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:

* **February 6th, Wednesday** (3:30-4:55pm)

Speaker :
Topic:

Abstract:

* **February 13th, Wednesday** (3:30-4:55pm)

Speaker :
Topic:

Abstract:

* **February 20th , Wednesday** (3:30-4:55pm)

Speaker:
Topic:

Abstract:

* **February 27th , Wednesday** (3:30-4:55pm)

Speaker:

Topic:

Abstract:

* **March 6th, Wednesday** (3:30-4:55pm)

Speaker:
Topic:

Abstract:

* **March 13th, Wednesday** (3:30-4:55pm)

Speaker:
Topic:

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* **March 20th, Wednesday** (3:30-4:55pm)

Speaker:
Topic:

Abstract:

* **March 27th, Wednesday** (3:30-4:55pm)

Speaker:
Topic:

Abstract:

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

Speaker:
Topic:

Abstract:

* **April 10th, Wednesday** (3:30-4:55pm)

Speaker:
Topic:

Abstract:

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

Speaker:
Topic:

Abstract:

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

Speaker:
Topic:

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.

* **May 15th, Wednesday** (3:30-4:55pm)

Speaker:
Topic:

Abstract:

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 10th, Wednesday** (3:30-4:55pm)

Speaker:
Topic:

Abstract:

* **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 7th, Wednesday** (3:30-4:55pm)

Speaker:
Topic:

Abstract:

* **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.