

Kochi School on Random Schrodinger Operators: Abstracts

Jean-Michel Combes (Marseille)

Introduction to spectral statistics of Random Schrödinger Operators of Anderson type

Abstract: We first present some standard models of Random Schrödinger Operator Theory with emphasis on some generic spectral properties. After analysing the spectral consequences of ergodicity properties we will concentrate mostly on the one level (Wegner) statistics and describe the various tools used in this type of problem in particular spectral averaging and trace estimates for spectral projections of random operators. We will briefly discuss n -level (Minami) statistics, some related models and open problems .

Abel Klein (Irvine)

The multiscale analysis and localization of random Schrödinger operators

Abstract: I will discuss the multiscale analysis method for proving localization of random Schrödinger operators. In the first lecture I will explain the multiscale analysis. In the second lecture I will show how to extract localization from the conclusions of the multiscale analysis.

Günter Stolz (Birmingham)

Anderson Localization via the Fractional Moments Method

Abstract: We will give an introduction to the so-called Fractional Moments Methods (FMM), which was developed by Aizenman and Molchanov in the 1990s and provides an interesting alternative to Multiscale Analysis (MSA) in proving localization properties of Anderson models. The first lecture will mostly discuss the original ideas of Aizenman and Molchanov in the context of the discrete Anderson model. We will present a complete proof of exponential decay of fractional moments of the Green function at large disorder and outline how this is used to deduce spectral and dynamical localization.

In the second lecture we will present some more recent extensions of the FMM. In particular, we will discuss continuum Anderson-type models and Anderson models for interacting particles. We also plan to compare the ideas behind FMM and MSA, which sheds light on the potential of the FMM as well as on its limitations.

François Germinet (Paris)

Characterization of the Anderson dynamical transition and application to dynamical delocalization in quantum Hall systems

Abstract : We shall review several kind of localization properties that appear within the context of random Schrödinger operators. Besides spectral localization and the so called Anderson localization property, stronger forms of localization have been developed over the past 15 years. It leads to a characterization of the Anderson transition in dynamical terms. In particular too slow transport is shown to be incompatible with the structure of random Schrödinger operators. Using the quantification of the Hall conductance it enables us to prove the existence of transport in quantum Hall systems near the Landau levels. We shall mention recent developments on this subject matter.

Frédéric Klopp (Paris)

Spectral statistics for random Hamiltonians in the localized regime

Abstract: the talks are based on joint work with F. Germinet. We present recent results on the level, level spacings and localization center statistics for random Hamiltonians in the localized regime. The first talk will be devoted to the presentation of the setting and the results. In the second talk, we will explain the ideas and methods leading to these results. The main tools of the analysis are a characterization of the localized regime which can be obtained through multiscale analysis (see A. Klein's lectures) or through the fractional moment method (see G. Stolz's lecture) and local spectral statistics (Wegner and Minami's estimate (see JM. Combes's lectures)). These ingredients essentially allow us to realize the spectral data of random Hamiltonians as independent random objects; this description is then used to obtain the results on the statistics. If time allows, we will also explain new spectral decorrelation estimates.

Peter Müller (München)

Electrical conductivities for random Schrödinger operators

Abstract: Electrical conductivities are observables of primary physical interest for random Schrödinger operators. In this talk I introduce the concept of electrical conductivity measures and sketch a mathematically sound definition of these quantities within linear response theory. I review some properties of electrical conductivities for the discrete Anderson model that have been obtained recently and list open problems.

Yoshiko Ogata (Tokyo)

Large deviations in quantum spin chains

Abstract: Large deviation principle holds in equilibrium states of in quantum spin chains with finite range interaction. There exist two different proofs for this theorem. In this talk, I will explain about the approach based on subadditivity arguments. This is a joint work with Luc Rey-Bellet.

Hiroaki Niikuni (Tokyo)

On the degenerate spectral gaps of the one-dimensional Schrödinger operators with the periodic $\delta^{(1)}$ -interactions

Abstract: In this talk, we focus on the one-dimensional Schrödinger operators with the periodic $\delta^{(1)}$ -interactions, which is defined through the distribution theory for the discontinuous test functions. According to the Floquet-Bloch theory, its spectrum consists of the infinitely many closed interval, which is called the band of the spectrum. Each consecutive bands are separated by an open set which is called the spectral gap. The main purpose of this talk is to determine the j -th spectral gap is degenerate or not for a given $j \in \mathbf{N}$ by using the rotation number.

Naomasa Ueki (Kyoto)

Classical and quantum behavior of the integrated density of state for a randomly perturbed lattice (joint work with R. Fukushima)

Abstract: For a Schrödinger operator with a random potential obtained by putting a single site potential at each site of a randomly perturbed lattice describing an intermediate situation between the completely ordered lattice and the completely random Poisson point processes, we discuss about the leading term of the asymptotic behavior of the integrated density of states at the infimum of the spectrum. As in the Poisson case, only the classical effect appears in the leading term when the decay of the single site potential is slow, and the quantum effect appears when the decay of the single site potential is fast. In the multidimensional cases, the leading order depends on the order of the decay of the single site potential in different ways from the Poisson case.