Fall 2025

* **August 20th, Wednesday** (4:00-5:00pm)

Speaker :
Topic: organizational meeting

* **September 10th, Wednesday** (4:00-5:00pm)

Speaker : Rohan Sarkar(Binghamton)
Topic: Spectrum of Lévy-Ornstein-Uhlenbeck semigroups on R^d

Abstract: We investigate spectral properties of Markov semigroups associated with Ornstein-Uhlenbeck (OU) processes driven by Lévy processes. These semigroups are generated by non-local, non-self-adjoint operators. In the special case where the driving Lévy process is Brownian motion, one recovers the classical diffusion OU semigroup, whose spectral properties have been extensively studied over past few decades. Our main results show that, under suitable conditions on the Lévy process, the spectrum of the Lévy-OU semigroup in the L^p-space weighted with the invariant distribution coincides with that of the diffusion OU semigroup. Furthermore, when the drift matrix B is diagonalizable with real eigenvalues, we derive explicit formulas for eigenfunctions and co-eigenfunctions. A key ingredient in our approach is intertwining relationship: we prove that every Lévy-OU semigroup is intertwined with a diffusion OU semigroup, thereby preserving the spectral properties.

* **September 17th, Wednesday** (4:00-5:00pm)

Speaker : Ziyao Xu (Binghamton)
Topic: A Conservative and Positivity-Preserving Discontinuous Galerkin Method for the Population Balance Equation

Abstract: We develop a conservative, positivity-preserving discontinuous Galerkin (DG) method for the population balance equation (PBE), which models the distribution of particle numbers across particle sizes due to growth, nucleation, aggregation, and breakage. To ensure number conservation in growth and mass conservation in aggregation and breakage, we design a DG scheme that applies standard treatment for growth and nucleation, and introduces a novel discretization for aggregation and breakage. The birth and death terms are discretized in a symmetric double-integral form, evaluated using a common refinement of the integration domain and carefully selected quadrature rules. Beyond conservation, we focus on preserving the positivity of the number density in aggregation-breakage. Since local mass corresponds to the first moment, the classical Zhang-Shu limiter, which preserves the zeroth moment (cell average), is not directly applicable. We address this by proving the positivity of the first moment on each cell and constructing a moment-conserving limiter that enforces nonnegativity across the domain. To our knowledge, this is the first work to develop a positivity-preserving algorithm that conserves a prescribed moment. Numerical results verify the accuracy, conservation, and robustness of the proposed method.

* **September 24th, Wednesday** (4:00-5:00pm)(Rosh Hashanah)

Speaker : Rosh Hashanah break
Topic:

* **October 1st, Wednesday** (4:00-5:00pm) (Yom Kippur)

Speaker: Yom Kippur break
Topic:

* **October 8th, Wednesday** (4:00-5:00pm)

Speaker: Prof. Lixin Shen (Syracuse University)

Topic: Explicit Characterization of the ℓ_p Proximity Operator for $0<p<1$

Abstract: The nonconvex ℓ_p quasi-norm with $0<p<1$ is a powerful surrogate for sparsity but complicates the evaluation of proximal maps that underpin modern algorithms. In this talk we give an explicit characterization of the

scalar proximal operator of $|\cdot|^p$ for all $0<p<1$, including the structure and admissible ranges of global minimizers and conditions ensuring strict, isolated solutions. By applying the Lagrange–Bürmann inversion formula to the stationarity equation, we derive a uniformly convergent series for the larger positive root, yielding an exact and numerically stable formula for the ℓ_p proximal map above the classical threshold. We further provide a Mellin–Barnes integral representation and identify the series as a Fox–Wright function, which determines its radius of convergence. Specializations recover the known closed forms for $p=\tfrac12$ and $p=\tfrac23$, and we supply compact hypergeometric expressions for additional rational cases (e.g., $p=\tfrac13$). These results unify scattered formulas into a single framework and enable high-accuracy evaluation of ℓ_p proximity operators across the full range $0<p<1$.

* **October 30th, Thursday(Special date)** (4:00-5:00pm)

Speaker: Zengyan Zhang (Penn State)
Topic: Geometric local parameterization for solving Hele-Shaw problems with surface tension

Abstract: With broad applications in biology, physics, and material science, including tumor growth and fluid interface dynamics, the Hele-Shaw problem with surface tension provides a canonical model for studying the dynamics of evolving interfaces. Solving such problems requires precise treatment of sharp boundaries. However, constructing a global parameterization for complicated surfaces and explicitly tracking boundary motion is challenging. In this work, we present a geometric local parameterization approach for efficiently solving the two-dimensional Hele-Shaw problems, where the boundary is identified only from randomly sampled data. Through convergence and error analysis, as well as numerical experiments, we demonstrate the capability and effectiveness of our approach in resolving complex interface evolution.

November 5th, Wednesday (4:00-5:00pm)

Speaker: Yuanyuan Pan (Syracuse University)

Topic: On the Spectral Geometry and Small-Time Mass of Anderson Models on Planar Domains

Abstract: We consider the Anderson Hamiltonian (AH) and the parabolic Anderson model (PAM) with white noise and Dirichlet boundary condition on a bounded planar domain $D\subset\mathbb R^2$. We compute the small-t asymptotics of the AH's exponential trace up to order $O(\log t)$, and of the PAM's mass up to order $O(t\log t)$. Applications of our main result include the following:

(i) If the boundary ∂D is sufficiently regular, then D's area and ∂D's length can both be recovered almost surely from a single observation of the AH's eigenvalues.

(ii) If D is simply connected and ∂D is fractal, then ∂D's Minkowski dimension (if it exists) can be recovered almost surely from the PAM's small-t asymptotics.

(iii) The variance of the white noise can be recovered almost surely from a single observation of the AH's eigenvalues.

* **Room 309, November 20th, Thursday** (4:00-5:00pm) (Special room and time)

Speaker: Brian Kirby(Binghamton University)
Topic: Compactifying the Manifold given by the Schwartzchild Metric

Abstract: Consider the metric in $\mathbb{R}^4$ given by $ds^2=f(r)dt^2 - 1/f(r)dr^2 - r^2dg^2$, where g is the standard Riemannian metric in $\mathbb{R}^2$, $f(r) = \phi(r)(r - r_0)$, where ϕ is a continuous, differentiable, positive function on $\mathbb{R}$. We will construct the Penrose diagram (the compactified manifold) for the given metric via coordinate changes and compactification. We will then discuss extensions to topological Penrose Diagrams and metric functions with an arbitrary number of roots, if time permits.

* **November 26th, Wednesday** (4:00-5:00pm) (Thanksgiving Break)

Speaker: Thanksgiving Break
Topic:

* **December 3rd, Wednesday** (4:00-5:00pm)

Speaker: Job interview
Topic:

Abstract:

Spring 2025

* **January 22nd, Wednesday** (4-5pm)

Speaker : organizational meeting
Topic: organizational meeting

Abstract: organizational meeting

* **January 29th, Wednesday** (4-5pm)

Speaker :
Topic: job interview

Abstract:

* **March 19th, Wednesday** (4-5pm)

Speaker: Pierre Yves Gaudreau Lamarre (Syracuse)
Topic: From critical signal detection to spectral geometry.

Abstract: In this talk, we discuss a remarkable connection between two seemingly unrelated problems in probability/statistics and analysis, namely: detecting low-rank perturbations of random matrices, and recovering information about a differential operator's domain from its spectral asymptotics.

We will then discuss recent works that show how this connection can be exploited to prove new results regarding so-called “critical” perturbations/signals. That is, signals that are right at the threshold for detectability using spectral techniques.

This talk will feature discussions of various joint works with Promit Ghosal, Wilson Li, Yuchen Liao, and Mykhaylo Shkolnikov.

* **March 26th, Wednesday** (4-5pm)

Speaker: Alper Gunes (Princeton)
Topic: Joint moments of characteristic polynomials of random matrices

Abstract: Joint moments of characteristic polynomials of unitary random matrices and their derivatives have gained attention over the last 25 years, partly due to their conjectured relation to the Riemann zeta function. In this talk, we will consider

the asymptotics of these moments in the most general setting allowing for derivatives of arbitrary order, generalising previous work that considered only the first derivative. Along the way, we will examine how exchangeable arrays and integrable systems play a crucial role in understanding the statistics of a class of infinite Hermitian random matrices. Based on joint work with Assiotis, Keating and Wei.

* **April 2nd, Wednesday** (4-5pm)

Speaker: Zhihan Wang (Cornell)
Topic: Shape of Mean Curvature Flow near and Passing Through a Non-degenerate Singularity

Abstract: A central question in geometric flow is to understand how the geometry and topology change after passing through singularities. I will explain how the local dynamics influence the shape of a mean curvature flow, the negative gradient flow of area functional, near a singularity, and how the geometry and topology of the flow change after passing through a singularity with generic dynamics. This talk is based on the joint work with Ao Sun and Jinxin Xue.

* **April 9th, Wednesday** (4-5pm)

Speaker: Yanfei Wang (Johns Hopkins University)
Topic: Weyl law improvement on products of Zoll manifolds

Abstract: Iosevich and Wyman have proved that the remainder term in classical Weyl law can be improved from $O(\lambda^{d-1})$ to $o(\lambda^{d-1})$ in the case of product manifold by using a famous result of Duistermaat and Guillemin. They also showed that we could have polynomial improvement in the special case of Cartesian product of round spheres by reducing the problem to the study of the distribution of weighted integer lattice points. In this paper, we show that we can

extend this result to the case of Cartesian product of Zoll manifolds by investigating the eigenvalue clusters of Zoll manifold and reducing the problem to the study of the distribution of weighted integer lattice points too.

* **April 16th, Wednesday, 2:20-3:20pm, WH 329** (Special time and room)

Speaker: Merrick Chang (Binghamton)
Topic: ABD Exam

Abstract:

* **April 16th, Wednesday** (4-5pm)

Speaker: Mikołaj Sierżęga (Cornell University/ University of Warsaw)
Topic: Li-Yau-Type Bounds for the Fractional Heat Equation

Abstract: Differential Harnack bounds are a key analytical device that bridge partial differential equations of the elliptic or parabolic type with Harnack bounds, which provide pointwise estimates on the local variability of solutions. A prime example is the famous Li-Yau inequality, which applies to positive solutions of the classical heat equation.

The growing interest in the theory and applications of nonlocal diffusion models naturally raises questions about analogues of Li-Yau-type inequalities in the nonlocal setting. However, despite many parallels between local and nonlocal diffusion models, even the model case of fractional heat flow presents both conceptual and technical challenges.

In my talk, I will discuss recent progress on optimal differential Harnack bounds for fractional heat flow. In particular, I will show how the structural properties of these

estimates offer new insights into classical results for the standard heat equation.

* **April 30th, Wednesday** (4-5pm)

Speaker: Chad Nelson (Binghamton)
Topic: ABD Exam: Pseudodifferential Operators and Hodge Theory on Compact Manifolds

Abstract: The goal of Hodge theory is to relate the de Rham cohomology of a compact manifold, which is essentially a topological object, with precise information regarding the differentiation of differential forms on the manifold. One elegant way to do this is to employ pseudodifferential operators. These are operators that generalize the notion of a differential operator, motivated by the Fourier transform.

First, we will develop the theory of pseudodifferential operators on Euclidean space. This involves, for example, proving properties regarding the taking of adjoints, of composing two operators, etc. We will prove the existence of a pseudo-inverse, or a parametrix, for elliptic differential operators. Next, we will translate this theory from Euclidean space to compact manifolds. We will then give a precise description of the de Rham cohomology (and more!) using the parametrix construction for elliptic operators on the manifold.

No prior knowledge about differential equations or cohomology will be assumed.

* **May 7th, Wednesday** (4-5pm)

Speaker: Marius Beceanu (Albany)
Topic: Uniform decay estimates for Hamiltonians with first and second-order perturbations

Abstract: I will present new results regarding the uniform decay of solutions to

Schroedinger and wave equations, whose Hamiltonian $H=-\Delta+iA \cdot \nabla + V$ contains a magnetic potential (a first-order perturbation) or where the Laplacian is replaced by the Laplace-Beltrami operator on a more general manifold (second-order perturbations).

Fall 2024

* **August 21st, Wednesday** (3:30-4:30pm)

Speaker :
Topic: organizational meeting

* **September 18th, Wednesday** (3:30-4:30pm)

Speaker : Ao Sun (Lehigh University)
Topic: Local dynamics and shape of mean curvature flow passing through a singularity

Abstract: A central question in geometric flow is to understand how the geometry and topology change after passing through singularities. I will explain how the local dynamics influence the shape of the flow near a singularity, and how the geometry and topology of the flow will change after passing through a singularity with generic dynamics. This talk is based on joint work with Zhihan Wang and Jinxin Xue

* **October 2nd , Wednesday** (3:30-4:30pm) (Rosh Hashanah and Fall Break)

Speaker:
Topic:

Abstract:

* **October 23rd, Wednesday** (3:30-4:30pm)

Speaker: David Renfrew (Binghamton University)
Topic: Universality for roots of derivatives of entire functions

Abstract: We show for a large class of entire functions, f, that after proper rescaling, on compact sets, the derivatives of f converge to cosine, in particular their roots become evenly spaced. This proves a conjecture of Farmer and Rhoades [Trans. Amer. Math. Soc., 357(9):3789–3811, 2005] and Farmer [Adv. Math., 411:Paper No. 108781, 14, 2022] for our class of entire functions. A main ingredient of our proof is to show that high derivatives of high degree polynomials behave like Hermite polynomials, which we prove using the techniques from the newly developed field of finite free probability.

* **October 30th, Wednesday** (3:30-4:30pm)

Speaker: Shukai Du (Syracuse University)
Topic: Forward and inverse computation for radiative transfer via hp-adaptive mesh refinement and machine learning acceleration

Abstract: The forward and inverse problems for radiative transfer are important in many applications, such as climate modeling, optical tomography, and remote sensing. However, these problems are notoriously challenging to compute due to their high dimensionality, significant memory requirements, and the computational expense associated with solving the inverse problem iteratively. To address these challenges, we present recent progress on two approaches. The first approach is hp-adaptive mesh refinement, which has proved effective in efficiently representing solutions where they are smooth with high-order approximations, while also

providing the flexibility to resolve local features through adaptive refinements. For the forward problem, we demonstrate that exponential convergence with respect to degrees of freedom (DOFs) can be achieved even when the solution exhibits sharp gradients. For the inverse problem, we introduce a goal-oriented hp-adaptive mesh refinement method that blends the two optimization processes—one for inversion and one for mesh adaptivity—thereby reducing computational cost and memory requirements. The second approach, termed element learning, aims to accelerate finite element-type methods through machine learning. This approach retains the desirable features of finite element methods while substantially reducing training costs. It draws on principles from hybridizable discontinuous Galerkin (HDG) methods, replacing HDG's local solvers with machine learning models. Numerical tests for both approaches are presented to demonstrate their computational efficiency in addressing the forward and inverse computations of radiative transfer.

* **November 27th, Wednesday** (3:30-4:30pm) (Thanksgiving Break)

Speaker:
Topic:

Abstract:

* **December 6th, Friday** (3:30-4:30pm)

Speaker:Jacob Shapiro (Princeton University)
Topic: Topological Classification of Insulators: the non-interacting spectrally gapped case

Abstract: An important theme in contemporary condensed matter physics is “topological phases of matter”. This refers to exotic materials which exhibit a number of striking phenomena. E.g., they have a quantized macroscopic observable which is stable under large classes of perturbations and in their bulk they are insulators though they exhibit robust edge currents along their boundaries. To mathematically explain this, we define an appropriate topological space of quantum

mechanical Hamiltonians which describe the motion of (single) electrons in an insulator, and calculate its path-connected components. Hamiltonians in the same path-component are said to be topologically “equivalent”. The presentation will be based on joint pre-prints together with Jui-Hui Chung.

Spring 2024

* **January 24th, Wednesday** (4-5pm)

Speaker : organizational meeting
Topic: organizational meeting

Abstract: organizational meeting

* **February 29th, Thursday (Special date)** (4-5pm)

Speaker: Alex Iosevich (Rochester)

Topic: Signal recovery, uncertainty principles and Fourier restriction theory

Abstract: We are going to consider functions $f: {\mathbb Z}_N \to {\mathbb C}$ and view them as signals. Suppose that we transmit this signal via its Fourier transform

$$\widehat{f}(m)=\frac{1}{N} \sum_{x=0}^{N-1} e^{-\frac{2 \pi i xm}{N}} f(x),$$

and that the values of $\widehat{f}(m), m \in S$, are lost. Under what circumstances is it possible to recover the original signal? We shall see how this innocent question quickly leads us into the deep dark forest of Fourier analysis.

* **March 6th, Wednesday** (4-5pm) **(Spring Break)**

Speaker:

- **Topic***:*

Abstract:

* March 13th, Wednesday **(4-5pm)**

Speaker: **Daozhi Han (Buffalo)**
Topic: **A quasi-incompressible Chan-Hilliard-Darcy model for two-phase flows in porous media**

Abstract: Two-phase flows in porous media are known as the Muskat problem. The Muskat problem can be ill-posed. In this talk, we introduce a quasi-incompressible Cahn-Hilliard-Darcy model as a relaxation of the Muskat problem. We show the global existence of weak solutions to the model. We then present a high-order accurate bound-preserving and unconditionally stable numerical method for solving the equations. The talk is based on works joint with Yali Gao and Xiaoming Wang.

* March 20th, Wednesday **(4-5pm)**

Speaker: **Zachary Selk (Queen's University, Canada)**
Topic: **Stochastic Calculus for the Theta Process**

Abstract: The theta process is a stochastic process of number theoretical origin arising as a scaling limit of quadratic Weyl sums. It has several properties in common with Brownian motion such as its H\"older regularity, uncorrelated increments and quadratic variation. However crucially, we show that the theta process is not a semimartingale making It\^o calculus techniques inapplicable. However we show that the celebrated rough paths theory does work by constructing the iterated integrals - the ``rough path'' - above the theta process. Rough paths theory takes a signal and its iterated integrals and produces a vast and robust theory of stochastic differential equations. In addition, the rough path we construct can be described in terms of higher rank theta sums.

* April 17th, Wednesday **(4-5pm)**

Speaker: **Christopher Sogge (Johns Hopkins University)**
Topic: **Curvature and harmonic analysis on compact manifolds**

Abstract: We shall explore the role that curvature plays in harmonic analysis on compact manifolds. We shall focus on estimates that measure the concentration of eigenfunctions. Using them we are able to affirm the classical Bohr correspondence principle and obtain a new classification of compact space forms in terms of the growth rates of various norms of (approximate) eigenfunctions. This is joint work with Xiaoqi Huang following earlier work with Matthew Blair. About the Speaker: Christopher Sogge is the J. J. Sylvester Professor of Mathematics at Johns Hopkins University and the editor-in-chief of the American Journal of Mathematics. His research concerns Fourier analysis and partial differential equations. He graduated from the University of Chicago in 1982 and earned a doctorate in mathematics from Princeton University in 1985 under the supervision of Elias M. Stein. He taught at the University of Chicago from 1985 to 1989 and UCLA from 1989 to 1996 before moving to Johns Hopkins University, where he was chair from 2002 to 2005. He gave an invited talk at the International Congress of Mathematicians in Zurich in 1994 and became one of the inaugural fellows of the American Mathematical Society in 2012. He has received numerous awards including a National Science Foundation Postdoctoral Fellowship, Presidential Young Investigator Award, and a Sloan Fellowship. He was named both a Guggenheim and a Simons Fellow. He received the Diversity Recognition Award from JHU in 2007 and earned the distinction of JHU Professor of the Year in 2014.

* April 24th, Wednesday **(4-5pm)** (Passover Break)

Speaker:
Topic:

Abstract:

* May 1st, Wednesday **(4-5pm)**

Speaker: **Cheng Wang (UMass-Dartmouth)**
Topic: **Numerical Analysis of a positivity-preserving, energy-stable, and convergent scheme for the Poisson-Nernst-Planck system**

Abstract: A finite difference numerical scheme is proposed and analyzed for the Poisson-Nernst-Planck equation (PNP) system. To understand the energy structure of the PNP model, we make use of the Energetic Variational Approach (EnVarA), so that the PNP system could be reformulated as a non-constant mobility, conserved gradient flow, with singular logarithmic energy potentials involved. To ensure the unique solvability and energy stability, the mobility function is explicitly treated, while both the logarithmic and the electric potential diffusion terms are treated implicitly, due to the convex nature of these two energy functional parts. The positivity-preserving property for both concentrations is established at a theoretical level. This is based on the subtle fact that the singular nature of the logarithmic term around the value of 0 prevents the numerical solution from reaching the singular value so that the numerical scheme is always well-defined. In addition, an optimal rate convergence analysis is provided in this work, in which many highly non-standard estimates have to be involved, due to the nonlinear parabolic coefficients. The higher-order asymptotic expansion (up to third-order temporal

accuracy and fourth-order spatial accuracy), the rough error estimate (to establish the discrete maximum norm bound), and the refined error estimate have to be carried out to accomplish such a convergence result. In our knowledge, this work will be the first to combine the following three theoretical properties for a numerical scheme for the PNP system: (i) unique solvability and positivity, (ii) energy stability, and (iii) optimal rate convergence. A few numerical results are also presented in this talk, which demonstrates the robustness of the proposed numerical scheme.

——— ====Fall 2023==== * August 23rd, Wednesday **(3:30-4:30pm)**

Speaker **:**
*Topic***: organizational meeting**

***** August 30th, Wednesday **(3:30-4:30pm)**

Speaker **: Emmett Wyman (Binghamton University)**
*Topic***: Can You Hear Where a Drum is Struck?**

Abstract: When you hit a drum, the sound it makes is a mix of overtones with frequencies corresponding to the drum's Laplace eigenvalues. A classic paper by Kac ["Can one hear the shape of a drum?" 1966] asks if the frequencies of these overtones uniquely determine the shape of the drum head. This question is still richly studied. Yakun Xi and I recently posed a related question: Can one hear where a drum is struck? Imagine you know a drum's shape. Could you determine where it is struck, up to symmetry, by listening also to the amplitudes of these overtones? In this talk, I will state this problem precisely, give additional physical interpretations, work some examples, and share our results so far while trying to not get too deep into the details.

* September 13th, Wednesday **(3:30-4:30pm)**

Speaker **: Zongyuan Li (Binghamton University)**
*Topic***: Liouville-type theorems for conformally invariant PDEs**

Abstract: In this talk, we discuss Liouville-type theorems for several conformally invariant elliptic PDEs. These equations, also commonly known as``nonlinear Yamabe problems, find their applications in studying conformal metrics on Riemannian manifolds. Based on recently joint works with Baozhi Chu and Yanyan Li (Rutgers).
</WRAP>

* **September 20th, Wednesday** (3:30-4:30pm)

Speaker : Xiangjin Xu (Binghamton University)
Topic: Sharp estimates of the heat kernel and Green's function on the manifold with nonnegative Ricci curvature

Abstract: The heat kernel and Green's function are the minimal fundamental solutions of the heat equation and Laplace equation respectively, which play very important roles in many problems in PDEs and geometric analysis. The dependence of the global behavior of the heat kernel and Green's function on the large-scale geometry of M is an interesting and important problem that has been intensively studied during the past few decades by many mathematicians.
In this talk, on a complete Riemannian manifold (M,g) with $Ric(M)\geq 0$, I will discuss my recent work on the sharp estimates of the heat kernel and Green's function, based on the sharp Li-Yau's Harnack inequality, Cheeger-Yau's heat kernel comparison Theorem, and Bishop-Gromov's volume comparison Theorem on such a manifold. We first prove sharp two-side Gaussian bounds for the heat kernel, then we obtain the rigidity of R^n with respect to the asymptotic lower bound of the heat kernel and the sharp gradient estimates on the logarithmic heat kernel. Secondly, on a complete manifold with $Ric(M)\geq 0$ and Euclidean volume growth, we prove the new pointwise lower and upper bounds for the heat kernel by a natural geometric quantity that is characterized by the decay rate of the Bishop–Gromov quantities. As applications of the two side bounds, we obtain the large-scale behavior (asymptotics) of the heat kernel and Green's function on such a manifold.

* **October 4th , Wednesday** (3:30-4:30pm)

Speaker: Jia Zhao (Binghamton University)
Topic: When Differential Equations Meet Computation: A Friendly Introduction to Numerical Analysis for DEs

Abstract: Differential equations are a pillar in the field of mathematical analysis, revealing complex behaviors in nature, science, and engineering. However, providing analytical solutions for them often presents significant challenges, especially in real-world applications. This is where computational mathematics comes into play. In this talk, we'll explore the realm where rigorous analysis intersects with the practicality of numerical methods, offering a friendly introduction to the numerical analysis of (partial) differential equations. This presentation is crafted to be accessible to a general audience, with no prior knowledge of computational methods necessary.

* **October 18th, Wednesday** (3:30-4:30pm)

Speaker:
Topic: fall break

Abstract:

* **November 22nd, Wednesday** (3:30-4:55pm)

Speaker:
Topic: Thanksgiving break

Abstract:

——— ====Spring 2023==== * **January 25th, Wednesday** (3:30-4:30pm)

Speaker : organizational meeting
Topic: organizational meeting

Abstract: organizational meeting

* **February 22nd, Wednesday** (3:30-4:30pm)

Speaker: Paul Barber (Binghamton University)

Topic: Pointwise estimates on the dynamics of generic singularities for a nonlinear heat equation

Abstract:What can be viewed as a continuation of a talk given last semester, in this talk I will discuss some improved estimates for the behavior of generic singularities for solutions of the equation $\partial_{\tau} u = \partial_y^2 u +u^3$. Studying the dynamics of nonlinear heat equations such as this one have proven very fruitful in studying the singularities of PDEs arising from geometric flows, including mean curvature flow and Ricci flow. Because of the cubic nonlinearity, solutions to this equation blow up in finite time. In the previous talk, the generic blowup dynamics was discussed in terms of the rescaled solution $v(y,\tau) = \sqrt{T-t} u(x,t)$, where $y:= x / \sqrt{T-t}$, $\tau:= -\ln(T-t)$, and T is the blowup time of u. Ideally, we would like to use the dynamics of this rescaled solution to study the original, however, the spacetime region the previous results were considered in is too small to be of much use. We discuss this issue in more detail, along with some techniques used to expand the region of effective control.

* **March 2nd, Thursday** (3:30-4:30pm)

Speaker: Jacob Shapiro (Princeton)
Topic: The Classification Problem of Disordered Topological Insulators

Abstract: Topological insulators are novel materials which are insulators in their bulk and conductors along their boundary. They are characterized by a

topological invariant which is a continuous map from the space of Hamiltonians to Z or Z_2. Identifying this invariant with a measurable quantity (such as electric conductivity) is then a macroscopic form of quantization. In this talk I will discuss the problem of defining the ambient topology for this space of Hamiltonians so that the invariant is indeed continuous (and hence locally constant), as well as proving that its path components are bijective to the codomain Z or Z_2, in the regime when Hamiltonians have strong disorder.

* **March 22nd, Wednesday** (3:30-4:30pm)

Speaker: Mihai Stoiciu (Williams College)
Topic: The Eigenvalue Distribution for Random Unitary Matrices: An Approach Using Entropy

Abstract: CMV matrices are the unitary analogues of one-dimensional discrete Schrodinger operators. Depending on the distribution of their coefficients, random CMV matrices exhibit a transition in their eigenvalue distribution from a Poisson process (no eigenvalue correlation) to “picket fence” (strong eigenvalue repulsion). We investigate this transition from the perspective of the joint entropy of the coefficients of the random CMV matrix.

* **March 29th, Wednesday** (3:30-4:30pm)

Speaker: David Renfrew (Binghamton University)
Topic: Eigenvalues of minors of random matrices and roots of derivatives of random polynomials

Abstract: I will describe the limiting behavior of the eigenvalues of minors of large bi-unitarily random matrices and the roots of derivatives of polynomials with independent, random coefficients, by giving a convolution semi-group which relates the two processes together.

* **April 5th, Wednesday** (3:30-4:30pm) **(Spring break)**

Speaker:
Topic:

Abstract:

* **April 12th, Wednesday** (3:30-4:30pm)

Speaker:Rongwei Yang (University at Albany)
Topic: Joint spectrum and the Julia set

Abstract: It was discovered recently that the joint spectrum of linear operators gives rise to an interesting link between self-similar group representations and complex dynamics. This talk will review this link. In particular, we shall see that, in the case of the infinite dihedral group D_∞, the projective joint spectrum coincides with the Julia set of of a rational map on the projective space ${\mathbb P}^2$ derived from the self-similarity. Such connection also seems to exist for some more complicated groups, such as the lamplighter group and the group of intermediate growth.

* **April 26th, Wednesday** (3:30-4:30pm)

Speaker: Paul Barber (Binghamton)
Topic:

Abstract:

——— ====Fall 2022==== * **September 7th, Wednesday** (3:30-4:30pm)

Speaker :
Topic: organizational meeting

* **September 21st, Wednesday** (3:30-4:30pm)

Speaker : Xiangjin Xu (Binghamton University)
Topic: Sharp Hamilton's Gradient and Laplacian Estimates for Heat Kernels on complete manifolds

Abstract: We first extend the gradient and Laplacian estimates of R. Hamilton for positive solutions of the heat equation on closed manifolds, to bounded positive solutions on complete non-compact manifolds with $Ric(M)\geq -k$ for constant $k\geq 0$. An application of our results, together with the two side Gaussian bounds of our recent work on the heat kernel, yields sharp estimates on the gradient and Laplacian of the heat kernel for complete manifolds with $Ric(M)\geq -k$, which are sharp with the same leading term in the short time asymptotic for all manifolds.

* **September 28th, Wednesday** (3:30-4:30pm)

Speaker : Gang Zhou (Binghamton University)
Topic: “Random currents and continuity of Ising model’s spontaneous magnetization” by M. Aizenman, H. Duminil-Copin and V. Sidoravicius

Abstract: I will present the paper “Random currents and continuity of Ising model’s spontaneous magnetization” by M. Aizenman, H. Duminil-Copin and V. Sidoravicius. In the paper they considered three dimensional antiferromagnetic Ising model. It is known that at the high temperature, the system is at disorder; at the low temperature, the system exhibits ferromagnetic order, or magnetization. They proved that at the critical temperature, the magnetization is continuous, which was a long standing conjecture. A crucial technique is the so-called switching lemma. It establishes a bijection between undirected graphs generated by the random current representation. In many important papers this was used, including the ones helping Hugo Duminil-Copin to win a Fields medal in 2022. However this technique does not work for the other spin models, for example, XY model or most of the quantum models. Any input is welcome.

* **October 5th , Wednesday** (3:30-4:30pm)

Speaker:
Topic: Yom Kippur Break

Abstract:

* **October 12th, Wednesday** (3:30-4:30pm)

Speaker: Marius Beceanu (University at Albany)

Topic: Spectral multipliers and decay estimates

Abstract: I will present some recent results about spectral multipliers for $-\Delta+V$, where V is a scalar potential in an optimal or almost optimal class of potentials. The results are used to prove new estimates for some partial differential equations. All results are in three space dimensions. This is joint work with Gong Chen and, separately, Michael Goldberg.

* **October 19th, Wednesday** (3:30-4:30pm)

Speaker: Calvin Chin (Binghamton University)
Topic: Deriving the central limit theorem from the de Moivre-Laplace theorem

Abstract: The de Moivre-Laplace theorem says that binomial distributions, when correctly rescaled, resemble normal distributions. This is arguably the simplest non-trivial special case of the central limit theorem. Given the fact that the de Moivre-Laplace theorem can be proved by direct computation, it is natural to ask whether the general version of the central limit theorem follows from it. In this talk, I will briefly go over existing proofs of the

(Lindeberg-Lévy) central limit theorem to provide a context, and derive the central limit theorem from the de Moivre-Laplace theorem using relatively elementary arguments. In particular, this proof will avoid the use of characteristic functions and Brownian motions.

* **October 26th, Wednesday** (3:30-4:30pm)

Speaker: Paul Barber (Binghamton University)
Topic: Blowup dynamics of some nonlinear heat equations

Abstract: In this talk I will present the papers “Asymptotically Self-similar Blow-up of Semilinear Heat Equations” by Yoshikazu Giga and Robert V. Kohn, and “Refined Asymptotics for the Blowup of $u_t-\Delta u = u^p$” by Stathis Filippas and Robert V. Kohn. The authors study the blowup dynamics of semilinear heat equation $u_t-\Delta u = u^p, p>1$ in $\mathbb{R}^n$ in both papers, with the first paving the way for the second. This nonlinear heat equation has structure similar to many other nonlinear equations, in particular several which arise in geometric analysis, and so often the techniques used to study the dynamics of spacial blow up of this equation may be used to study the blowup of curvature in geometric flows. Giga and Kohn show that for blowup solutions u which satisfy a weak blowup growth restriction, a version of u rescaled in time and space approaches its steady state solution asymptotically. Fillipas and Kohn then study the long time behavior of the rescaled solution from a dynamical systems point of view: by projecting the equation satisfied by v onto suitably chosen subspaces, one can show that the long time behavior is dominated by the neutral mode, whose dynamics may be obtained exactly. Some more recent and current work will be briefly discussed at the end.

* **November 2nd, Wednesday** (3:30-4:30pm)

Speaker: Gang Zhou (Binghamton University)
Topic: About two postulates for the quantum measurement

Abstract: In this talk I will present a progress we made on the quantum measurement. After a measurement on the quantum system, it will collapse into the observed state. There are two postulates for this, one was made by Von Neumann for the density matrices, the other one was made by Luder for the wave function. Based on a model proposed by Gisin, we prove the equivalence between these two. This is a joint work with Juerg Froehlich. This is a new direction for me. I will try to answer the questions.

November 9th, Wednesday (3:30-4:30pm)

Speaker: Hans Emil Oscar Mickelin (Princeton University)

Topic: An optimal scheduled learning rate for a randomized Kaczmarz algorithm

Abstract: The Kaczmarz algorithm is a classical iterative numerical method for solving large and overdetermined linear systems. It has received increasing attention over the last decade, starting with a proof in 2009 of a convergence rate that applies to general matrices, for a variation of the algorithm known as the randomized Kaczmarz algorithm. This talk will outline extensions of the algorithm to deal with systems perturbed by noise, with applications to machine learning and medical imaging.

* **November 23rd, Wednesday** (3:30-4:55pm)

Speaker:
Topic: Thanksgiving break

Abstract:

—- —- ====Spring 2020==== * **January 22nd, Wednesday** (4:00-5:00pm)

Speaker :
Topic:

* **January 29th, Wednesday** (4:00-5:00pm)

Speaker : organizational meeting
Topic: organizational meeting

Abstract: organizational meeting

* **February 5th, Wednesday** (4:00-5:00pm)

Speaker : David Renfrew (Binghamton)
Topic: The circular law

Abstract: I will discuss the eigenvalues of random matrices with i.i.d. entries and show they converge to the uniform measure on the unit disk.

* **February 12th, Wednesday** (3:30-4:30pm)

Speaker : Guillaume Dubach (CUNY Baruch)
Topic: Words and surfaces

Abstract: Words of random matrices with i.i.d. complex Gaussian entries (a.k.a. complex Ginibre matrices) can be studied using a topological expansion formula, or genus expansion. This results in a generalization of well-known properties of products of i.i.d. complex Ginibre matrices on the one hand, and powers of one Ginibre matrix on the other hand. For instance, the empirical distribution of singular values of any word is shown to converge to a Fuss-Catalan distribution whose parameter only depends on the length of the word. (Joint work with Yuval Peled.)

* **February 19th , Wednesday** (3:40-4:40pm)

Speaker: Indrajit Jana (Temple University)
Topic: CLT for non-Hermitian random band matrices with variance profiles.

Abstract: We show that the fluctuations of the linear eigenvalue statistics of a non-Hermitian random band matrix of bandwidth b_{n} with a continuous variance profile converges to a Gaussian distribution. We obtain an explicit formula for the variance of the limiting Gaussian distribution, which depends on the test function, and as well as the growth rate of the bandwidth b_{n}. In particular, if the band matrix is a full matrix i.e., $b_{n}=n$, the formula is consistent with Rider, and Silverstein (2006). We also compute an explicit formula for the limiting variance even if the bandwidth b_{n} grows at a slower rate compared to n i.e., $b_{n}=o(n)$.

* **February 26th , Wednesday** (4:00-5:00pm)

Speaker: Liming Sun (John Hopkins)

Topic: Some convexity theorems of translating solitons in the mean curvature flow

Abstract:I will be talking about the translating solitons (translators) in the mean curvature flow. Convexity theorems of translators play fundamental roles in the classification of them. Spruck and Xiao proved any two dimensional mean convex translator is actually convex. Spruck and I proved a similar convex theorem for higher dimensional translators, namely the 2-convex translating solitons are actually convex. Our theorem implies 2-convex translating solitons have to be the bowl soliton. Our second theorem regards the solutions of the Dirichlet problem for translators in a bounded convex domain . We proved the solutions will be convex under appropriate conditions. This theorem implies the existence of n-2 family of locally strictly convex translators in higher dimension. In the end, we will show that our method could be used to establish a convexity theorem for constant mean curvature graph equation.

* **March 4th, Wednesday** (4:00-5:00pm) **(Winter Break)**

Speaker:
Topic:

Abstract:

* **March 18th, Wednesday** (4:00-5:00pm)

Speaker: Gang Zhou
Topic:

Abstract:

* **March 25th, Wednesday** (4:00-5:00pm)

Speaker: Xiangjin Xu
Topic:

Abstract:

* **April 1st, Wednesday** (4:00-5:00pm)

Speaker: Paul Barber
Topic:

Abstract:

* **April 8th, Wednesday** (4:00-5:00pm) **(Spring break)**

Speaker:
Topic:

Abstract:

* **April 15th, Wednesday** (4:00-5:00pm)

Speaker: Xiangjin's visitor(?)
Topic:

Abstract:

* **April 22nd, Wednesday** (4:00-5:00pm)

Speaker: Gang's visitor
Topic:

Abstract:

——— ====Fall 2019==== * **August 28th, Wednesday** (3:30-4:30pm)

Speaker :
Topic: organizational meeting

* **September 4th, Wednesday** (3:30-5:00pm)(No talk due Monday schedule)

Speaker :
Topic: No talk

Abstract:

* **September 5th, Thursday** (WH 309, 2:30-4:30pm)(Special time and location)

Speaker : David Cervantes-Nava (Binghamton University)
Topic: Admissions to Candidacy Exam

Abstract: TBD

* **September 18th, Wednesday** (4:00-5:00pm)

Speaker : Xiangjin Xu (Binghamton University)
Topic: Characterization of Carleson measures on compact manifolds with boundary

Abstract: On the subspaces of $L^2(M)$ generated by eigenfunctions of eigenvalues less than $L(>1)$ associated to the Dirichlet (Neumann) Laplace–Beltrami operator on a compact Riemannian manifold (M,g) with boundary, we discuss some positive and negative results on the characterization of the Carleson measures and the Logvinenko–Sereda sets for Dirichlet (or Neumann) Laplacian on M, which generalized the corresponding results of J. Ortega-Cerda and B. Pridhnani on a compact boundaryless manifold (Forum Math.25 (2013), DOI 10.1515/FORM.2011.110).

* **September 25th , Wednesday** (3:30-4:55pm)

Speaker: Gang Zhou (Binghamton University)
Topic: The dynamics of effective equation of polaron

Abstract: Polaron theory is a model of an electron in a crystal lattice. It is studied in the framework of nonequilibrium statistic mechanics, and it has a lot of applications. In the recent year, jointly with Rupert Frank, we studied the quantum and classical models and obtained different results. Still there are open problems. In this talk I present the results for the dynamics of classical model.

* **October 9th, Wednesday** (3:30-4:55pm)(Holiday, Yom Kippur)

Speaker:
Topic:

Abstract:

* **October 17th, Thursday** (1:00-2:00pm, WH 309) Note the special time and location

Speaker: Yuan Yuan, Syracuse University
Topic: Bergman projection on pseudoconvex domains

Abstract: Bergman projection plays important roles in function theory and d-bar Neumann problem on pseudoconvex domains. After giving a brief introduction to the general theory, I will focus on the boundedness of the Bergman projection in L^p spaces. This talk is based on joint work with Chen and Krantz.

* **October 23rd, Wednesday** (4:00-5:00pm)

Speaker: Adam Weisblatt (Binghamton University)
Topic: The wraparound universe

Abstract: Cosmologists have been trying to determine the shape of the universe. Although most of the evidence says the universe is flat, it need not imply the universe looks like R^3. In this talk we discuss the most plausible candidates for the shape of the universe and how to go about detecting such models. Much of the studies into the shape of the the universe has been topological. I will present some new results on how to do analysis on them.

* **November 6th, Wednesday** (4:00-5:00pm)

Speaker: Alexis Drouot, Columbia University
Topic: Transport at interfaces of topological insulators

Abstract: In this talk, I consider a PDE modeling interface effects between insulators: a Schrodinger equation with periodic asymptotics (the bulk), away from a strip (the interface). I will state the bulk-edge correspondence. This theorem predicts that the interface between two topologically distinct insulators always conducts energy. I will illustrate it in the context of graphene; explain applications to robust waveguides; and provide dynamical interpretations.

* **November 13th, Wednesday** (4:00-5:00pm)

Speaker: Steven Gindi (Binghamton University)
Topic: Long Time Limits of Generalized Ricci Flow

Abstract: We derive modified Perelman-type monotonicity formulas for solutions to the generalized Ricci flow equation with symmetry on principal bundles. This leads to rigidity and classification results for nonsingular solutions.

* **November 27th, Wednesday** (3:30-4:55pm)(Thanksgiving break)

Speaker:
Topic:

Abstract:

* **December 6th, Friday** (2:00-3:00pm) (Special date and time)

Speaker: Cheng Zhang (University of Rochester)
Topic: Eigenfunction estimates of the fractional Laplacian on a bounded domain

Abstract: We will introduce the eigenvalue problem of the Dirichlet fractional Laplacian on a bounded domain in R^n. We obtained new interior L^p estimates for the eigenfunctions by using latest results on sharp resolvent estimates, heat kernels, and commutator estimates. This is a joint work with Xiaoqi Huang and Yannick Sire (arXiv:1907.08107).

—- ====Spring 2019==== * **January 23rd, Wednesday** (3:30-4:30pm)

Speaker :
Topic: organizational meeting

* **January 30th, Wednesday** (3:30-5:00pm)(No talk due Monday schedule)

Speaker :
Topic: No talk

Abstract:

* **May 1st, Wednesday** (3:30-4:55pm)

Speaker: Lu Wang (University of Wisconsin & IAS)
Topic: Mean Curvature Flow Expanders of Low Entropy

Abstract: Colding and Minicozzi introduced a notion of entropy of a hypersurface, which is defined by the supremum over all Gaussian integrals with varying centers and scales. In this talk, we will discuss the properties of self-expanding solutions of mean curvature flow with small entropy. This is joint work with Jacob Bernstein.

* **May 8th, Wednesday** (3:30-4:55pm)

Speaker:John Ma (Rutgers University)
Topic: Uniqueness Theorem for non-compact Mean Curvature Flow with possibly unbounded curvatures

Abstract: We discuss uniqueness for mean curvature flow of non-compact manifolds. We use an energy argument to prove a uniqueness theorem for mean curvature flow with possibly unbounded curvatures. These generalize the results in Chen and Yin (CAG, 07). This is a joint work with Man-Chun Lee.

—- ====Fall 2018==== * **August 29th, Wednesday** (3:30-4:30pm)

Speaker :
Topic: organizational meeting

* **September 5th, Wednesday** (3:30-5:00pm)(No talk due Monday schedule)

Speaker :

Topic: No talk

Abstract:

* **September 12th, Wednesday** (3:30-4:55pm)

Speaker : Gang Zhou (Binghamton University)
Topic: A description of generic singularities formed by mean curvature flow

Abstract: In this talk I will present the progresses my collaborators, including Michael Sigal and Dan Knopf, and I made in the past few years. We developed a new way of studying mean curvature flow, and I am trying to use it to understand the evolution of hypersurfaces under mean curvature flow.

* **September 19th, Wednesday** (3:30-4:55pm)(Holiday, Yom Kippur)

Speaker :
Topic:

Abstract:

* **September 26th , Wednesday** (3:30-4:55pm)

Speaker: Adam Weisblatt (Binghamton University)
Topic: The heat equation on planar diagrams.

Abstract: The heat kernel on a surface helps to describe its geometry. However, solving the heat equation explicitly and extracting the geometric information can be difficulty. In this talk, I will offer a new approach to the heat equation using planar diagrams. The heat kernel constructed will not be the authentic heat kernel for the surface, but we will show how it captures geometry.

* **October 3rd, Wednesday** (3:30-4:55pm)

Speaker: Brian Allen (West Point)

Topic: Stability Questions and Convergence of Riemannian Manifolds

Abstract: We will start by surveying the stability of the scalar torus rigidity theorem, a result about the impact of geometry on topology, and the stability of the positive mass theorem, an important theorem in mathematical relativity. Since stability requires a notion of closeness this will lead us

naturally to consider various notions of distance between and convergence of Riemannian manifolds. We will end by discussing theorems and important examples which aim at contrasting these notions of convergence which have been, and will continue to be, applied to stability problems.

* **October 17th, Wednesday** (3:30-4:55pm)

Speaker: Shengwen Wang (Binghamton University)
Topic: Mean curvature flow with surgery and applications

Abstract: I will first review about mean curvature flow with surgery for 2-convex hypersurfaces. Then I will report on joint work with Mramor for mean curvature flow with surgery for low entropy mean-convex hypersurfaces and an application to the classification of self-shrinkers. I will also discuss what elements we still lack to do surgery for generic mean curvature flow.

* **October 24th, Wednesday** (3:30-4:55pm)

Speaker: Lu Zhang (Binghamton University)
Topic: Some useful methods for Fourier multipliers

Abstract: I will give a introduction of some methods that have been recently used to study the Lp bounds for the multi-parameter Fourier multipliers, which include one method that was applied in my recent work.

* **October 31st, Wednesday** (3:30-4:55pm)

Speaker: Xiangjin Xu (Binghamton University)
Topic: New heat kernel estimates on manifolds with negative Ricci curvature

Abstract: In this talk, we first introduce some new sharp Li–Yau type gradient estimates, both in local and global version, for the positive solution $u(x,t)$ of the heat equations $$\partial_t u-\Delta u=0$$ on a complete manifold with $Ric(M)\geq -k$. As applications, some new parabolic Harnack inequalities, both in local and global version, are derived. Based on the new parabolic Harnack inequalities, some new sharp Gaussian type lower bound and upper bound of the heat kernel on a complete manifold with $Ric(M)\geq -k$ are proved, which are new even for manifold M with nonnegative Ricci curvature, $Ric(M)\geq 0$. An upper bound of $\mu_1 (M) \geq 0$, the greatest lower bound of the L^2-spectrum of the Laplacian on a complete noncompact manifold M, is achieved. At the end, we discuss some open questions related to the sharp Li–Yau type estimates.

* **November 14th, Wednesday** (3:30-4:55pm)

Speaker: Phil Sosoe, Cornell University
Topic: Applications of CLTs and homogenization for Dyson Brownian Motion to Random Matrix Theory

Abstract: I will explain how two recent technical developments in Random Matrix Theory allow for a precise description of the fluctuations of single eigenvalues in the spectrum of large symmetric matrices. No prior knowledge of random matrix theory will be assumed. (Based on joint work with B Landon and HT Yau).

* **November 21st, Wednesday** (3:30-4:55pm)(Thanksgiving break)

Speaker:
Topic:

Abstract:

* **November 28th, Wednesday** (3:30-4:55pm)

Speaker: Martin Fraas, Virginia Tech
Topic: Perturbation Theory of Quantum Trajectories

Abstract: Quantum trajectories are certain Markov processes on a complex projective space. They describe the evolution of a quantum system subject to a repeated indirect measurement. For a given set of matrices A and a unit vector x, a probability of a sequence of matrices $V_1, V_2, \dots , V_n$, $Vj \in A$ is proportional to $||V_n \dots V_1x||^2$. The Markov process is given by $x_n \sim V_n \dots V_1 x$. In this talk, I will review the basic properties of this process, in particular, conditions that guarantee the uniqueness of the stationary measure. Then I will discuss how the measure and the process change if the underlying set of matrices A changes.

* **December 5th, Wednesday** (3:30-4:55pm)

Speaker: Kunal Sharma (Binghamton University)
Topic:

Abstract:

—- ====Spring 2018==== * **January 17th, Wednesday** (3:30-4:30pm)

Speaker :
Topic: organizational meeting

* **January 24th, Wednesday** (3:30-5:00pm)

Speaker :
Topic: No talk

Abstract:

* **January 31st, Wednesday** (3:30-4:30pm)

Speaker : Adam Weisblatt (Binghamton University)
Topic: Computation of Cohomology

Abstract: I will present a method to compute various cohomologies of surfaces.

* **February 7th, Wednesday** (3:30-4:30pm)(Cancelled due weather)

Speaker : Adam Weisblatt (Binghamton University)
Topic: Computation of Cohomology (continue)

Abstract: I will present a method to compute various cohomologies of surfaces.

* **February 14th , Wednesday** (3:30-4:30pm)(Cancelled)

Speaker: Kunal Sharma (Binghamton University)
Topic: Some remarks on Calderon-Seeley projector

Abstract: We will show how Calderon-Seeley projector comes up in study of boundary values problems for elliptic operators on a compact manifold with boundary. Its properties and applications to address Fredholmness of the operator will be discussed.

* **February 21st, Wednesday** (3:30-4:30pm)

Speaker: Binbin Huang (Binghamton University)

Topic: Some Geometric Constructions on Manifolds with Corners

Abstract: Manifolds with corners are of little new interest for pure

topologists - they are just the manifolds with boundaries. For differential geometers, there are a few intriguing phenomena to study. On the other hand, they are (at least philosophically) unavoidable for analysts who study linear differential operators. In this talk, we will look at some fundamental notions in the theory of manifolds with corners. Some geometric constructions closely related to linear differential operators will be discussed, paving the way to the study of various (pseudo-)differential calculi.

* **February 28th, Wednesday** (3:30-4:30pm)

Speaker: Binbin Huang (Binghamton University)
Topic: Some Geometric Constructions on Manifolds with Corners (Continue)

Abstract: Manifolds with corners are of little new interest for pure topologists - they are just the manifolds with boundaries. For differential geometers, there are a few intriguing phenomena to study. On the other hand, they are (at least philosophically) unavoidable for analysts who study linear differential operators. In this talk, we will look at some fundamental notions in the theory of manifolds with corners. Some geometric constructions closely related to linear differential operators will be discussed, paving the way to the study of various (pseudo-)differential calculi.

* **March 7th, Wednesday** (3:30-4:30pm)(Winter break)

Speaker:
Topic:

Abstract:

* **March 14th, Wednesday** (3:30-4:30pm)

Speaker: Timur Akhunov (Binghamton University)
Topic: Changing dispersion for KdV

Abstract: Dispersive partial equations describe evolution of waves, whose speed of propagation depends on wave frequency. The uncertainty principle of quantum mechanics is intimately tied to the dispersion in the Schrodinger equation. The Korteweg-de Vries (KdV) equation was originally derived in 1890s to explain surface waves in a shallow fluid is among the most studied nonlinear dispersive PDE. Dispersion has since then found a way to connect with harmonic analysis, number theory and algebraic geometry. In a series of papers (the last in collaboration with David Ambrose and Doug Wright from Drexel) we have independently rediscovered and adapted techniques from thin-film equations to the context of KdV.

* **March 21th, Wednesday** (3:30-4:30pm)

Speaker: Shengwen Wang (John Hopkins University)
Topic: Hausdorff stability of round spheres under small-entropy perturbation

Abstract: The Colding-Minicozzi entropy functional is defined on the space of all hypersurfaces and it measures the complexity of a hypersurface. It is monotonic non-increasing along mean curvature flow and the entropy minimizer among all closed hypersurfaces are round spheres. In this talk I will present a Hausdorff stability result of round spheres under small entropy perturbation.

* **March 28th, Wednesday** (3:30-4:30pm)

Speaker: Binbin Huang (Binghamton University)
Topic: On an extension of the b-calculus

Abstract: The b-calculus developed by R. Melrose, is among the first materializations of his program of “microlocalizing boundary fibration structures”. Along with other closed related calculi, it provides a convenient framework to study geometric-analytic problems on manifolds with certain singular structures. Due to its nice mapping properties on (b-)Sobolev spaces, techniques from functional analysis can be applied, which makes it a natural choice for the study of index theory. With a more geometric approach initiated by P. Loya, we developed a theory that extends the classical b-calculus. It is obtained by replacing the boundary decay condition by a more modest one. In this talk, we will begin with a brief review of the b-calculus, then we will give a detailed description of our calculus, and study its Fredholm problem.

* **April 4th, Wednesday** (3:30-4:30pm)(Spring break)

Speaker:
Topic:

Abstract:

* **April 11th, Wednesday** (3:30-4:30pm)

Speaker: Kunal Sharma (Binghamton University)
Topic: Some remarks on Calderon-Seeley projector

Abstract: We will show how Calderon-Seeley projector comes up in study of boundary values problems for elliptic operators on a compact manifold with boundary. Its properties and applications to address Fredholmness of the operator will be discussed.

* **April 18th, Wednesday** (3:30-4:30pm)

Speaker:Benjamin Harrop-Griffiths (NYU)
Topic: Degenerate dispersive equations

Abstract: We discuss recent work on some quasilinear toy models for the phenomenon of degenerate dispersion, where the dispersion relation may degenerate at a point in physical space. In particular, we present a proof of the existence of solutions using a novel change of variables reminiscent of the classical hodograph transformation. This is joint work with Pierre Germain and Jeremy L. Marzuola.

* **April 24th, Tuesday** (2:50-4:10pm at WH 309) (Special date, time and location)

Speaker: Binbin Huang (Binghamton University)
Topic: Thesis Defense

Abstract:

* **April 25th, Wednesday** (3:30-4:30pm)

Speaker: Marius Lemm (Institute for advanced studies, Princeton)
Topic: On the averaged Green's function for an elliptic equation with random coefficients

Abstract: We consider an elliptic operator on the discrete d-dimensional lattice whose coefficient matrix is a small i.i.d. perturbation of the identity. Recently, Jean Bourgain introduced novel techniques from harmonic analysis to prove the convergence of the Feshbach-Schur perturbation series for the averaged Green's function of this model. Our main contribution is a refinement of Bourgain's approach which yields a conjecturally nearly optimal decay estimate. As an application, we derive estimates on higher derivatives of the averaged Green's function which go beyond the second derivatives considered by Delmotte-Deuschel and related works. This is joint work with Jongchon Kim (IAS).

* **May 2nd, Wednesday** (3:30-5:00pm)

Speaker: Adam Weisblatt (Binghamton University)
Topic: Thesis Defense

Abstract:

====Fall 2017==== * **August 23th, Wednesday** (3:30-4:30pm)

Speaker :
Topic: organizational meeting

* **August 30th, Wednesday** (3:30-5:00pm)

Speaker : Adam Weisblatt (Binghamton University)
Topic: The dirichlet problem on manifolds with corners.

Abstract: It is well known that the dirichlet problem in R^2 has a solution when the boundary of the region is smooth. We will use geometric techniques to construct an integral operator which gives the solution of the dirichlet problem when the boundary has corners.

* **September 6th, Wednesday** (3:30-4:30pm)

Speaker : Adam Weisblatt (Binghamton University)
Topic: The dirichlet problem on manifolds with corners.(continued)

Abstract: It is well known that the dirichlet problem in R^2 has a solution when the boundary of the region is smooth. We will use geometric techniques to construct an integral operator which gives the solution of the dirichlet problem when the boundary has corners.

* **September 13th, Wednesday** (3:30-4:30pm)

Speaker : Gang Zhou (Binghamton University)
Topic: Derivation of an effective evolution equation for a strongly coupled polaron

Abstract: Polaron theory is a model of an electron in a crystal lattice. It is in the framework of nonequilibrium statistic mechanics, which becomes important in recent year because people can conduct better experiments. There are two different mathematical models for polaron: H. Frohlich proposed a quantum model in 1937; L. Landau and S. I. Pekar proposed a system of nonlinear PDEs in 1948. In a joint work of Rupert Frank, we proved that these two models are equivalent to certain orders.

* **September 20th, Wednesday** (3:30-4:30pm) (Rosh Hashanah)

Speaker: Adam Weisblatt (Binghamton University)

Topic: The dirichlet problem on manifolds with corners.(continued)

Abstract: It is well known that the dirichlet problem in R^2 has a solution when the boundary of the region is smooth. We will use geometric techniques to construct an integral operator which gives the solution of the dirichlet problem when the boundary has corners.

* **September 27th, Wednesday** (3:30-4:30pm)

Speaker: Gang Zhou (Binghamton University)

Topic: On the evolution of surfaces under mean curvature flow

Abstract: In this talk I will present the progresses made in the past few years on the evolution of surfaces under mean curvature flow. Our contributions were to prove the uniqueness of limit cylinder at the time of blowup and to unify different approaches by different parties, and to address some open problems, especially in four dimensional manifolds. These were made possible by applying different techniques learned from theoretical physics and mathematical physics. Joint works of Dan Knopf and Michael Sigal.

* **October 4th, Wednesday** (3:30-4:30pm)

Speaker: Marius Beceanu (Albany University -SUNY)
Topic: Strichartz estimates for the wave and Klein–Gordon equations

Abstract: In this talk I shall present some new Strichartz-type estimates for wave and Klein–Gordon equations, with a few sample applications.

* **October 11th, Wednesday** (3:30-4:30pm)

Speaker: Lu Zhang (Binghamton University)
Topic: Multi-parameter singular Radon transforms

Abstract: I will give a brief introduction to a type of the multi-parameter singular Randon transforms. Such type of operators was originally studied by Christ, Nagel, Stein and Wainger. The theory was extended to the cases involving product kernels and general multi-parameter setting by B. Street and Stein.

* **October 18th, Wednesday** (3:30-4:30pm)

Speaker: Philippe Sosoe (Cornell University)

Topic: A sharp quasi-invariance result for the quartic NLS equation with Gaussian initial data

Abstract: I will discuss a recent result, with T. Oh and N. Tzvetkov, proving that the distribution of the solution of a dispersive equation on the circle with random initial data according to some Gaussian measure remains regular at positive times. This result is optimal in two senses which will be clarified in the talk.

* **October 25th, Wednesday** (3:30-4:30pm)

Speaker: Yakun Xi (University of Rochester)
Topic: Geodesic period integrals of eigenfunctions on Riemannian surfaces.

Abstract: We use the Gauss-Bonnet theorem and the triangle comparison theorems of Rauch and Toponogov to show that on compact Riemannian surfaces of negative curvature, period integrals of eigenfunctions over geodesics go to zero at the rate of $O((\log \lambda)^{(-1/2)})$ if λ are their frequencies. No such result is possible in the constant curvature case if the curvature is $≥ 0$.

* **November 1st, Wednesday** (3:30-4:30pm)

Speaker:
Topic: the Analysis Caucus Meeting for next year's teaching

Abstract: To discuss and make recommendations on what analysis courses, numbered above Math 330 for both graduate and undergraduate, should be offered in 2018-19, and who should (or would like to) teach them.

* **November 8th, Wednesday** (3:30-4:30pm)

Speaker: Zhenfu Wang (University of Pennsylvania)
Topic: Quantitative estimates of propagation of chaos for stochastic particle systems

Abstract: We derive quantitative estimates proving the propagation of chaos for large stochastic systems of interacting particles. We obtain explicit bounds on the relative entropy between the joint law of the particles and the tensorized law at the limit. We have to develop for this new laws of large numbers at the exponential scale. But our result only requires very weak regularity on the interaction kernel in the negative Sobolev space $W^{-1, \infty}$, thus including the Biot-Savart law and the point vortices dynamics for the 2d incompressible Navier-Stokes.

* **November 15th, Wednesday** (3:30-4:30pm)

Speaker:
Topic:

Abstract:

* **November 22rd, Wednesday** (Thanksgiving)

Speaker:
Topic:

Abstract:

* **November 29th, Wednesday** (3:30-4:30pm)

Speaker: Rongwei Yang (SUNY Albany)
Topic: Projective Spectrum and Finitely Generated Groups

Abstract: For a tuple $A= (A_1; A_2;\ldots.. A_n)$ of elements in a unital Banach algebra B, its projective spectrum $P(A)$ is the collection of $z\in \mathbb{C}^n$ such that the multiparameter pencil $A(z) =z_1 A_1+z_2 A_2+\ldots+z_n A_n$ is not invertible. If $(\rho;H)$ is a unitary representation of a finitely generated group $G=< g_1;g_2;;g_{nj}>$ and $Ai=(g_i);i= 1,2,\ldots,n;$ then $P(A)$ reflects the structure of G as well as the property of ρ. In this talk we will see how projective spectrum characterizes amenability, Haagerup's property and Kazhdan's property (T) of the groups. Projective spectrum can be computed explicitly for some groups. We will have an in-depth look at the case of the innite dihedral group $D1$, and will indicate a connection with group of intermediate growth. A big part of this talk is joint work with R. Grigorchuk.

* **December 6th, Wednesday** (3:30-4:30pm)(Cancelled)

Speaker: Kunal Sharma (Binghamton University)
Topic: Some remarks on Calderon-Seeley projector

Abstract: We will show how Calderon-Seeley projector comes up in study of boundary values problems for elliptic operators on a compact manifold with boundary. Its properties and applications to address Fredholmness of the operator will be discussed.

====Spring 2017==== * **January 18th, Wednesday** (3:30-4:30pm)

Speaker **:**
Topic: **organizational meeting**

Abstract:

* **January 25th, Wednesday** (3:30-5:00pm)

Speaker **: Timur Akhunov (Binghamton University)**
Topic: **Spectrum of Laplacian. Part 1**

Abstract: Spectrum of Laplacian reveals properties of heat, sound, light and atomic properties. Addressing some of these questions motivated Fourier in the 18th to develop harmonic analysis that decomposes signals into distinct frequencies. Fast forward to the 21st century - how does the distribution of frequencies or spectrum is influenced by the curved geometry of space (or space-time). In the series of expository lectures over the course of the semester, several members of the analysis faculty will address these questions. The first lecture will begin with the overview of the Laplace and wave equation in the Euclidean space. It should be broadly accessible. The lectures are based on the book: **Hangzhou Lectures on Eigenfunctions of the Laplacian, Christopher D. Sogge, (Annals of Mathematics Studies-188), Princeton University Press. 2014**

* **February 1st, Wednesday** (3:30-4:30pm)

Speaker **: Timur Akhunov (Binghamton University)**
Topic: **Spectrum of Laplacian. Part 2 - Fundamental solutions of the d'Alembertian**

Abstract: Spectrum of Laplacian reveals properties of heat, sound, light and atomic properties. Addressing some of these questions motivated Fourier in the 18th to develop harmonic analysis that decomposes signals into distinct frequencies. Fast forward to the 21st century - how does the distribution of frequencies or spectrum is influenced by the curved geometry of space (or space-time). In the series of expository lectures over the course of the semester, several members of the analysis faculty will address these questions. This lecture will overview the fundamental solutions of the wave equation in the Euclidean space. It should be broadly accessible. The lectures are based on the book: **Hangzhou Lectures on Eigenfunctions of the Laplacian, Christopher D. Sogge, (Annals of Mathematics Studies-188), Princeton University Press. 2014**

* **February 8th, Wednesday** (3:40-4:40pm)

Speaker **: Hyunchul Park (SUNY - New Paltz)**

Topic: **Spectral heat content for symmetric stable processes for general open sets in $\mathbb{R}^1$**

Abstract: In this talk, we study asymptotic behavior of spectral heat content with respect to symmetric stable processes for arbitrary open sets with finite Lebesgue measure in a real line. Spectral heat content can be interpreted as fractional heat particles that remain in the open sets after short time $t > 0$. We are mainly interested in the relationship between the heat content and the geometry of the domain. Three different behaviors appear depending on the stability indices α of the stable processes and in each case different geometric objects of the domain are discovered in the asymptotic expansion of the corresponding heat content expansion. This is a joint work with R. Song and T. Grzywny.

* **February 15th, Wednesday** (3:40-5:00pm)

Speaker **: Lu Zhang (Binghamton University)**
Topic: **Spectrum of Laplacian. Part 3 - Laplace-Beltrami Operator and Geodesics**

Abstract: The Laplace operator on Euclidean space can be generalized to Laplace-Beltrami operator on compact manifolds, which is defined as the divergence of the gradient. We will do a brief review of some properties of the Lapace-Beltrami operator such as the related elliptic regularity estimates. Moreover, we will see for any point in the domain, by choosing proper local coordinate system vanishing at this point, rays through the origin will be geodesics for the metric involved in the Laplace-Beltrami operator. The lectures are based on the book: **Hangzhou Lectures on Eigenfunctions of the Laplacian, Christopher D. Sogge, (Annals of Mathematics Studies-188), Princeton University Press. 2014**

* **February 22nd, Wednesday** (3:40-5:00pm)

Speaker **: Lu Zhang (Binghamton University)**
Topic: **Spectrum of Laplacian. Part 4 - The Hadamard Parametrix**

Abstract: To study the fundamental solution of the wave operator, We will introduce the Hadamard parametrix, in which the error term can be made arbitrarily smooth. Such construction gives the singularities of the fundamental solution with any desired precision. Also, we will see the use of geodesic normal coordinates in the establishment of a uniqueness theorem for the Cauchy problem. The lectures are based on the book: **Hangzhou Lectures on Eigenfunctions of the Laplacian, Christopher D. Sogge, (Annals of Mathematics Studies-188), Princeton University Press. 2014**

* **March 1st, Wednesday** (3:40-5:00pm)

Speaker **: Xiangjin Xu (Binghamton University)**
Topic: **Spectrum of Laplacian. Part 5 - the sharp Weyl formula**

Abstract: This talk is mainly devoted to the proof of the sharp Weyl formula of the spectrum of Laplacian on compact boundaryless Riemannian manifolds.The proof presented uses the Hadamard parametrix. If time allows, we will discuss that no improvements of the sharp Weyl formula are possible for the standard sphere, and one can make significant improvements for bounds for the remainder term in the Weyl law for manifolds with nonpositive curvature (especially for flat n-torus). The lectures are based on the book: **Hangzhou Lectures on Eigenfunctions of the Laplacian, Christopher D. Sogge, (Annals of Mathematics Studies-188), Princeton University Press. 2014**

* **March 8th, Wednesday** (Winter break)

Speaker **:**
Topic:

Abstract:

* **March 15th, Wednesday** (Snow storm)

Speaker **:**
Topic:

Abstract:

* **March 22nd, Wednesday** (3:40-5:00pm)

Speaker **: Gang Zhou (Caltech)**
Topic: **motion of an invading heavy tracer particle in a Bose gas**

Abstract: I will present recent results on a non-relativistic Hamiltonian model of quantum friction, about the motion of an invading heavy tracer particle in a Bose gas exhibiting Bose Einstein condensate. We prove the following observations: if the initial speed of the tracer particle is lower than the speed of sound in the Bose gas, then in large time the particle will travel ballistically; if the initial speed is higher than the speed of sound, the it will converge to the speed of sound. In both regimes the system will converge to some inertial states. Joint works with Juerg Froehlich, Michael Sigal, Avy Soffer, Daneil Egli and Arick Shao.

* **March 29th, Wednesday** (3:40-5:00pm)

Speaker **: Adam Weisblatt (Binghamton University)**
Topic: **Spectrum of Laplacian. Part 6 - Introduction to oscillatory integrals**

Abstract: We will define what it means to be an oscillatory integral and investigate it's stationary phase properties. The lectures will partially base on the book: Hangzhou Lectures on Eigenfunctions of the Laplacian, Christopher D. Sogge, (Annals of Mathematics Studies-188), Princeton University Press. 2014

* **April 5th, Wednesday** (3:40-5:00pm)

Speaker **: Lu Zhang (Binghamton University)**
Topic: **Spectrum of Laplacian. Part 7 - Pseudo-differential operators and microlocal analysis**

Abstract: We will do a brief introduction to Pseudo-differential operators on Riemannian manifold, as well as some related microlocal analysis. By taking advantage of their properties, one can prove the propagation of singularities for the half wave equation, which involves the square root of Laplace Beltrami, and also a special case of the Egorov's theorem. The lectures will base on the book: Hangzhou Lectures on Eigenfunctions of the Laplacian, Christopher D. Sogge, (Annals of Mathematics Studies-188), Princeton University Press. 2014

* **April 12th, Wednesday** (Spring break)

Speaker **:**
Topic:

Abstract:

* **April 19th, Wednesday** (3:40-5:00pm)

Speaker **:Mihai Bailesteanu (Central Connecticut State University)**
Topic: **Harnack inequalities for parabolic equations**

Abstract: We discuss an aglorithm to produce Harnack inequalities for various parabolic equations. As an application, we obtain a Harnack inequality for the curve shortening flow and one for the parabolic Allen Cahn equation on a closed n-dimensional manifold.

* **April 26th, Wednesday** (No seminar talk)

Speaker **:**
Topic:

Abstract:

* **May 3rd, Wednesday** (3:40-5:00pm)

Speaker **: Guozhen Lu (University of Connecticut)**
Topic: **Hardy-Adams inequalities on hyperbolic spaces and Hardy-Sobolev-Maz'ya inequalities on half spaces**

Abstract: We establish sharp Hardy-Adams inequalities on hyperbolic spaces and Hardy-Sobolev-Maz'ya inequalities with high order derivatives on half spaces. The Hardy-Sobolev-Maz'ya inequalities follow from sharpened Sobolev inequalities for Paneitz operators on hyperbolic spaces.

* **May 4th,Thursday** (4:30-5:30pm) (Dean's Lecture in Analysis)

Speaker **: Guozhen Lu (University of Connecticut)**
Topic: **Sharp geometric and functional inequalities and applications to geometry and PDEs**

Abstract: Sharp geometric and functional inequalities play an important role in applications to geometry and PDEs. In this talk, we will discuss some important geometric inequalities such as Sobolev inequalities, Hardy inequalities, Hardy-Sobolev inequalities Trudinger-Moser and Adams inequalities, Gagliardo-Nirenberg inequalities and Caffarelli-Kohn-Nirenberg inequalities, etc. We will also brief talk about their applications in geometry and nonlinear PDEs. Some recent results will also be reported. This talk is intended to be for the general audience.

====Fall 2016==== * **September 7th** (3:30-4:30pm)

Speaker **: Lu Zhang (Binghamton University)**
Topic: **Equivalence of Critical and Subcritical Sharp Trudinger-Moser Inequalities.**

Abstract: Trudinger-Moser inequalities describe the limiting case of the Sobolev embeddings. There are two types of such optimal inequalities: critical and subcritical inequalities, both with the best constants. Surprisingly, we are able to show these two types of inequalities are actually equivalent. Moreover, we can provide a precise relationship between their supremums.

* **September 14th** (4:40-5:40pm)

Speaker **: Timur M Akhunov (Binghamton University)**
Topic: **On hypoellipticity of degenerate elliptic operators**

Abstract: Solutions of the laplace equation are always smooth in the interior of the domain. This property, called hypoellipticity, is inherited by the solutions of the uniformly elliptic operators. However, if the elliptic operator is degenerate in some directions, would solutions still be smooth? Ellipticity is such a powerful effect, that degeneracy may not be enough to create singular solutions. The type of degeneracy matters and we investigate a large class of indefinitely degenerate operators.

* **September 19th, Monday** (4:40-5:40pm)

Speaker **: Lu Zhang (Binghamton University)**
Topic: **Trudinger-Moser Inequalities with Exact Growth**

Abstract: Original Trudinger-Moser inequality on the bounded domain with sharp constant fails on the whole plane. In this case a subcritial inequality holds, or the full Sobolev norm instead of the seminorm is needed to attain a critical inequality. In fact, we can establish a version of critical inequality under the restriction of the seminorm only, where instead we should add a polynomial decay into the inequality.

* **September 28th, Wednesday** (4:40-5:30pm)

Speaker **: Timur M Akhunov (Binghamton University)**
Topic: **When is it possible to have wellposedness of the fully non-linear KdV equation without resorting to weighted spaces?**

Abstract: The Korteweg-de Vries equation is a famous model for the propagation of long waves in a shallow canal. In generalization of this model with stronger nonlinear effects a competition between dispersion and anti-diffusion is possible. Solutions to these equations can fail to depend continuously on data unless data has extra decay. In this talk, joint work with David Ambrose and Doug Wright, we investigate a wide class of equations, where this extra decay is not needed.

* **October 5th, Wednesday** (4:40-5:30pm)

Speaker **: Adam Weisblatt (Binghamton University)**
Topic: **Pricing in financial mathematics**

Abstract: We will discuss the philosophy and analysis required to price financial derivatives.

* **October 12th (Yom Kippur)**

Speaker **:**
Topic:

Abstract:

* **October 19th, Wednesday** (4:40-5:30pm)

Speaker **: Danyu Zhang (Binghamton University)**
Topic: **Introduction to Riemannian Geometry**

Abstract: I am going to introduce Riemannian metric, connections, geodesics, different curvatures and Jacobi fields, with examples, based on Do Carmo's book Remannian Geometry.

* **October 26th, Wednesday** (4:40-5:30pm)

Speaker **: David Renfrew (Binghamton University)**
Topic: **Eigenvalues of large non-Hermitian random matrices with a variance profile.**

Abstract: The eigenvalues of non-Hermitian random matrices with independent, identically distributed entries are governed by the circular law. We consider the eigenvalues of random matrices with independent entries but remove the assumption of identical distributions, allowing entries to have different variances. We describe the eigenvalue density of such matrices under certain assumptions on the graph theoretic properties on the connectivity of the variance profile.

* **November 2nd**

Speaker **:**
Topic:

Abstract:

* **November 9th**

Speaker **: Chenyun Luo (Johns Hopkins University)**
Topic: **On the motion of a slightly compressible liquid**

Abstract: I would like to go over some recent results on the compressible Euler equations with free boundary. We first provide a new apriori energy estimates which are uniform in the sound speed, which leads to the convergence to the solutions of the incompressible Euler equations.This is a joint work with Hans Lindblad.

On the other hand, the energy estimates can be generalized to the compressible water wave problem, i.e., the domain that occupied by the fluid is assumed to be unbounded. Our method requires the detailed analysis of the geometry of the moving boundary.

* **November 16th**

Speaker **: Mathew Wolak (Binghamton University)**
Topic: **Invariant differential operators for the classical Cartan Motion Groups**

Abstract: Lie group contraction is a process that ``flattens out a Lie group, similar to the process by which a sphere becomes a plane as the radius tends to infinity. The Cartan motion groups are special contractions of semisimple Lie groups. I will present generators for the algebra of bi-invariant differential operators for the Cartan motion groups.

- **November 23rd (Thanksgiving)**

  Speaker **:**
  *Topic***:**

  Abstract:

- **November 30th, Wednesday** (4:40-5:30pm)

  Speaker **: Binbin Huang (Binghamton University)**
  *Topic***: Introduction to Spectral Geometry via Heat Trace Asymptotic Expansion**

  Abstract: The study of spectral geometry concerns concerns relationships between geometric structures of manifolds and spectra of canonically defined differential operators, e.g., Laplace–Beltrami operator on a closed Riemannian manifold. It's also closely related to the heat kernel approach for Atiyah-Singer index theorem. The heat trace and its Asymptotic expansion provide an elegant way in this study. We will go over this method from scratch, beginning with the definition of trace-class operators and culminating in a proof of the celebrated Weyl's law.

- **December 2nd, Friday**(4:40-5:40pm) (Colloquium)

  Speaker **: Ling Xiao (Rutgers)**
  *Topic***: Translating Solitons in Euclidean Space.**

- *Abstract*: Mean curvature flow may be regarded as a geometric version of the heat equation. However, in contrast to the classical heat equation, mean curvature flow is described by a quasilinear evolution system of partial differential equations, and in general the solution only exists on a finite time interval. Therefore, it's very typical that the flow develops singularities. Translating solitons arise as parabolic rescaling of type II singularities. In this talk, we shall outline a program on the classification of translating solitons. We shall also report on some recent progress we have made in the joint work with

Joel Spruck.

- **December 5th, Monday**(4:40-5:40pm) (Colloquium)

  Speaker **: Gang Zhou (Caltech)**
  *Topic***: On Singularity Formation Under Mean Curvature Flow**

- *Abstract*: In this talk I present our recent works, jointly with D.Knopf and I.M.Sigal, on singularity formation under mean curvature flow. By very different techniques, we proved the uniqueness of collapsing cylinder for a generic class of initial surfaces. In the talk some key new elements will be discussed. A few problems, which might be tackled by our techniques, will be formulated.

- **December 7th, Wednesday**(4:40-5:40pm) (Colloquium)

  Speaker **: Chen Le (University of Kansas)**
  *Topic***: Stochastic heat equation: intermittency and densities.**

- *Abstract*: Stochastic heat equation (SHE) with multiplicative noise is an important model. When the diffusion coefficient is linear, this model is also called the parabolic Anderson model, the solution of which traditionally gives the Hopf-Cole solution to the famous KPZ equation. Obtaining various fine properties of its solution will certainly deepen our understanding of these important models. In this talk, I will highlight several interesting properties of SHE and then focus on the probability densities of the solution. In a recent joint work with Y. Hu and D. Nualart, we establish a necessary and sufficient condition for the existence and regularity of the density of the solution to SHE with measure-valued initial conditions. Under a mild cone condition for the diffusion coefficient, we establish the smooth joint density at multiple points. The tool we use is Malliavin calculus. The main ingredient is to prove that the solutions to a related stochastic partial differential equation have negative moments of all orders.

Spring 2016

- **March 9**

  Speaker **: Adam Weisblatt (Binghamton University)**
  *Topic***: Constructing heat kenels**

  Abstract: We will carefully examine the properties of heat kernels in euclidean space. Then we construct the most natural manifold where the kernels should exist and be studied.

- **April 13**

  Speaker **: Binbin Huang (Binghamton University)**
  *Topic***: An elementary introduction to spectral sequences and applications in differential geometry (Part 1)**

Abstract: The technique of spectral sequences was applied to study the isomorphism between De Rham cohomology and Cech cohomology. This could be thought as supplementary material to Dr. Loya's class this semester on the geometry and analysis on manifolds. Definitions and proof details would be shown.

- **April 20**

Speaker **: Lu Zhang (Wayne State University)**
*Topic***: L^p estimates for some pseudo-differential operators.**
Time **: 3:30pm-4:30pm**

Abstract: We study the H\”older's type L^p estimates for a class of pseudo-differential operators in one and bi-parameter setting. Such operators include some trilinear pseudo-differential differential operators with symbols as products of two H\”omander class $BS^0_{1,0}$ functions defined on lower dimensions, and also a bi-parameter bilinear Calder\'on-Vaillancourt theorem, where the symbols are taken from the bi-parameter H\”omander class $BBS^m_{0,0}$.

- **April 20**

Speaker **: Pearce Washabaugh (Boulder)**
*Topic***: Model Fluid Mechanics Equations and Universal Teichmüller Spaces**
Time **: 4:40pm-5:40pm**

Abstract: One of the ways of approaching the problems of 3D fluid mechanics is to study simpler lower dimensional model equations that capture some of the key analytic properties of the full 3D situation. The Wunsch equation, a special case of a generalization of the Constantin-Lax-Majda equation, is one such one dimensional model. It, along with the Euler-Weil-Petersson equation, arise as geodesic equations on the Universal Teichmüller Curve and Universal Teichmüller Space respectively. In this talk, I will discuss new results on blowup and global existence for these equations, numerical simulations applying conformal welding to their solutions, and how the Surface Quasi-Geostrophic equation, a two dimensional model for the 3D Euler equation, is a possible higher dimensional version of this picture. This is joint work with Stephen Preston.

- **April 27**

Speaker **: Kyle Thompson (Toronto)**
*Topic***: Superconducting Interfaces**

Abstract: In this talk we will look for solutions to a two-component system of nonlinear wave equations with the properties that one component has an interface and the other is exponentially small except near the interface of the first component. The second component can be identified with a superconducting current confined to an interface. In order to find solutions of this nature, we will carry out a formal analysis which will suggest that for suitable initial data, the energy of solutions concentrate about a codimension one timelike surface whose dynamics are coupled in a highly

nonlinear way to the phase of the superconducting current. We will finish by discussing a recent result confirming the predictions of this formal analysis for solutions with an equivariant symmetry in two dimensions.

- **May 4**

  Speaker **: Binbin Huang (Binghamton University)**
  *Topic***: An elementary introduction to spectral sequences and applications in differential geometry (Part 2)**

  Abstract: The technique of spectral sequences was applied to study the isomorphism between De Rham cohomology and Cech cohomology. This could be thought as supplementary material to Dr. Loya's class this semester on the geometry and analysis on manifolds. Definitions and proof details would be shown.

- Fall 2015
  - **October 7**

    Speaker **: Changwei Zhou (Binghamton University)**
    *Topic***: Hochschild homology for polynomial algebra in R^n**

    Abstract: In this talk we will attempt to compute the Hochschild homology of polynomial algebra in R^n using Richard Melrose's elementary approach. The audience is welcome to offer critical, honest opinion whenever they felt it is needed. The speaker welcomes the proof to be debated to foster a laid back atmosphere helping a refined understanding of the subject.

  - **October 14**

    Speaker **: Kunal Sharma (Binghamton University)**
    *Topic***: Homology of pseudo differential symbols**

    Abstract: We will consider the algebra of classical pseudo-differential operators on a compact closed manifold and will compute its homology.

  - **October 22, 2:50-3:50pm (Special Date, Joint with Geometry and Topology Seminar)**

    Speaker **: Jiuyi Zhu (Johns Hopkings University)**
    *Topic***: Doubling estimates, vanishing order and nodal sets of Steklov eigenfunctions**

    Abstract: Recently the study of Steklov eigenfunctions has been attracting much attention. We investigate the qualitative and quantitative properties of Steklov eigenfunctions. We obtain the sharp doubling estimates for Steklov eigenfunctions on the boundary and interior of the manifold using Carleman inequalities. As an application, optimal vanishing order is derived, which describes

quantitative behavior of strong unique continuation property. We can ask Yau's type conjecture for the Hausdorff measure of nodal sets of Steklov eigenfunctions. We derive the lower bounds for interior and boundary nodal sets. In two dimensions, we are able to obtain the upper bounds for singular sets and nodal sets. Part of work is joint with Chris Sogge and X. Wang.

- **October 28**

  Speaker **: Adam Weisblatt (Binghamton University)**
  *Topic***: Heat kernel on a manifold**

  Abstract: We will explicitly construct the heat kernel on a closed manifold using semiclassical pseudodifferential operators.

- **November 4**

  Speaker **: Adam Weisblatt (Binghamton University)**
  *Topic***: Heat kernel on a manifold (continued)**

  Abstract: We will continue constructing the heat kernel on a closed manifold using semiclassical pseudodifferential operators.

- **November 18**

  Speaker **: Adam Weisblatt (Binghamton University)**
  *Topic***: Heat kernel on a manifold (continued)**

  Abstract: We continue the construction of the heat kernel on a closed manifold.

- **December 2**

  Speaker **: Adam Weisblatt (Binghamton University)**
  *Topic***: Heat kernel on a manifold (continued)**

  Abstract: We will extend the heat kernel from Euclidean spaces to closed manifolds.

- Spring 2015
  - **February 26 (unusual day & time: Thursday, 4:30pm)**

    Speaker **: Niels Martin Moeller (Princeton University)**
    *Title***: Gluing of Geometric PDEs - Obstructions vs. Constructions for Minimal Surfaces & Mean Curvature Flow Solitons**

Abstract: For geometric nonlinear PDEs, where no easy superposition principle holds, examples of (global, geometrically/topologically interesting) solutions can be hard to come about. In certain situations, for example for 2-surfaces satisfying an equation of mean curvature type, one can generally “fuse” two or more such surfaces satisfying the PDE, as long as certain global obstructions are respected - at the cost (or benefit) of increasing the genus significantly. The key to success in such a gluing procedure is to understand the obstructions from a more local perspective, and to allow sufficiently large geometric deformations to take place. In the talk I will introduce some of the basic ideas and techniques (and pictures) in the gluing of minimal 2-surfaces in a 3-manifold. Then I will explain two recent applications, one to the study of solitons with genus in the singularity theory for mean curvature flow (rigorous construction of Ilmanen's conjectured “planosphere” self-shrinkers), and another to the non-compactness of moduli spaces of finite total curvature minimal surfaces (a problem posed by Ros & Hoffman-Meeks). Some of this work is joint w/ Steve Kleene and/or Nicos Kapouleas.

- Fall 2014
  - **November 5**

    Speaker **: Yuanzhen Shao (Vanderbilt University)**
    *Topic***: Continuous maximal regularity on manifolds with singularities and applications to geometric flows**

    Abstract: In this talk, we study continuous maximal regularity theory for a class of degenerate or singular differential operators on manifolds with singularities. Based on this theory, we show local existence and uniqueness of solutions for several nonlinear geometric flows and diffusion equations on non-compact, or even incomplete, manifolds, including the Yamabe flow and parabolic p-Laplacian equations. In addition, we also establish regularity properties of solutions by means of a technique consisting of continuous maximal regularity theory, a parameter-dependent diffeomorphism and the implicit function theorem.

  - **December 3**

    Speaker **: Douglas J. Wright (Drexel University)**
    *Topic***: Approximation of Polyatomic FPU Lattices by KdV Equations**

    Abstract: Famously, the Korteweg-de Vries equation serves as a model for the propagation of long waves in Fermi-Pasta-Ulam (FPU) lattices. If one allows the material coefficients in the FPU lattice to vary periodically, the “classical” derivation and justification of the KdV equation go awry. By borrowing ideas from homogenization theory, we can derive and justify an appropriate KdV limit for this problem. This work is joint with Shari Moskow, Jeremy Gaison and Qimin Zhang.