Last name	First name	Institution	Type of presentation	Title of proposed presentation	Abstract
Allan	Blake	Baylor University	Contributed talk	Explicit Krein Resolvent Identities for Singular Sturm--Liouville Operators	We derive explicit Krein resolvent identities for generally singular Sturm--Liouville operators in terms of boundary condition bases and the Lagrange bracket. As an application of the identities obtained, we compute the trace of the resolvent difference for a pair of self-adjoint realizations of the Bessel expression, and use the resulting trace formula to explicitly determine the spectral shift function for the pair. Based on joint work with J. Kim, G. Michajlyszyn, R. Nichols, and D. Rung, supported by the National Science Foundation Grant DMS-1852288.
Balogh	Andras	University of Texas Rio Grande Valley	Poster presentation	A Random Network Model of Parental Vaccine Acceptance and Disease Spread	Authors: Andras Balogh and Tamer Oraby Abstract: An agent-based network model based on the Erdős-Rényi random network model is considered with nodes representing households that have a number of children connected through a physical network. Parents are connected through a different (social) network via which they exchange experiences and information. The model is implemented using stochastic simulation using High performance parallel computations to examine the effect of information cascades on vaccine opinion and pediatric disease spread.
Berkolaiko	Gregory	Texas A&M Univesity	Contributed talk	Global extrema of dispersion relation of tight-binding models	Tight-binding approximation is frequently used in physics to analyze wave propagation through periodic medium. Its Floquet--Bloch transform is a compact graph with a parameter-dependent operator defined on it. The graph of the eigenvalues as functions of parameters is called the dispersion relation. Extrema (minima and maxima) of the dispersion relation give rise to band edges: endpoints of intervals supporting continuous spectrum and therefore allowing wave propagation. Locating the extrema can be difficult in general; there are examples where extrema occur away from the set of parameters with special symmetry. In this talk we will show that a large family of tight-binding models have a curious property: any local extremum is in fact a global extremum. Based on a joint project with Yaiza Canzani, Graham Cox, Jeremy Marzuola.

Last name	First name	Institution	Type of presentation	Title of proposed presentation	Abstract
Cho	Manki	University of Houston - Clear Lake	Contributed talk	Steklov representations of regularized harmonic functions	Eigenfunction expansion methods have been studied in various ways to study solutions of PDEs. This talk will feature error estimates for approximation of solutions of Laplace's equation with Dirichlet, Robin or Neumann boundary value conditions using the regularized harmonic Steklov eigenfunctions. Based on the spectral theory of trace spaces, the solutions are represented by orthogonal basis in terms of the Steklov eigenfuntions. When the region is a rectangle, with explicit formulas for the Steklov eigenfunctions, both theoretical analysis and numerical experiments will introduce the efficiency and accuracy of the Steklov expansion methods in this talk
Chong	Jacky	University of Texas at Austin	Contributed talk	Dynamical Hartree-Fock-Bogoliubov Approximation to Interacting Bosons	We consider a many-body Boson system with pairwise particle interaction given by N^{3β−1}v(N^βx) for 0<β<1 and v a non-negative spherically-symmetric function. Our main result is the extension of the local-in-time Fock space (norm) approximation of the exact dynamics of squeezed states proved in Grillakis and Machedon, Comm. PDEs, (2017) for 0<β<23 to a global-in-time norm approximation for 0<β<1. Our work can also be viewed as a generalization of the results of Boccato, Cenatiempo, and Schlein, Ann. Henri Poincaré, (2017) to a more general set of initial data that includes coherent states along with an improved error estimate. The key ingredients in establishing the norm approximation are the work of Grillakis and Machedon on the local wellposedness theory, Grillakis and Machedon, Comm. PDEs, (2019), and our quantitative result on the uniform in N global wellposedness of the time-dependent Hartree-Fock-Bogoliubov (TBHFB) system.
Deng	Keng	University of Louisiana at Lafayette	Contributed talk	Global existence and blow-up for nonlinear diffusion equations with boundary flux governed by memory	We introduce the study of global existence and blow-up in finite time for nonlinear diffusion equations with flux at the boundary governed by memory. Via a simple transformation, the memory term arises out of a corresponding model introduced in previous studies of tumor-induced angiogenesis. We establish an identical set of necessary and sufficient conditions for blow-up in finite time as previously established in the case of local flux conditions at the boundary.
Dong	Xin	University of Maryland, College Park	Contributed talk	Estimates for Pauli-type Operators and Local Well-posedness for the Reduced Hartree-Fock Equation	We consider a system of infinitely many electrons with pair interaction and a constant external magnetic field. In our case, the one particle Hamilton is the Pauli operator, which demonstrates distinct properties from the Laplace operator, for example, it has a discrete spectrum and infinite-dimensional eigenspaces. With the help of the Wigner transform and the asymptotic properties of associated Laguerre polynomials, we prove a collapsing estimate and obtain a local well-posedness result when the initial data is the pertubation of a Fermi sea.

Last name	First name	Institution	Type of presentation	Title of proposed presentation	Abstract
Fillman	Jake	Texas State University	Contributed talk	Multidimensional Schr\" odinger Operators Whose Spectrum Features a Half-Line and a Cantor Set	[Joint work with D. Damanik and A. Gorodetski] We construct multidimensional Schr\"odinger operators with a spectrum that has no gaps at high energies and that is nowhere dense at low energies. Our construction uses Schr\"odinger operators with separable potentials that decompose into one-dimensional potentials generated by the Fibonacci sequence and relies on the study of such operators via the trace map and the Fricke-Vogt invariant. To show that the spectrum contains a half-line, we prove an abstract Bethe--Sommerfeld criterion for sums of Cantor sets which may be of independent interest.
Harwell	Erik	Texas A&M University-Kingsville	Contributed talk	Complex Mass-energy & Hyper-Spherical Space: Complex Energy and Momentum, Superluminal Particles, Antimatter and Black Holes.	The Special and General Theories of Relativity cannot recognize velocities faster than the speed of light. However, there are phenomena that do appear to transmit data and maybe energy much faster than the speed of light. New assumptions will be postulated that two of matter's intrinsic components, 1) Inertial mass, and 2) E&M charge, are a single complex quantity: M=m+iq. The inertial mass will be measured by real number system and the E&M charge on the imaginary axis. We will review the history of Complex Mass-energy & Hyper-Spherical Space (CM&HSS), introduce complex numbers, scalars, and vectors, then explain how momentum and energy are reformulated in (CM&HSS), and use the (CM&HSS) concept to help explain antiparticles, Dark Matter/Energy, and conjecture the existence of tachyons which are implied by our theory and may help explain how the wave-functions of entangled particles collapse so quickly. We will also propose a (CM&HSS) model for black holes where tachyons could solve many of the difficulties that are present in relativistic black hole models.
Hatinoglu	Burak	Texas A&M University	Contributed talk	Inverse Problems for Jacobi Operators with Mixed Spectral Data	We consider semi-infinite Jacobi matrices with discrete spectrum. After a brief review of inverse spectral theory of one dimensional Schroedinger and Jacobi operators, we will discuss the following Borg-Marchenko type problem: Can one spectrum together with subsets of another spectrum and norming constants recover the Jacobi operator?
HU	Lijun	School of Math & Stat Sciences, University of Texas Rio Grande Valley	Contributed talk	A shock stable Roe scheme for hypersonic flows	Low dissipation shock-capturing methods, including the popular Roe scheme, will encounter the shock instability when simulating hypersonic flows. The stability analysis of Roe scheme is carried out which shows that all perturbations in the longitudinal direction of the shock front are damped, but the perturbations of density and shear velocity in the transverse direction are undamped. The viscosity of entropy wave and shear wave are added to the flux transverse to the shock front to suppress the instability of Roe, and a switching function is defined to restore the contact surface and shear layer. Numerical tests show that the modified Roe scheme not only retains the merit of high resolution, but also has better robustness.

Last name	First name	Institution	Type of presentation	Title of proposed presentation	Abstract
Hui	Jiang	University of Texas Rio Grande Valley	Poster presentation	Dynamics of duopoly game model in advertising competition with Sales Promotions	In this paper, duopoly game model in advertising competition with sales promotion is constructed and investigated. The conditions of the stability of period-T solutions is calculated by the theory of the discrete map.The bifurcation and complex dynamics phenomena are analyzed by the center manifold theory.Through calculation and analysis, this paper discussed the sales promotion strategies of oligarches in different situations.The application and effect of advertising promotion strategy in the game are analyzed by the case study and simulation.Theoretical suggestions are put for the advertising strategy from the example and numerical simulations.
Karagulyan	Davit	University of Maryland	Contributed talk	Dynamical walks in random environment	By dynamical random walk (DRW) we mean a map F defined on $M\times \Z^d$ where M is an internal state of the walker. Namely, suppose that for each $z\in \Z^d$ we have a map $T_z: M\to M$ and a partition $M=\cup_v W_{v, z}$ (gate partition) where $v\in \{0, \pm e_1, \dots \pm e_d\}.$ Let $$ F(x, z)=\left(T_z x, z+\sum_v 1_{W_v} v\right)$$. In other words, the internal state of the particle changes by the local dynamics and then it moves to a neighboring site as prescribed by the gate. In this work we study a one dimensional model of (DRW) and show that under certain conditions it satisfies the central limit theorem. this is joint work with D. Dolgopyat [1]
Kutsenko	Anton	Jacobs University, Bremen, Germany	Contributed talk	An Entire Function Connected with the Approximation of the Golden Ratio	In 1987, R. B. Paris introduced an analytic function g to estimate the rate of convergence of nested square root radicals to the golden ratio. The function g is nonentire and, perhaps, cannot be expressed in terms of some standard known functions. We show that the inverse $f=g^{-1}$ is an entire function satisfying the Poincar\'{e} equality. We provide some explicit expansions of f based on exact formulas for its zeros. The zeros of f form fractal structures similar to Fatou and Julia sets.
Liu	Wencai	TAMU	Contributed talk	A discrepancy problem related to multi-frequency shifts and semi-algebraic sets and it is applications to the large deviation theorem of analytic quasi-periodic operators	We establish the large deviation theorem (LDT) for general analytic k-frequency quasi-periodic operators on $\Z^d$ for arbitrary b, d. This is a generalization of Bourgain-Goldstein-Schlag's result $b=d=2$ and Bourgain's result $b=d\geq 3$. As applications, Anderson localizations were obtained. This is joint work with Jitomirskaya and Shi.

Last name	First name	Institution	Type of presentation	Title of proposed presentation	Abstract
Luhrmann	Jonas	Texas A&M University	Contributed talk	Asymptotics for the 1D Klein-Gordon equation with variable coefficient nonlinearities	The asymptotic stability analysis of one-dimensional topological solitons such as the well-known “kink” in the \phi^4 model requires an understanding of the asymptotic behavior of small solutions to 1D Klein-Gordon equations with variable coefficient quadratic and cubic nonlinearities. In this talk I will first describe the difficulties caused by variable coefficients to deal with the long-range nature of such nonlinearities. Then I will present a new result on sharp decay estimates and asymptotics for small solutions to 1D Klein-Gordon equations with constant and variable coefficient cubic nonlinearities. The main novelty of our approach is the use of pointwise-in-time local decay estimates to deal with the variable coefficient nonlinearity. If time permits, I will also discuss work in progress on the variable coefficient quadratic case, which exhibits a striking resonant interaction between the spatial oscillations of the variable coefficient and the temporal oscillations of the solutions. This is joint work with Hans Lindblad and Avy Soffer.
Ong	Darren	Xiamen University Malaysia	Contributed talk	A closed-form formula for Thue-Morse autocorrelation coefficients	Let v_i for $\i\in\mathbb N$ take the values +1 or -1, where the sequence is arranged according to the Thue-Morse sequence. For example, the first eight values for v_i are -1,1,1,-1,1,-1,-1,1. The autocorrelation coefficients are defined as $\eta(m):=\lim_{N\to\infty} \frac{1}{N} \sum_{i=0}^{N-1} v_i v_{i+m}$. These coefficients are important because they connect the structure of the Thue-Morse sequence and the diffraction measure of the Thue-morse chain. We introduce a closed-form formula for these auto-correlation coefficients, and discuss a generalization of this formula to higher-order correlations. We briefly describe how it may help to clarify the relationship between the diffraction and Schr\"odinger spectral measures related to the Thue-Morse sequence. This is joint work with Peter Zeiner.

Last name	First name	Institution	Type of presentation	Title of proposed presentation	Abstract
Pirhadi	Ali	Oklahoma State University	Contributed talk	Random cosine polynomials with dependent coefficients	It is well known that a random cosine polynomial $ V_n(x) = \sum_ {j=0} ^{n} a_j \cos (j x) , \ x \in (0,2\pi) $, with the coefficients being independent and identically distributed (i.i.d.) real-valued standard Gaussian random variables (asymptotically) has $ 2n / \sqrt{3} $ expected real roots. On the other hand, out of many ways to construct a dependent random polynomial, one is to force the coefficients to be palindromic. Hence, it makes sense to ask how many real zeros a random cosine polynomial (of degree $ n $) with identically and normally distributed coefficients possesses if the coefficients are sorted in palindromic blocks of a fixed length $ \ell. $ In this talk, we see that the asymptotics of the expected number of real roots of such a polynomial is $ \mathrm{K}_\ell \cdot 2n / \sqrt{3} $, where the constant $ \mathrm{K}_\ell$ (depending only on $ \ell $) is greater than 1, and can be explicitly represented by a double integral formula. That is to say, such polynomials have slightly more expected real zeros compared with the classical case with i.i.d. coefficients. [2]
Qi	Xutian	University of Texas Rio Grande Valley	Contributed talk	Singular Perturbation Theory and its Applications	Singular perturbation theory will be introduced in this presentation including boundary layer function method, contrast structures, etc., and it will be applied to find the asymptotic solutions of some singularly perturbed problems such as piecewise continuous problem, fractional order problem and KBK equation with small dissipation.
Simanek	Brian	Baylor Univeristy	Contributed talk	Zeros of Paraorthogonal Polynomials	Paraorthogonal polynomials on the unit circle are the characteristic polynomials of rank one unitary dilations of cutoff CMV matrices. We will discuss several properties of their zeros such as nearest neighbor spacings, bulk distribution, and their connection to Poncelet’s Theorem from projective geometry.
STARR	SHANNON	University of Alabama at Birmingham	Contributed talk	Probability in Quantum Spin Systems and vice-versa	Using the Perron-Frobenius theorem, questions about ground states of quantum spin systems may be rewritten in terms of some questions for Markov chains in probability theory. Likewise, bounds on spectral gaps of Quantum Spin Systems can be useful tools in concentration-of-measure for Markov chains.

Last name	First name	Institution	Type of presentation	Title of proposed presentation	Abstract
Xianfei	Hui	North Dakota State University	Poster presentation	Complex analysis on urban transportation systems under different game situations with sharing economy	The discussion of impact of sharing means of transportation such as bicycle and car sharing is useful for creation of an efficient transportation system. In this paper, we develop a model of automobile-bicycle-subway urban transportation system using the demand, supply, and profit functions. The triopoly urban transportation game model considering different game situations is discussed and the conditions to maintain the stability of the transportation system are obtained. By comparing the different strategies in different models, we analyze profit changes in the urban transportation systems after the impact of sharing economy. Based on complex theory, we use bifurcation diagrams and the largest Lyapunov exponent diagrams to analyze the impact of the price adjustment parameter on the stability of the urban transportation system. It is verified that when government regulation and the traditional transportation system participate in the triopoly transportation game, the profit and risk are lower than the model without government regulation.
Yaofeng	Su	University of Houston	Contributed talk	random Young tower and quenched limit law	We prove quenched almost sure invariance principle for random Young tower. Applications includes i.i.d. perturbations of non-uniformly expanding map
Yeager	Aaron	College of Coastal Georgia	Contributed talk	Real Zeros of Random Sums with I.I.D. Coefficients	Let $\{f_k\}$ be a sequence of entire functions that are real valued on the real-line. We study the expected number of real zeros of random sums of the form $P_n(z)=\sum_{k=0}^n\eta_k f_k(z)$, where $\{\eta_k\}$ are real valued i.i.d.~random variables. We establish a formula for the density function ρ_n for the expected number of real zeros of P_n. As a corollary, taking the random variables $\{\eta_k\}$ to be i.i.d.~standard Gaussian, appealing to Fourier inversion we recover the representation for the density function previously given by Vanderbei through means of a different proof. Placing the restrictions on the common characteristic function ϕ of $\{\eta_k\}$ that $\|\phi(s)\|\leq (1+as^2)^{-q}$, with $a>0$ and $q\geq 1$, as well as that ϕ is three times differentiable with each the second and third derivatives being uniformly bounded, we achieve an upper bound on the density function ρ_n with explicit constants that depend only on the restrictions on ϕ. As an application we consider asymptotics for the expected number of zeros when the spanning functions $f_k(z)=p_k(z)$, $k=0,1,\dots, n$, where $\{p_k\}$ are Bergman polynomials on the unit disk.

Last name	First name	Institution	Type of presentation	Title of proposed presentation	Abstract
Young	Giorgio	Rice University	Contributed talk	Uniqueness of solutions of the KdV-hierarchy via Dubrovin-type flows	We consider the Cauchy problem for the KdV hierarchy - a family of integrable PDEs with a Lax pair representation involving one-dimensional Schrödinger operators -- under a local in time boundedness assumption on the solution. For reflectionless initial data, we prove that reflectionlessness is conserved and describe the time evolution of Dirichlet data. For almost periodic initial data with absolutely continuous spectrum, we prove that under Craig-type conditions on the spectrum, Dirichlet data evolve according to a Lipschitz Dubrovin-type flow, so the solution is uniquely recovered by a trace formula. This applies to algebro-geometric (finite gap) solutions; more notably, we prove that it applies to small quasiperiodic initial data with analytic sampling functions and Diophantine frequency. This also gives a uniqueness result for the Cauchy problem on the line for periodic initial data, even in the absence of Craig-type conditions. This is joint work with Milivoje Lukić.
Zhou	Jing	University of Maryland	Contributed talk	A Rectangular Billiard with Moving Slits	We describe an exponential Fermi accelerator in a two-dimensional billiard with moving slits. We have found a mechanism of trapping regions which provides the exponential acceleration for almost all initial conditions with sufficiently high initial energy. Under an additional hyperbolicity assumption, we estimate the waiting time after which most high-energy orbits start to gain energy exponentially fast.

[1] Responder updated this value.

[2] Responder updated this value.