Mathématiques des systèmes quantiques désordonnés

Université Paris 13, Villetaneuse, 28-30 mai 2012

Titres et résumés des exposés

X. Blanc (CEA)

Titre : *Existence of the thermodynamic limit for disordered quantum Coulomb systems.*

Résumé : Following a recent method introduced by C. Hainzl, J.P. Solovej and M. Lewin, we prove the existence of the thermodynamic limit for a system made of quantum electrons, and classical nuclei whose positions and charges are randomly perturbed in an ergodic fashion. All the particles interact through Coulomb forces. This is a joint work with M. Lewin.

N. Dombrowski (Université de Nice Sophia-Antipolis)

Titre : *Analysis of the phenomenon of cancellation of the magnetic field.*

Résumé : In this talk I will present a series of results on the analysis of magnetic transport phenomena leading to the resolution of a conjecture of B.Helffer Y.A.Kordyukov on the semi-classical analysis of phenomenon of cancellation of the magnetic field in collaboration with N.Raymond.

T. Ekanga (Université Paris 7)

Titre : *A simplified scaling analysis of multi-particle Anderson models at low energies or with weak interaction.*

Résumé : I will discuss a simplified version of the multi-particle multi-scale analysis at low energies for the discrete Anderson model based on a recent eigenvalue concentration bound recently obtained by Chulaevsky. On the other hand, we show stability of the multiscale analysis bounds under perturbation by weak interaction. As a consequence of the results from multiscale analysis, we get Anderson Localization at low energies.

F. Germinet (Université de Cergy-Pontoise)

Titre : *Spectral Statistics for the Anderson model in the localized regime.*

Résumé : A préciser

P. Hislop (University of Kentucky)

Titre : *Wegner estimates and the IDS for N-body random Schrödinger operators.*

Résumé : We establish an optimal Wegner estimate for 2-body random Schrödinger operators similar to that obtained for one-body random Schrödinger operators and indicate

its extension to N-body operators (work in progress). In the case that the random variables are iid with a bounded compactly-supported density, this method yields a Wegner estimate that implies the Lipschitz continuity of the integrated density of states (IDS) as described by Klopp and Zenk (Adv. Math. Phys. **2009**). This extends their result to the case when no covering condition on the supports of the single-site potentials are required. The basic idea is to exploit the symmetry of the system with respect to translations of all variables by the same amount and to use the unique continuation principle of Combes, Hislop and Klopp (IMNR **2003**). This is joint work with F. Klopp.

F. Hoecker (Université Paris 13)

Titre : *The Anderson model at weak disorder*

Résumé : In a weak disorder regime the integrated density of states of the Anderson model exhibits a Lifschitz behaviour in an interval I at the bottom of the spectrum. This behaviour is known to imply the existence of localized states. A number of works have established quantitative lower estimates on the size of the interval I. In this talk we will discuss new lower and upper estimates on the size of I.

A. Joye (Université de Grenoble)

Titre : *Dynamical Localization for d-Dimensional Random Quantum Walks.*

Résumé : We consider a d-dimensional random quantum walk with site-dependent random coin operators. The corresponding transition coefficients are characterized by deterministic amplitudes times independent identically distributed site-dependent random phases. When the deterministic transition amplitudes are close enough to those of a quantum walk which forbids propagation, we prove that dynamical localization holds for almost all random phases.

W. Kirsch (Fern Universität Hagen)

Titre : *Some remarks on Kronig-Penney-type models.*

Résumé : We review some old and some new results on Schrödinger operators with random point interaction potentials.

C. Molina-Rojas (Université de Cergy-Pontoise)

Titre : *Dynamical localization for Delone–Anderson operators.*

Résumé : Delone-Anderson operators represent a particle moving in a medium with impurities that have a quasi-crystalline configuration. The lack of periodicity in the underlying configuration yields a break of ergodicity in the model. In order to study these models using the Bootstrap multi-scale analysis adapted to the non ergodic setting, we prove suitable Wegner estimates and initial length scale estimates. As a result, we obtain dynamical localization at the bottom of the spectrum and a bound on the size of the localization interval in terms of the geometric parameters of the underlying Delone set. We consider both regular and Bernoulli single-site measures and emphasize the role of quantitative unique continuation principles in the process. We conclude our study with a discussion on the existence of the integrated density of states for these models in the

framework of randomly coloured Delone sets. This is joint work with F. Germinet and P. Müller.

H. Najar (Faculté des Sciences de Monastir)

Titre : *The integrated density of states behavior for continuous Laplacian in the site percolation case.*

Résumé : We study the behavior of the integrated density of states for continuous Laplacian in a site percolation situation. By this we mean that we delete a random set Γ_ω from $\mathbb{R}^d$ and consider the Dirichlet or Neumann Laplacian on $D = \mathbb{R}^d \setminus \Gamma_\omega$. We prove that the integrated density of states exhibits Lifshitz behavior at the bottom of the spectrum when we consider Dirichlet boundary conditions, while when we consider Neumann boundary conditions , it is bounded from below by a van Hove behavior. The Lifshitz tails are proven independently of the percolation probability, whereas for the van Hove case we need some assumption on the volume of the sets taken out as well as on the percolation probability. It is a joint work with W. Kirsch.

F. Nakano (Gakushuin University)

Titre : *The level statistics of one-dimensional Schrödinger operator with random decaying potential.*

Résumé : We study the level statistics of the one-dimensional Schrödinger operator with random potential decaying like $x^{-\alpha}$ at infinity. The results obtained so far is summarized as follows :

(i) (ac spectrum case) if $\alpha > \frac{1}{2}$, the point process ξ_L consisting of the rescaled eigenvalues converges to a clock process, and the fluctuation of the eigenvalue spacing converges to Gaussian.

(ii) (critical case) if $\alpha = \frac{1}{2}$, ξ_L converges to the limit of the circular β-ensemble.

M. Sabri (Université Paris 7)

Titre : *Anderson Localization for a multi-particle quantum graph.*

Résumé : We prove strong dynamical localization in the Hilbert-Schmidt norm near the spectral edge for a multi-particle quantum graph with random potential. To this end, we adapt the multi-particle multi-scale analysis to the quantum graph setting. Apart from the results on multi-particle systems, we also prove Lifshitz-type asymptotics for single-particle systems. This shows in particular that localization for single-particle quantum graphs holds under a weaker assumption on the random potential than previously known.

J. Schenker (Michigan State University)

Titre : *A préciser*

Résumé : A préciser

A. Taarabt (Université de Cergy-Pontoise)

Titre : *Equality of bulk and edge conductances in a localization region and in the continuous setting.*

Résumé : We shall consider the Hall and edge conductances associated to 2D-continuous model where the Fermi energy lies in localization region of the Bulk Hamiltonian. We prove their equality in the presence of an electric or a magnetic wall.

V. Tchoulaevski (Université de Reims)

Titre : *Simplified strategies in the multi-particle multi-scale analysis.*

Résumé : We describe two approaches to the multi-particle Anderson localization. The first one derives the spectral and dynamical localization from the fixed-energy scaling analysis. The second approach focuses from the beginning on the decay properties of eigenfunctions in arbitrarily large finite volumes.

N. Veniaminov (Université Paris 13)

Titre : *Thermodynamic Limit for Interacting Fermions in Random Media. The Pieces Model.*

Résumé : In this talk, a system of fermions interacting in a random environment represented by the one-dimensional pieces model is considered. We are interested in the ground state wavefunction of this system in the thermodynamic limit for small particle densities. The description of the ground state will be given in terms of properly chosen functional subspaces, its autocorrelation function and one- and two-particle densities. The proofs mainly rely on perturbative approach.

I. Veselic (Technische Universität Chemnitz)

Titre : *Glivenko-Cantelli-Theorems, concentration inequalities, and the IDS.*

Résumé : The Glivenko-Cantelli Theorem states that the distribution functions of empirical measures generated by real-valued iid samples converge uniformly to the distribution function of the original measure. There exist various extensions of the Theorem to the mutivariate case and to Banach-space random variables, as well as criteria when the convergence holds in a stronger topology. We discuss the relation of the above results to concentration inequalities and applications in the spectral theory of random operators.