

Between Dynamics and Spectral Theory

workshop Talk Schedule

Events for:
Monday, June 6th - Friday, June 10th

Monday, June 6th

9:00am **Registration and Welcome**

9:40am **Anton Gorodetski - SCGP 102**

Title: The Fibonacci Hamiltonian

Abstract: We will describe the spectral properties (structure and dimension of the spectrum, properties of the density of states measure, transport exponents) of the Fibonacci Hamiltonian. The relations between hyperbolic dynamics, thermodynamic formalism, polynomial dynamics, and the spectral theory will be discussed. The talk is based on the series of papers joint with David Damanik and William Yessen.

10:40am **Coffee Break**

11:10am **Yuki Takahashi - SCGP 102**

Title: The Labyrinth model and products of two Cantor sets

Abstract: We consider the Labyrinth model, which is a two-dimensional quasicrystal model. We show that the spectrum of this model, which is known to be a product of two Cantor sets, is an interval for small values of the coupling constant. We also consider the density of states measure of the Labyrinth model, and show that it is absolutely continuous with respect to Lebesgue measure for almost all values of coupling constants in the small coupling regime.

12:10pm **Lunch**

2:15pm **Thomas VandenBoom - SCGP 102**

Title: The Toda Lattice with Almost Periodic Initial Data

Abstract: The Toda lattice is a completely integrable system of differential equations modeling infinite chains of particles with nearest-neighbor interactions. Via numerical experiments in the 1950s, solutions to these types of system are expected to approach almost-periodic solutions in time. We demonstrate this time almost-periodicity for a class of solutions with almost periodic initial data having absolutely continuous spectrum satisfying a certain thickness condition.

3:30pm **Tea - SCGP Lobby**

4:00pm **Xuanji Hou - SCGP 102**

Tuesday, June 7th

9:00am **Raphael Krikorian - SCGP 102**

Title: On the almost reducibility for pseudo rotations of the disk

Abstract: A pseudo rotation of the disk is an orientation and area preserving diffeomorphism of the 2-disk, preserving globally the boundary, fixing the origin and having no other periodic points than the origin. It is said to be almost reducible if the boundary of its conjugacy class for the smooth topology contains a rigid rotation. In this talk I shall present the following result: a pseudo rotation close enough to the identity (or any rigid rotation) is almost reducible (in the smooth topology). This is a joint work with Artur Avila.

10:00am **Coffee Break**

10:30am **Jiangong You - SCGP 102**

Title: Applications of Quantitative Almost Reducibility

11:30am **Lunch**

1:00pm **SCGP Weekly Talk- Hakan Eliasson "Reducibility of quasi-periodic co-cycles--from Schrödinger to infinite dimension" - SCGP 102**

Speaker: Hakan Eliasson

Title: Reducibility of quasi-periodic co-cycles--from Schrödinger to infinite dimension

2:00pm **Short Break**

2:15pm **Jean Bellissard - SCGP 102**

Title: Periodic Approximations to Aperiodic Hamiltonians

Abstract: Computing the energy spectrum of electrons in a quasicrystal or any other aperiodic solid is still a challenge today. A review of techniques and mathematical methods available will be presented. Most of the methods are restricted to one dimensional systems and short range interactions. We will present a different approach using the full force of the theory of groupoid C^* -algebras and continuous fields of C^* -algebras. The main result will be a series of criteria allowing to approximate the aperiodic system by periodic ones, together with precise statement concerning the convergence of the spectrum as a set.

3:30pm **Tea - SCGP Lobby**

Wednesday, June 8th

9:00am **Svetlana Jitomirskaya - SCGP 102**

Title: Quantitative continuity of singular continuous spectral measures and arithmetic criteria for quasiperiodic Schrödinger operators.

Abstract: We introduce a notion of beta-almost periodicity and prove quantitative lower spectral/quantum dynamical bounds for general bounded almost periodic potentials. Applications include a sharp arithmetic criterion of full spectral dimensionality for analytic quasiperiodic Schrödinger operators in the positive Lyapunov exponent regime as well as arithmetic criteria for families with zero Lyapunov exponents, with applications to Sturmian potentials and the critical almost Mathieu operator.

10:00am **Coffee Break**

10:30am **Ilya Kachkovskiy - SCGP 102**

Title: Reducibility, localization, and quasiperiodic XY spin chains

Abstract: We show that reducibility of quasiperiodic Schrödinger cocycles (i. e. existence of Bloch wave solutions) implies Anderson localization for the dual model (joint work with Svetlana Jitomirskaya). The corollaries include strong phase-averaged ballistic transport bound in the reducibility regime and a lower bound on Lieb-Robinson velocity for quasiperiodic XY spin chains.

11:30am **Short Break**

11:45am **Silvius Klein - SCGP 102**

Title: Continuity, positivity and simplicity of the Lyapunov exponents for quasi-periodic cocycles

Abstract: The purpose of this talk is to describe a recent result on the continuity of the Lyapunov exponents for analytic quasi-periodic cocycles. The new feature of this work is extending the availability of such results to cocycles that are identically singular (i.e. non-invertible anywhere), in the several variables torus translation setting. This feature is exactly what allows us, through a simple limiting argument, to obtain criteria for the positivity and simplicity of the Lyapunov exponents of such cocycles. Specializing to the family of cocycles corresponding to a block Jacobi operator, we derive consequences on the continuity, positivity and simplicity of its Lyapunov exponents, and on the continuity of its integrated density of states. [Joint work with Pedro Duarte from University of Lisbon.]

12:45pm **Lunch**

2:15pm **David Damanik - SCGP 102**

Title: Quantum Transport in Quasicrystalline Environments

Abstract: In this talk we discuss how quantum states evolve in simple mathematical models of quasicrystals. The central model is given by the Fibonacci chain, for which we discuss in detail the recent progress that has been obtained regarding rigorous results about the spectrum, the eigenstates and the transport properties. We will describe the known results and some of the mechanisms leading to them. Higher-dimensional models are discussed as well, especially those for which the study may be informed by the recent progress in one dimension.

3:30pm **Tea - SCGP Lobby**

4:00pm **Vitalii Gerbuz - SCGP 102**

Title: Quantum transport for nonsingularly supported initial states

Thursday, June 9th

9:00am **Milivoje Lukic - SCGP 102**

Title: KdV equation with almost periodic initial data

10:00am **Coffee Break**

10:30am **Rui Han - SCGP 102**

Title: Full measure reducibility and localization for quasi-periodic Jacobi operators: a topological criterion

Abstract: We establish a topological criterion for connection between reducibility to constant rotations and dual localization, for the general family of analytic quasi-periodic Jacobi operators. As a corollary, we obtain the sharp arithmetic phase transition for the extended Harper's model in the positive Lyapunov exponent region.

11:30am **Short Break**

11:45am **Wencai Liu - SCGP 102**

Title: Sharp arithmetic spectral transitions and bounds on quantum dynamics for supercritical almost Mathieu operators.

Abstract: We will discuss a popular discrete quasiperiodic model- almost Mathieu operator, which is given by
$$(H_{\lambda, \alpha, \theta} u)(n) = u(n+1) + u(n-1) + 2\lambda \cos(2\pi(\theta + n\alpha))u(n),$$
 with $v(\theta) = 2\cos(2\pi\theta)$, where λ is the coupling, α is the frequency, and θ is the phase. Firstly, we study the spectral transitions, in both phase and frequency, for the almost Mathieu operator in the regime of positive Lyapunov exponents. Combining with some known results, we prove sharp transitions in both regimes: for all frequencies α and almost all phases θ , and for all phases θ and almost all frequencies α . We also determine the exact exponential asymptotics of eigenfunctions and of corresponding transfer matrices throughout the localized regime. Secondly, we can analyze the generalized eigenfunctions in the singular continuous regime, which will lead to the nontrivial bounds on quantum dynamics. The talk is based on papers joint with S.Jitomirskaya and S.Tcheremchancev.

12:45pm **Lunch**

2:15pm **Chris Marx - SCGP 102**

Title: Sub-critical behavior for quasi-periodic Jacobi operators

Abstract: In this talk we will present sufficient criteria implying sub-critical behavior for quasi-periodic Schrödinger- and, more generally, Jacobi operators if the sampling functions are trigonometric polynomials. For non-singular Jacobi operators, sub-critical behavior is known to imply purely absolutely continuous spectrum for Lebesgue almost every value of the phase.

3:30pm **Tea - SCGP Lobby**

4:00pm **Jake Fillman - SCGP 102**

Title: Ballistic Motion for Limit-Periodic Potentials

Friday, June 10th

9:00am **Fan Yang - SCGP 102**

Title: Arithmetic phase transition for meromorphic potentials.

Abstract: We prove that Schrödinger operators with general meromorphic potentials $(H_{\alpha, \theta} u)_n = u_{n+1} + u_{n-1} + \frac{g(\theta + n\alpha)}{f(\theta + n\alpha)} u_n$ have purely singular continuous spectrum on the set $\{E: L(E) \in \Delta(\alpha, \theta)\}$, where Δ is an explicit function, and L is the Lyapunov exponent. This extends results of Jitomirskaya and Liu for the Maryland model and of Avila, You and Zhou for the almost Mathieu operator, to the general family of meromorphic potentials. For Maryland model, we have also obtained a new proof of pure point spectrum on the set $\{E: L(E) > \beta(\alpha)\}$. Furthermore, we are able to characterize the exact exponential asymptotics of eigenfunctions.

10:00am **Coffee Break**

11:30am **Lunch**

3:30pm **Tea - SCGP Lobby**