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The Analysis Seminar

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The seminar meets Wednesdays in WH-100E at 4:00-5:00 p.m. There are refreshments and snacks in WH-102 at 3:15.

The seminar is partly funded as one of Dean's Speaker Series in Harpur College (College of Arts and Sciences) at Binghamton University.

Organizers: Paul Loya, David Renfrew, Minghao Rostami, Emmett Wyman, Xiangjin Xu, Jia Zhao and Gang Zhou

Previous talks

Fall 2014 to Spring 2023

Spring 2024

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

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

Abstract: organizational meeting

* January 31st, Wednesday (4-5pm)

Speaker : Topic:

Abstract:

* February 7th, Wednesday (4-5pm)	
Speaker : Topic:	
Abstract:	
* February 14th , Wednesday (4-5pm)	
Speaker: Topic:	
Abstract:	
* February 21st, Wednesday (4-5pm)	
Speaker:	
Topic:	
Abstract:	

* February 28th, Wednesday (4-5pm)

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* 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.

* March 27th, Wednesday (4-5pm)

Speaker: Topic:

* April 24th, Wednesday (4-5pm) (Passover Break)				
Speaker: Topic:				
Abstract:				
* May 1st, Wednesday (4-5pm)				
Speaker: Cheng Wang (UMass-Dartmouth) Topic: TBA				
Abstract: TBA				
* May 8th, Wednesday (4-5pm) Speaker: Topic:				
Abstract:				

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

Speaker :

Topic: No talk this week

Abstract:

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

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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).

* 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.

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

Speaker:

Topic:

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* October 4th , Wednesday (3:30-4:30pm)	
Speaker : Jia Zhao (Binghamton University) Topic : When Differential Equations Meet Computation: A Friendly Introduction to Numerical Ar	nalysis 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 11th, Wednesday (3:30-4:30pm)	
Speaker:	
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* October 18th, Wednesday (3:30-4:30pm)

Speaker:

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The Analysis Seminar

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

Speaker:

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