Special Session 84: Theory, Numerics and Applications of Quasi-Periodic and Almost Periodic Schrodinger Operators

Charles Fulton, Florida Institute of Technology, USA

Computation of the spectral density function for periodic potentials

Charles Fulton
Florida Institute of Technology, USA
cfulton@fit.edu

In this talk we will discuss a new numerical algorithm for computation of spectral density function over the stability intervals associated with periodic potentials (Mathieu equation, in particular) on the half line $[0, \infty)$. The algorithm is based on a new characterization of the spectral density function, which enables the shooting with piecewise trigonometric/ hyperbolic splines to be done over a single period. This represents an improvement in speed and accuracy over the algorithm used in the SLEDGE software package (compare ACM TOMS 22 (1996), 423-446). Some ideas for extension to the almost Mathieu equation will be discussed. This is joint work with Steven Pruess.

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Computation of the spectral density function for periodic potentials

Charles Fulton
Florida Institute of Technology, USA
cfulton@fit.edu

We give a characterization of the spectral function associated with one-sided tridiagonal Jacobi matrices, and some numerical approximations for the absolutely continuous band spectra of discrete periodic potentials.

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Spectral theory of extended Harper's model

Christoph Marx
University of California, Irvine (UCI), USA
cmarx@uci.edu

Extended Harper's model arises as a natural generalization of Harper's (or almost Mathieu) operator, when allowing the tight-binding electron to hope to both nearest and next-nearest neighboring lattice sites. In this talk we present a complete spectral picture of the model, holding for Lebesgue a.e. frequency. Most interestingly, it will be shown that in the self-dual regime, the model exhibits a collapse from purely absolutely to purely singular continuous spectrum induced by a (lack of) symmetry in the next-nearest neighbor couplings. This symmetry induced collapse is not at all present in the "classical" Haper's model, thus constitutes one good reason to go beyond nearest neighbor interaction. The talk is based on joint work with S. Jitomirskaya.

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Quasiperiodic operators with rough potentials

Rajinder Mavi
University of California, Irvine, USA
rmavi@math.uci.edu

We discuss discrete Schrodinger operators in the regime of positive Lyapunov exponent. Many properties of the operator in this case are known for analytic potentials. We discuss a technique to extend some of these results to the case of Lipschitz continuous potentials.

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Positivity of the Lyapunov exponent from crude estimates on the density of the states

Mira Shamis
IAS & Princeton Univ., USA
shamis@ias.edu
T. Spencer

We prove a (sharp) lower bound on the Lyapunov exponent for several classes of Schrdinger operators, for all energies outside an exceptional set which is (super) exponentially small in the coupling constant. The main application is to the Schrdinger operator corresponding to the Standard Map. This is joint work with T. Spencer.

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Electronic transport in golden-mean and silver-mean labyrinth tilings

Stefanie Thiem
Chemnitz University of Technology, Germany
stefanie.thiem@physik.tu-chemnitz.de

The electronic transport properties are studied for two- and three-dimensional labyrinth tilings constructed from a class of quasiperiodic chains, in which the atoms are coupled by weak and strong bonds aligned according to the golden-mean and silver-mean sequences. The numerical results of the wave packet dynamics reveal anomalous diffusion for

these systems. Using a renormalization group approach and perturbation theory it is possible to show that the underlying quasiperiodic structure of the labyrinth tiling and its electronic transport properties are related in the regime of strong quasiperiodic modulation.

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Perturbations of finite gap Jacobi matrices beyond the Szego class

Maxim Zinchenko
University of Central Florida, USA
maxim@math.ucf.edu

In this talk I will discuss a perturbation result for finite gap Jacobi matrices and the associated orthogonal polynomials that goes beyond the settings of the Szego class.

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