is outlined, and a new family of diffusion processes - "quantum jump processes" - is described. Some open problems are described.

Fritz Gesztesy (Baylor University)

On factorizations of differential operators and Hardy-Rellich-type inequalities

Abstract: We will illustrate how factorizations of singular, even-order partial differential operators yield an elementary approach to classical inequalities of Hardy-Rellich-type. More precisely, using this factorization method, we will derive a general (and, apparently, new) inequality and demonstrate how particular choices of the parameters contained in this inequality yield well-known inequalities, such as the classical Hardy and Rellich inequalities as special cases. Actually, other special cases yield additional and apparently less well-known inequalities. We will indicate that our method, in addition to being elementary, is quite flexible when it comes to a variety of generalized situations involving the inclusion of remainder terms and higher-order operators. This is based on joint work with Lance Littlejohn.

Daniel Grieser (Carl von Ossietzky Universität Oldenburg)

The spectrum of the Laplacian on polygonal domains

Abstract: We consider the spectrum of the Dirichlet or Neumann Laplacian on planar polygonal domains. For example, the counterexamples to the famous ‚Can you hear the shape of a drum?‘ problem are such domains. We discuss recent results on various topics including the inverse problem and thin domain asymptotics.

Hynek Kovařík (Universitá degli studi di Brescia)

On the first eigenvalue of the p-Laplacian with Robin boundary conditions.

Abstract: In this talk we will consider the p-Laplace operator with Robin boundary conditions on Euclidean domains with sufficiently regular boundary. In particular, it will be shown how the asymptotic behaviour of the first eigenvalue, when the strength of the (negative) boundary term grows to infinity, depends on the geometry of the domain. Localisation of the corresponding minimisers will be discussed as well. This is a joint work with Konstantin Pankrashkin.

David Krejčiřík (Czech Technical University Prague)

Absence of eigenvalues of Schrödinger operators with complex potentials

Abstract: We prove that the spectrum of Schrödinger operators in three dimensions is purely continuous and coincides with the non-negative semiaxis for all potentials satisfying a form-subordinate smallness condition. By developing the method of multipliers, we also establish the absence of point spectrum for electromagnetic Schrödinger operators in all dimensions under various alternative hypotheses, still allowing complex-valued potentials with critical singularities. - This is joint work with Luca Fanelli and Luis Vega.

Katya Krupchyk (University of California, Irvine)

L^p resolvent estimates for elliptic operators on compact manifolds and applications

Abstract: We shall discuss uniform L^p resolvent estimates for elliptic operators. Originally obtained by Kenig, Ruiz, and Sogge in the case of the Euclidean space, they have been established by Dos Santos Ferreira, Kenig, and Salo for the Laplacian on a compact manifold. We shall discuss an extension to the case of higher order self-adjoint operators, as well as to some weakly non-self-adjoint operators, such as the stationary damped wave operator. Our approach is based on the techniques of semiclassical Strichartz estimates. Applications to spectral theory for periodic Schrodinger operators as well as to inverse boundary problems for elliptic operators with low regularity coefficients will also be discussed. This talk is based on joint works with Gunther Uhlmann and with Nicolas Burq and David Dos Santos Ferreira.

Richard Laugesen (University of Illinois)

Asymptotically optimal shapes: drums with least n-th frequency, and generalized ellipses enclosing most lattice points

Abstract: What shape of domain minimizes the n-th eigenvalue (frequency) of the Laplacian, for large n? Does the minimizer approach a disk as n tends to infinity? This asymptotic optimality conjecture is supported by the discovery of Antunes and Freitas that among rectangular drums, the one minimizing the n-th frequency converges to a square as n tends to infinity. Their proof relies on lattice point counting in ellipses. We extend to lattice point counting inside concave and convex curves such as p-ellipses with $p \neq 1$, and allow both positive and (some) negative translations of the lattice. A natural open problem then arises about right triangles or, equivalently, about asymptotically optimal harmonic oscillators. - Joint with Shiya Liu (U. of Illinois) and Sinan Ariturk (Pontificia U. Catolica do Rio de Janeiro, Brazil).

Enno Lenzmann (Universität Basel)

Spectral problems for half-harmonic maps

Abstract: Half-harmonic maps are intriguing objects with close connections to minimal surfaces, conformal geometry, and completely integrable systems. In my talk, I will focus on the the so-called energy-critical case of half-harmonic maps from the real line (R) to the two-dimensional unit sphere (S^2). In particular, I will discuss spectral key properties of the linearized operator around such half-harmonic maps. A striking feature of these (nonlocal) operators is that they can be analyzed in great detail by looking at certain Jacobi-type operators acting on the unit circle. This is joint work with Armin Schikorra (Freiburg i. Br.).

Douglas Lundholm (KTH Royal Institute of Technology, Stockholm)

A Thomas-Fermi model for magnetically self-interacting bosons

We consider a two-dimensional model for a confined quantum particle that interacts with itself purely magnetically, with a magnetic field proportional to the density and an interaction strength regulated by a single dimensionless parameter β. This model arises upon considering a gas of identical particles with statistics intermediate between bosons and fermions in a certain limit close to bosons, known as anyons in the average-field approximation, with $\beta = 0$ corresponding to non-interacting bosons. In the "less bosonic" limit $\beta \to \infty$ we derive an effective Thomas-Fermi-like description for the ground state. The talk is based on joint work with M. Correggi, R. Duboscq and N. Rougerie.

Jacob Schach Møller (Aarhus University)

The discrete Laplacian: A Bessel function approach

Abstract:We discuss how to use optimal estimates on Bessel functions by Krasikov and Landau to derive L^p-weighted estimates for the free propagator and resolvent of the discrete Laplacian on a cubic lattice. As an application, we shall discuss an associated Birman-Schwinger equation and derive consequences for the spectral and scattering theory for discrete Schrödinger operators. - The talk is based on joint work with Evgeny Korotyaev.

Phan Thành Nam (Masaryk University)

Binding energy of weakly interacting Bose gases

Abstract: In 1947, Bogoliubov suggested an approximation method to predict the excitation spectrum of a weakly interacting Bose gas. We will argue that Bogoliubov approximation can be used also to calculate the binding energy, namely the energy needed to add or remove one particle from the system. Our calculation can be made rigorous for the homogeneous gas with mean-field interaction. However, the general case is left open.

Stéphane Nonnenmacher (Université Paris-sud)

Spectral correlations for randomly perturbed nonselfadjoint operators

Abstract: We are interested in the spectrum of semiclassical nonselfadjoint operators. Due to a strong pseudospectral effect, a tiny perturbation can dramatically modify the spectrum of such an operator. Hager & Sjöstrand have thus considered adding small random pertubations, and proved that the eigenvalues of the perturbed operator typically spread over the classical spectrum, satisfying a probabilistic Weyl's law in the semiclassical limit. Beyond this Weyl's law, we investigate the correlations between the eigenvalues, at microscopic distances. In the case of 1-dimensional operators, these correlations depend on the structure of the energy shell of the unperturbed operator (a finite set of points), and of the type of perburbation (random matrix vs. random potential), but otherwise enjoy a form of universality, where the central object is the Gaussian Analytic Function (GAF), a family of random entire functions. The GAF was originally introduced in the context of Quantum Chaos in the 1990s, in order to describe the statistical properties of 1D chaotic eigenfunctions. In the present model the GAF (and its variants) rather arise through the spectral determinant of our randomly perturbed operator. - This is a joint work with Martin Vogel (Orsay).

Stefano Olla (Université Paris Dauphine, PSL Research University)

Entropic hypocoercivity and hydrodynamic limits

Abstract: Entropic hypocoercivity provides estimates on regularity independent of the dimensions of the system. It seems to be the right tool to extend relative entropy methods to degenerate dynamics where noise acts only on velocities. I will provide some examples that were untreatable before.

Gianluca Panati (“La Sapienza" University of Rome)

The Localization Dichotomy for gapped periodic quantum systems

Abstract: The talk concerns the localization properties of independent electrons in a periodic background, possibly including a periodic magnetic field, as e.g. in ordinary insulators, in Chern insulators and in Quantum Hall systems. Since, generically, the spectrum of the Hamiltonian is absolutely continuous, localization is characterized by the decay, as $|x|$ tends to infinity, of the composite (magnetic) Wannier functions associated to the Bloch bands below the Fermi energy, which is supposed to lie in a spectral gap. We prove the validity of a localization dichotomy, in the following sense: either there exist exponentially localized composite Wannier functions, and correspondingly the system is in a trivial topological phase with vanishing Chern numbers, or the decay of \emph{any} composite Wannier function is such that the expectation value of the squared position operator is infinite. Equivalently, in the topologically non-trivial phase the localization functional introduced by Marzari and Vanderbilt diverges, as numerically observed in the case of the Haldane model. The result is formulated by using only the relevant symmetries of the system, and extends to the case of interacting electrons within the Hartree-Fock approximation.

Marcello Porta (University of Zürich)

Mean field evolution of fermionic systems

Abstract: In this talk I will consider the dynamics of interacting fermionic systems in the mean field regime. As the number of particles goes to infinity, the dynamics is expected to be well approximated by the time-dependent Hartree-Fock equation. In this talk, I will present results on the rigorous derivation of this effective evolution equation, at zero temperature (pure states) and at positive temperature (mixed states). Under the assumption that a suitable semiclassical structure of the initial datum is propagated along the Hartree-Fock flow, I will discuss the extension of these results to the case of particles interacting via a Coulomb potential.

Renato Renner (ETH Zürich)

The quantum conditional mutual information

Abstract: The quantum conditional mutual information is widely used in quantum information theory for the study of correlations. In this talk, I will present recent results which establish that the quantity can be interpreted as a measure for how well lost quantum information can be recovered from remaining pieces. The results can be applied to estimate the amount of information that is needed to accurately approximate the state of many-body systems.

Simona Rota Nodari (Université de Bourgogne)

Orbital stability in Hamiltonian PDEs with symmetries

Abstract: In this talk, I will describe the energy-momentum method for the proof of the orbital stability of relative equilibria of Hamiltonian dynamical systems on Banach spaces, in the presence of higher dimensional symmetry groups. More precisely, I will show that the proof of the orbital stability can be reduced to a "coercivity estimate" on an appropriately constructed Lyapunov function and I will illustrate how this estimate can be obtained in the general case of higher dimensional symmetry groups. - Works in collaboration with Stephan De Bièvre and François Genoud

Nicolas Rougerie (Université Grenoble-Alpes & CNRS)

Localized Regime for Mean-Field Bosons in a Double-Well Potential

Abstract: We study the many-body Schrödinger Hamiltonian for interacting bosons in a symmetric double-well potential, letting the distance between the two wells increase to infinity with the number of particles. We focus on an interaction-driven transition in the ground state, between a delocalized state (particles are independent and all live in both wells) and a localized state (particles are correlated, half of them live in each well). When tunneling is negligible against interaction energy, we prove a localization estimate showing that the particle number fluctuations in each well are strongly suppressed. The modes in which the particles condense are minimizers of nonlinear Schrödinger-type functionals. - Joint work with Dominique Spehner

Benjamin Schlein (University of Zürich)

Condensation and Excitation Spectrum of Bose Gases

Abstract: We consider systems of N interacting bosons in a box with periodic boundary conditions. The potential scales with N and it has the form $N^{-1+3\beta} V(N^{\beta} x)$, where $V \geq 0$ is smooth, has compact support and sufficiently small L^1-norm, and $\beta \in (0;1]$. Notice that the case $\beta = 1$ corresponds to the well-known Gross-Pitaevskii regime (while the case $\beta = 0$ would correspond to a mean-field limit). For $\beta \in (0;1]$, we prove that states with excitation energy of order one (in N) exhibit optimal condensation; the number of particles orthogonal to the condensate remains bounded, uniformly in N. For $\beta \in (0;1)$, we also show that low-lying spectral excitations are described, up to corrections vanishing in the limit of large N, by an appropriately modified Bogoliubov theory. This is joint work with C. Boccato, C. Brennecke and S. Cenatiempo.

Heinz Siedentop (Ludwig-Maximilians-Universität München)

From Excess Charge of Atoms to Blow-Up of the Patlak-Keller-Segel System

Abstract: We prove a blow-up criterion for the solutions to the ν-dimensional Patlak-Keller-Segel equation in the whole space. The condition is new in dimension three and higher. In dimension two it is exactly Dolbeault's and Perthame's blow-up condition, i.e., blow-up occurs, if the total mass exceeds 8π. - This is joint work with Li Chen (Mannheim).

Laurent Thomann (Université de Lorraine)

On the Lowest Landau Level equation

Abstract: We study the Lowest Landau Level equation with time evolution. This model is used in the description of fast rotating Bose-Einstein condensates. Using argument coming from the theory of the holomorphic functions, we provide a classification of the stationnary solutions. We also prove some stability results. This is a work in collaboration with Patrick Gérard (Paris-Sud) and Pierre Germain (Courant Institute).

Rafael Tiedra de Aldecoa (Pontifical Catholic University of Chile)

Spectral analysis of quantum walks with an anisotropic coin

Abstract: We perform the spectral analysis of the evolution operator U of quantum walks with an anisotropic coin, which include one-defect models, two-phase quantum walks, and topological phase quantum walks as special cases. In particular, we determine the essential spectrum of U, we show the existence of locally U-smooth operators, we prove the discreteness of the eigenvalues of U outside the thresholds, and we prove the absence of singular continuous spectrum for U. Our analysis is based on new commutator methods for unitary operators in a two-Hilbert spaces setting, which are of independent interest. - This is a joint work with Serge Richard (Nagoya University) and Akito Suzuki (Shinshu University).

Anna Vershynina (BCAM-Basque Center for Applied Mathematics)

Quantum analogues of geometric inequalities in Information Theory

Abstract: Geometric inequalities, such as entropy power inequality or the isoperimetric inequality, relate geometric quantities, such as volumes and surface areas. Classically, these inequalities have useful applications for obtaining bounds on channel capacities, and deriving log-Sobolev inequalities. In my talk I provide quantum analogues of certain well-known inequalities from classical Information Theory, with the most notable being the isoperimetric inequality for entropies. The latter inequality is useful for the study of convergence of certain semigroups to fixed points. In the talk I demonstrate how to apply the isoperimetric inequality for entropies to show exponentially fast convergence of quantum Ornstein-Uhlenbeck (qOU) semigroup to a fixed point of the process for a large class of initial states. The inequality representing the fast convergence can be viewed as a quantum analogue of a classical Log-Sobolev inequality.

Simone Warzel (TU München)

Low-energy Fock-space localization for attractive hard-core particles in disorder

Abstract: Imbrie's works notwithstanding, complete mathematical proofs of many-body localization for many particle systems remain a challenge. After providing a short overview of known results, I will present a new paper (jointly with V. Beaud). It concerns one-dimensional quantum systems of an arbitrary number of hard-core particles on the lattice, which are subject to a deterministic attractive interaction as well as a random potential. The choice of the interaction is motivated by the spectral analysis of the XXZ quantum spin chain. A version of high-disorder Fock-space localization expressed in the configuration space of hard-core particles is proven for energies below the two-cluster threshold. As a consequence, I will show the exponential decay of the two-point function of low-energy eigenfunction uniformly in the system size and the particle number. Technically, the proof is based on older works (joint with M. Aizenman concerning complete n-particle localization) and some energetic estimates.

Contributed Talks

Sabine Bögli (LMU München)

Schrödinger operator with non-zero accumulation points of complex eigenvalues

Abstract: In the 1960s Pavlov studied Schrödinger operators on the half-line with potentials that decay at infinity, subject to Robin boundary conditions at the endpoint. Using inverse spectral theory, he proved the existence of a real potential and a non-selfadjoint boundary condition so that the Schrödinger operator has infinitely many non-real eigenvalues that accumulate at an arbitrary prescribed point of the essential spectrum (the positive half-line). Since then, it has been an open question whether these results can be modified so that the non-selfadjointness is not coming from the boundary conditions but from a non-real potential. In this talk we consider Schrödinger operators on the whole Euclidean space (of arbitrary dimension) or on the half-space, subject to real Robin boundary conditions. I will present the construction of a non-real potential that decays at infinity so that the corresponding Schrödinger operator has infinitely many non-real eigenvalues accumulating at every point of the essential spectrum. - The talk is based on a recent publication in Communications in Mathematical Physics

Magda Khalile (Université Paris Sud)

Eigenvalues of a Robin Laplacian on infinite sectors

Abstract: We consider the Laplacian with a Robin boundary condition on infinite sectors. The aim is to study the spectral properties of this operator, and more precisely the behavior of its eigenvalues with respect to the angle of aperture of the sector. The essential spectrum of this Robin Laplacian does not depend on the angle and the discrete spectrum is non-empty iff the aperture is less than \pi. In this case, we show that the discrete spectrum is finite and we study the behavior of the discrete eigenvalues as the angle tends to 0. In addition, we can prove a property of localization for the associated eigenfunctions which will be useful to study the Robin Laplacian on polygons.

Alissa Geisinger (Universität Tübingen)

Persistence of Translational Symmetry in the BCS Model with radial pair interaction

Abstract: We consider the two-dimensional BCS functional with a radial pair interaction. We show that the translational symmetry is not broken in a certain temperature interval below the critical temperature. To this purpose, we first introduce the full BCS functional and the translation invariant BCS functional. Our main result states that the minimizers of the full BCS functional coincide with the minimizers of the translation invariant BCS functional for temperatures in the aforementioned interval. In the case of vanishing angular momentum our results translate to the three dimensional case. Finally, we will explain the strategy and main ideas of the proof. - This is joint work with Andreas Deuchert, Christian Hainzl and Michael Loss.

Niels Benedikter (University of Copenhagen)

On the Geometric Approach to Effective Evolution Equations

Abstract: Many-body Quantum Mechanics is a very successful theory; however, it is also so complex that approximations are the only way of obtaining predictions. In particular, the time evolution of non-stationary states in certain physical regimes can be approximated by non-linear effective evolution equations. In this talk I will present a reformulation of the Dirac-Frenkel principle for the derivation of effective equations and develop a new geometric point of view on the problem.(Based on joint work with Jeremy Sok and Jan Philip Solovej)

Marco Falconi (University di Roma Tre)

External Potentials Generated by the Interaction with a Semiclassical Field

Abstract: In physical experiments of condensed matter, quantum particles (atoms) are immersed in controllable external potentials, such as harmonic traps and optical lattices. These potentials are obtained using finely tuned lasers, or magnetic fields, acting on the atoms. In this talk I will present some results, obtained in collaboration with Michele Correggi, that shed light on the procedure above. We consider a coupled system consisting of N quantum particles in (linear) interaction with a scalar boson field. Using tools of infinite dimensional semiclassical analysis, a partially classical limit on the scalar field is studied. We prove the convergence of the partial trace of the full Hamiltonian to an effective reduced Hamiltonian on the particles alone (in either norm or strong resolvent sense). We also prove the convergence of the ground state energy of the full quantum system to the infimum on all possible classical field configurations of the ground state energy of the effective Hamiltonian.

Hans-Konrad Knörr (Aalborg Universitet)

On the adiabatic theorem when eigenvalues dive into the continuum

Abstract: We consider a Wigner-Weisskopf model of an atom consisting of a zero-dimensional quantum dot coupled to an absolutely continuous energy reservoir described by a 3D Laplacian. For this model we study the survival probability of a bound state when the dot energy varies smoothly and adiabatically in time. The initial state corresponds to a discrete eigenvalue which dives into the continuous spectrum and re-emerges from it as the dot energy is varied in time and finally returns to its initial value. Our main result is that for a large class of couplings, the survival probability of this bound state vanishes in the adiabatic limit. - This talk is based on joint work with H. Cornean, A. Jensen and G. Nenciu.