薛定谔算子与局域化研讨会

2024 年 1 月 4 日-7 日
(1 月 4 日报到，1 月 7 日离会)

会议指南

- 报到和会议

报到时间：2024 年 1 月 4 日

报到地点：南开大学嘉园宾馆

会议地址：南开大学陈省身数学研究所二楼 216 教室

- 就餐安排

日期 Date	早餐 Breakfast	午餐 Lunch	晚餐 Dinner
1.4			6：00-7：00 嘉园
1.5	7：20-8：00 嘉园	12：15-1：30 嘉园	6：00-7：00 嘉园
1.6	7：20-8：00 嘉园	12：15-1：30 嘉园	6：00-7：00 嘉园（晚宴）
1.7	7：20-8：00 嘉园	12：15-1：30 嘉园	6：00-7：00 嘉园

周边交通

学校地址：天津市南开区卫津路 94 号. 邮编：300071

注意：南门不开，请从东门或西南门进入校园。出租车不能进校园。

交通：

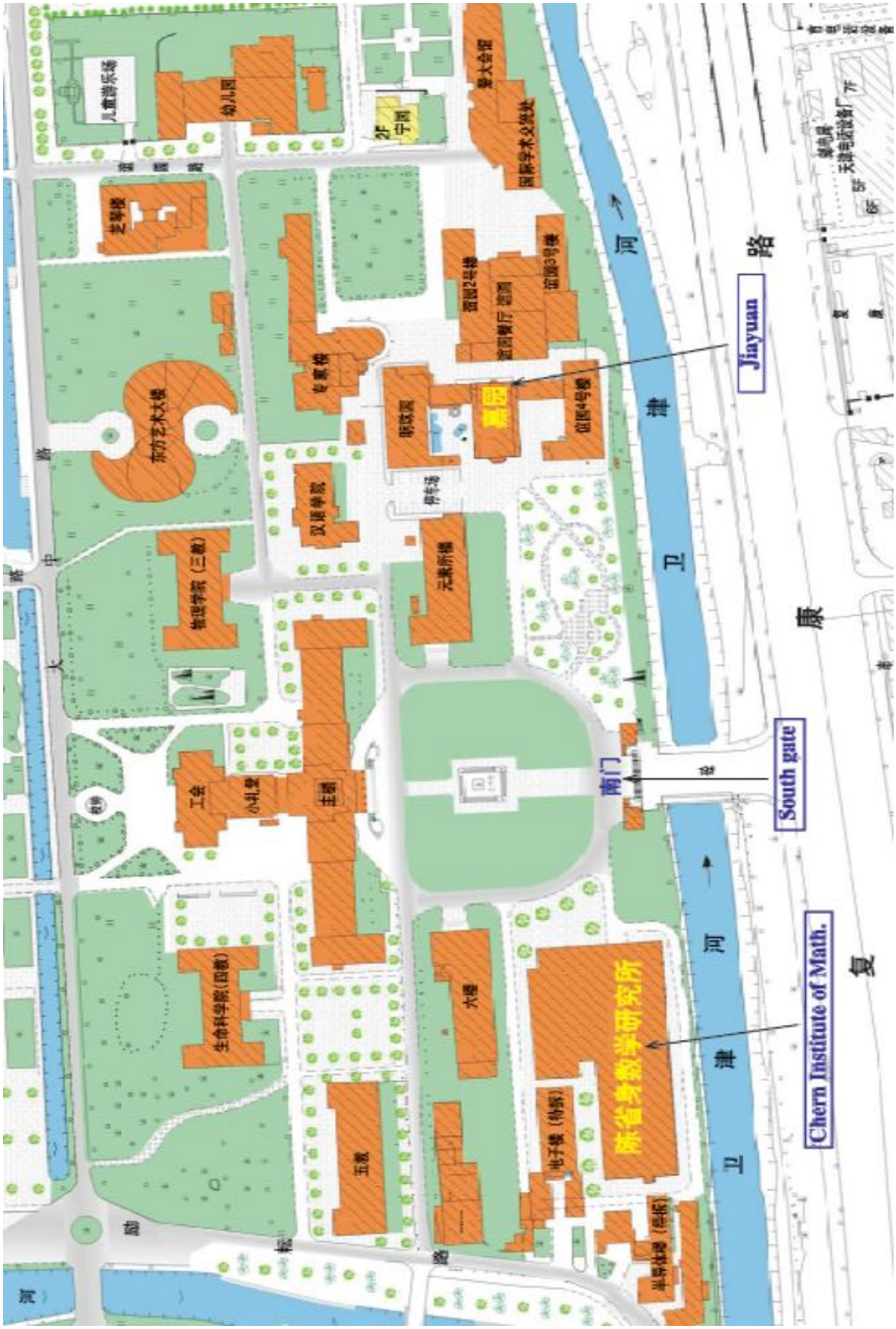
1.**天津滨海国际机场**乘坐地铁 2 号线（曹庄方向）至“天津站”换乘地铁 3 号线（南站方向）至“天塔站”下车，步行至南开大学。

2. 天津站乘坐地铁 3 号线（南站方向）至“天塔站”下车步行至南开大学，或乘坐公交 8 路、832 路至八里台（南开大学东门）。

3. 天津南站乘坐地铁 3 号线（小淀方向）至“天塔站”下车步行至南开大学。

4. 天津西站乘坐地铁 1 号线（双林方向）至“营口道站”换乘地铁 3 号线（南站方向）至“天塔站”下车，步行至南开大学，或在西站南广场乘坐公交 859 路至八里台（南开大学东门）下车。

南開大學
Nankai University



会议日程

时间		报告人	报告题目
1 月 5 日			
上午 主持人：尤建功	8:30-8:40	开幕式	
	8:40-9:40	王奕倩	cos-type 几何条件下 C^2 拟周期薛定谔算子谱的拓扑结构
	茶歇、合影		
	10:10-11:10	葛灵睿	Sharp phase transition for the type I operators
	11:10-12:10	王永健	Three types of exact mobility edges for 1D quasi-periodic models
午餐、午休			
下午 主持人：章志飞	2:00-3:00	石云峰	Anderson localization for the quasi-periodic nonlinear wave equation
	茶歇		
	3:30-4:30	王忠	On spectra of high order linearized operators around multi-solitons
	4:30-5:30	林耿鸿	Localization in periodic discrete Schrödinger equations with local superquadratic conditions

时间		报告人	报告题目
1 月 6 日			
上午 主持人: 朴大雄	8:30-9:30	杨帆	A random matrix model towards the quantum chaos transition conjecture
	茶歇		
	10:00-11:00	刘党政	Edge statistics for random band matrices
	11:00-12:00	肖惠	Conditioned local limit theorems for products of positive random matrices
午餐、午休			
下午 主持人: 杨帆	2:00-3:00	黎雄	Positive Lyapunov exponent for some Schrodinger cocycles over multi-dimensional strongly expanding torus endomorphisms
	茶歇		
	3:30-4:30	刘庆晖	Spectrums of substitutional Hamiltonians
	4:30-5:30	国书筝	Anderson localization for the quasi-periodic CMV matrices with Verblunsky coefficients defined by the skew-shift

时间		报告人	报告题目
1 月 7 日			
上午	8:30-9:10	潘亿	Reducibility of quasi-periodic cocycles valued in symplectic groups
	9:10-9:50	李先哲	Multifractal and universal structure of the absolutely continuous spectral measure
	茶歇		
主持人: 周麒	10:10-10:50	曹鸿艺	Strategy of Anderson localization via Green's function
	10:50-11:30	曹杰	Almost sure multifractal formalism for the density of states of Sturmian Hamiltonians
	11:30-12:10	吕一然	Absolutely continuous spectrum of discrete one-side periodic two-dimensional Schrödinger operators
午餐、午休			
下午	2:00-6:00	自由讨论	

摘要

曹鸿艺
（北京大学）

Strategy of Anderson localization via Green's function.

Abstract: In this talk, we will show the standard main steps of proving Anderson localization through Green's function method: resonance window about the origin, elimination of double resonances and resolvent iteration and then review the applications in Anderson model and quasi-periodic model.

曹杰
（清华大学）

Almost sure multifractal formalism for the density of states of Sturmian Hamiltonians

Abstract: We study the multifractal structure of the density of states measure of Sturmian Hamiltonian $H_{\alpha,\lambda,\theta}$ for Lebesgue a.e. α. We show that the relative topological pressure is C^1, strictly convex on $(0,\infty)$. Hence, for density of states measure $N_{\alpha,\lambda}$, the multifractal formalism holds for Lebesgue a.e. α. Our approach is based on the relativized thermodynamic formalism, relativized variational principle in non-compact setting and classical multifractal analysis.

葛灵睿
（北京大学）

Sharp phase transition for the type I operators

Abstract: We shall talk about sharp phase transition in frequency for the type I operators. This is a joint work with Professor Svetlana Jitomirskaya.

国书筝
（中国海洋大学）

Anderson localization for the quasi-periodic CMV matrices with Verblunsky coefficients defined by the skew-shift

Abstract: In this talk, quasi-periodic CMV matrices with Verblunsky coefficients given by the skew-shift is considered. We obtain the positivity of Lyapunov exponents and Anderson localization for almost all frequencies and large coupling parameter, which establish the analogous results of one-dimensional Schrodinger operators proved by Bourgain, Goldstein and Schlag. (Joint work with Yanxue Lin and Daxiong Piao.)

李先哲
（南开大学）

Multifractal and universal structure of the absolutely continuous spectral measure

Abstract: In this talk, we will show that there exists a dynamical $[1/2, 1]$*-Hölder continuity variation for the absolutely continuous spectral measure. This phenomenon is closely linked with the resonance of the fibered rotation number. Moreover, we can give a delicate characterization of the picture of the spectral measure.*

黎雄
（北京师范大学）

Positive Lyapunov exponent for some Schrodinger cocycles over multidimensional strongly expanding torus endomorphisms

Abstract: In the talk we are concerned with the discrete Schrodinger cocycle over two kinds of expanding endomorphisms on d-dimensional torus with a large class of potentials and a big coupling constant λ*, and will prove that the Lyapunov exponent* $L(E) > \log \lambda/8 - \log 5/4$ *for all energies E.*

林耿鸿
（广州大学）

Localization in periodic discrete Schrödinger equations with local superquadratic conditions

Abstract: In this talk, we deal with the existence of localization for a class of periodic discrete Schrödinger equations with local superquadratic conditions. The arising problem intensely involves major difficulties including the indefiniteness of the associated variational problem, the restriction of local superquadratic conditions and the boundedness of Cerami sequences. New methods including weak-compactness and an approximation scheme are developed to conquer these difficulties. This is a joint work with Prof. Jianshe Yu.*

刘党政
（中国科学技术大学）

Edge statistics for random band matrices

Abstract: We prove local eigenvalue statistics at the spectral edge for random band matrices in all dimension

刘庆晖
（北京理工大学）

Spectrums of substitutional Hamiltonians

Abstract: We introduce our recent results on spectrum of 1D Schrodinger operator with potentials generated by periodic doubling substitution and generalized Thue-Morse substitutions.

吕一然
（中国海洋大学）

Absolutely continuous spectrum of discrete one-side periodic two-dimensional Schrodinger operators

Abstract: We study two dimensional discrete Schrodingder operators on lattice with one-side periodic boundary condition. We prove that there exists a set where the ac spectrum of this kind of operators is prohibited to appear, which is reminiscent of the Ishii-Pastur theorem in one dimension.

潘亿
（Institute of Science and Technology Austria）

Reducibility of quasi-periodic cocycles valued in symplectic groups

Abstract: Reducibility of quasi-periodic cocyles valued in symplectic groups is related to the spectrum of discrete Schrödinger operators on strips. We will talk about a global reducibility result: given one parameter family of such cocycles, for almost every parameter, either the maximal Lyapunov exponent is positive, or the cocycle is almost reducible to some precise model. The techniques include Kotani thoery, KAM theory and in particular study of hyperbolicity of renormalization operator. This is a joint work with Artur Avila and Raphaël Krikorian.

石云峰
（四川大学）

Anderson localization for the quasi-periodic nonlinear wave equation

Abstract: We introduce the existence of Anderson localized states for the quasi-periodic nonlinear wave equation on Z^d. This is based on the joint work with Wei-Min Wang.

王奕倩
（南京大学）

cos-type 几何条件下 C^2 拟周期薛定谔算子谱的拓扑结构

Abstract:：拟周期薛定谔算子是电磁场环境下材料导电性，量子霍尔效应，准晶体等物理问题的数学模型。谱集合的拓扑结构是该领域的中心问题之一。*Avila* 和 *Jitomirskaya* 首先得到带 *cosine* 位势的 *Almost Mathieu* 算子在任何无理底频下具有 *Cantor* 谱，在正指数条件下，*Goldstein* 和 *Schlag* 对几乎所有底频得到了 *Cantor* 谱。之后 *Avila-Jitomirskay*，*Avila-You-Zhou* 进一步得到了 *dry version* 的 *Cantor* 谱结果。*cosine* 是目前唯一已知具有该性质的位势。*Johnson* 等人指出该性质不可能对所有解析位势都成立。本报告将介绍一种动力系统方法，基于该方法我们证明只要位势满足二阶光滑 *cosine-like* 几何条件，在 *Diophantine* 条件和大耦合条件下，我们就可以得到 *dry version* 的 *Cantor* 谱。这说明几何条件对于算子的性质有着决定性作用。证明的关键是估计旋转数。充分利用 *cos-type* 的特性，我们将提供一种简洁的估计方式。该工作是和葛灵睿，许珈豪合作完成。

王永健
（南京理工大学）

Three types of exact mobility edges for 1D quasi-periodic models

Abstract: The mobility edge, originally proposed by Mott, is the critical energy that separates the absolutely continuous spectrum from Anderson localization. We prove several classes of physically experimentally realized 1D quasi-periodic models have exact mobility edges. In addition, we extend the mobility edge concept, i.e., the critical energy separating different spectra, and introduce three types of exact mobility edges. This report is based on joint work with X. Xia, J. You, Z. Zheng, Q. Zhou.

王忠
（佛山科学技术学院）

On spectra of high order linearized operators around multi-solitons

Abstract:In this talk, I will report some progress related to the spectral analysis of linearized operators around multi-solitons for (m)KdV equations. By employing the bi-Hamiltonian structure of the equations and the completeness relations of square eigenfunctions of the recursion

operators, it was shown that such operators can be diagonalized to their constant coefficient counterparts. Some applications are presented in classifications of solutions of linear problems related to (m)KdV hierarchy and in asymptotic stability of their multi-solitons.

肖惠

（中国科学院数学与系统科学研究院）

Conditioned local limit theorems for products of positive random matrices

Abstract:For any integer $d \geq 2$, let $(g_n)_{n\geq 1}$ be a sequence of independent and identically distributed positive random $d \times d$ matrices. Consider the random matrix products $G_n := g_n \cdots g_1$. For any starting point $x \in \mathbb{R}_+^d$ with $\|x\| = 1$ and $y \geq 0$, we define the exit time $\tau_{x,y} = \inf\{k \geq 1 : y + \log \|G_k x\| < 0\}$. In this talk, we investigate the conditioned local probability $\mathbb{P}(y + \log \|G_n x\| \in [0, \Delta] + z, \tau_{x,y} > n)$ under various assumptions on y and z. For the case where $y = o(\sqrt{n})$, we establish precise upper and lower bounds for z within a compact interval, and provide exact asymptotic results as $z \to \infty$. Furthermore, we explore the case where $y \asymp \sqrt{n}$ and derive corresponding asymptotic expressions for different values of z.

杨帆

（清华大学）

A random matrix model towards the quantum chaos transition conjecture

Abstract: Consider D independent random systems that are modeled by independent $N \times N$ complex Hermitian Wigner matrices. Suppose they are lying on a circle and the neighboring systems interact with each other through a deterministic matrix A. We prove that in the asymptotic limit $N \to \infty$, the whole system exhibits a quantum chaos transition when the interaction strength $\|A\|_{HS}$ changes. More precisely, when $\|A\|_{HS} \geq N^{\epsilon}$, we prove that the bulk eigenvalue statistics match those of a $DN \times DN$ GUE asymptotically and each bulk eigenvector is equally distributed among all D subsystems with probability $1 - o(1)$. These phenomena indicate quantum chaos of the whole system. In contrast, when $\|A\|_{HS} \leq N^{-\epsilon}$, we show that the system is integrable: the bulk eigenvalue statistics behave like D independent copies of GUE statistics asymptotically and each bulk eigenvector is localized on only one subsystem. In particular, if we take $D \to \infty$ after the $N \to \infty$ limit, the bulk statistics of the whole system converge to a Poisson point process under the DN scaling.