

## Course Information

Course Number:	MATH 689
Course Title:	Spectral Theory of Schrodinger Operators
Section:	602
Time:	TR 12:45 – 2:00 p.m.
Location:	BLOC 121
Credit Hours:	3

## Instructor Details

Instructor:	Wencai Liu
Office:	BLOC 629C
E-Mail:	wencail@tamu.edu
Office Hours:	2:00 – 3:30 p.m., Tuesdays

## Course Description

The primary objective of this course is to present some basic tools (such as Floquet theory, spectral types, Prufer Transform) in the study of Schrodinger operators and to explore recent advancements (such as Anderson localization and quasi-periodic in time solutions) in related fields. The connections between Schrodinger operators, algebraic geometry, harmonic analysis, probability, and nonlinear partial difference equations will be explained.

## Course Prerequisites

Basics of measure theory will be helpful but not necessary.

## Course Learning Outcomes

- Analyze and apply fundamental tools such as Floquet theory, spectral types, and the Prufer transform to solve problems related to Schrodinger operators, demonstrating proficiency in these methodologies through written assessments and problem sets.
- Critically evaluate recent advancements in the field, such as Anderson localization and quasi-periodic solutions, and articulate their significance and application in contemporary research, as evidenced by presentation.
- Synthesize the interdisciplinary connections between Schrodinger operators and fields such as algebraic geometry, harmonic analysis, probability theory, and nonlinear partial difference equations, shown through a comprehensive project.

### Textbook and/or Resource Materials

The textbook is not required. For the first 3 weeks, we are going to use some materials from David Damanik, Jake Fillman. One-Dimensional Ergodic Schrödinger Operators, I: General Theory. Graduate Studies in Mathematics, 221. American Mathematical Society, 2022. ISBN-13: 978-1-4704-5606-1

### Grading Policy

The course grading will be based on attendance and 3 homework assignments.

attendance	80%
Homework	20%

*Graded Attendance* – I will record attendance at the beginning of each lecture.

*Homework* – Monthly homework assignments are integral to the course and must be submitted in written form on paper during the designated class period. No late homework will be considered.

*Work submitted by a student as makeup work for an excused absence is not considered late work and is exempted from the late work policy ([Student Rule 7](#)).*

### Course Schedule

TOPICS	TIME	READING
Some basics of spectral theory of self-adjoint operators	3 weeks	
Calculate the spectra of several examples	2 weeks	
Fourier transform, Floquet transform, Prufer transform	2 weeks	
Floquet theory	1 week	
Embedded eigenvalues of Schrodinger operators	2 weeks	
Anderson localization of Anderson model	2 weeks	
Borg's Theorem, Quasi-periodic Schrodinger operators, Nonlinear partial differential equations	2-3 weeks	

## University Policies

### Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to [Student Rule 7](#) in its entirety for information about excused absences, including definitions, and related documentation and timelines.

### Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to [Student Rule 7](#) in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" ([Student Rule 7, Section 7.4.1](#)).

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" ([Student Rule 7, Section 7.4.2](#)).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See [Student Rule 24](#).)

### Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

"Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one's work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case" ([Section 20.1.2.3, Student Rule 20](#)).

### Texas A&M at College Station

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at [aggiehonor.tamu.edu](http://aggiehonor.tamu.edu).

## Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact the Disability Resources office on your campus (resources listed below). Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

### **Texas A&M at College Station**

*Disability Resources is located in the Student Services Building or at (979) 845-1637 or visit [disability.tamu.edu](http://disability.tamu.edu).*

## Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see [University Rule 08.01.01.M1](#)):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, a person who is subjected to the alleged conduct will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University's goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

### **Texas A&M at College Station**

*Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with [Counseling and Psychological Services \(CAPS\)](#).*

*Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's [Title IX webpage](#).*

## Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student's academic success and overall wellbeing. Students are encouraged to engage in healthy self-care by utilizing available resources and services on your campus

### **Texas A&M College Station**

*Students who need someone to talk to can contact Counseling & Psychological Services (CAPS) or call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24-hour emergency help is also available through the 988 Suicide & Crisis Lifeline (988) or at [988lifeline.org](https://www.988lifeline.org) [Links to an external site.](#)*

## Campus-Specific Policies

### Statement on the Family Educational Rights and Privacy Act (FERPA)

FERPA is a federal law designed to protect the privacy of educational records by limiting access to these records, to establish the right of students to inspect and review their educational records and to provide guidelines for the correction of inaccurate and misleading data through informal and formal hearings. Currently enrolled students wishing to withhold any or all directory information items may do so by going to [howdy.tamu.edu](https://howdy.tamu.edu) and clicking on the "Directory Hold Information" link in the Student Records channel on the MyRecord tab. The complete [FERPA Notice to Students](#) and the student records policy is available on the Office of the Registrar webpage.

Items that can never be identified as public information are a student's social security number, citizenship, gender, grades, GPR or class schedule. All efforts will be made in this class to protect your privacy and to ensure confidential treatment of information associated with or generated by your participation in the class.

Directory items include name, UIN, local address, permanent address, email address, local telephone number, permanent telephone number, dates of attendance, program of study (college, major, campus), classification, previous institutions attended, degrees honors and awards received, participation in officially recognized activities and sports, medical residence location and medical residence specialization.