

Schedule of Mathematics Symposium August 2025

Friday, 29/08/2025

Chair of session	Slot	Speaker	Title
Mainak	9:30-10:00	Hitendra Kumar	Parameterized Algorithms for Editing to Uniform Cluster Graph
Mainak	10:10-10:40	Tejas Kalelkar	Connecting essential triangulations
	10:45-11:00	Tea Break	
Debargha	11:00-11:30	Rabeya Basu	An interplay between commutative algebra and classical K-theory
Mousomi	11:40-12:10	Aniket Sen	Regularity results for nonlocal double phase equations
Mousomi	12:20-12:50	Paramananda Das	Quasilinear problems with mixed local-nonlocal operator and concave-critical nonlinearities
	13:00-14:30	Lunch Break	
Mousomi	14:30-15:00	Anup Biswas	Pointwise convergence of the solutions to the initial data for the abstract heat equation
Mousomi	15:10-15:40	Krishna Kaipa	$PGL_2(q)$ orbits of lines of $P^3(F_q)$ and binary quartic forms in characteristic 3
	15:45-16:00	Tea Break	
	16:00-16:30	Debargha Banerjee	Galois representations
	16:40-17:10	Ayan Mahalanobis	Symplectic Elimination
	17:20-17:50	Divyang Bhimani	On the converse of Wiener-Levy theorem and applications to modulation spaces

Saturday, 30/08/2025

Chair of session	Slot	Speaker	Title
Chandrasheel	9:30-10:00	Anupam Singh	Chirality in finite groups of Lie type
Chandrasheel	10:10-10:40	Kaustabh Mondal	A Finite Linear Dependence of Discrete Series Multiplicities
	10:45-11:00	Tea Break	
Rama	11:00-11:30	Prachi Saini	Polynomial Maps with Constants on Split Octonion Algebra
Rama	11:40-12:10	Ramandeepsingh Arora	Equivariant principal bundles on toric Deligne-Mumford stacks
Rama	12:20-12:50	Subhash Ranjan Choudhary	Orthonormal Strichartz estimates on waveguide manifold
	13:00-14:30	Lunch Break	
Krishna	14:30-15:00	Srijan Das	On Ext group of ordinary parts in p-adic local Langlands correspondence
Krishna	15:10-15:40	Clifford J Rodrigues	On Serre's Open Image Theorem for Number Fields
Krishna	15:50-16:20	Vivek Mohan Mallick	Stratification on tensor triangulated categories
	16:20-16:40	Conclusion and Tea + snacks	

Title and Abstracts

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Speaker's Name: Hitendra Kumar

Title - Parameterized Algorithms for Editing to Uniform Cluster Graph

Abstract: Graph modification problems ask whether we can transform a given graph into one with a desired structure by applying only a few changes, such as deleting vertices or edges. In this talk, I will focus on *uniform cluster graphs*—graphs in which every connected component is a clique of the same size. I will present recent results on the Uniform Cluster Vertex Deletion problem, where the task is to remove at most k vertices to reach such a structure. In particular, I will describe a cubic vertex kernel and a faster fixed-parameter algorithm that improves the best-known bounds. I will also briefly touch on the Uniform Cluster Edge Deletion problem, for which we obtain a very simple linear-size kernel. These results resolve several open questions and provide new insights into the parameterized complexity of uniform cluster graphs.

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Speaker's Name: Tejas Kalelkar (joint work with Saul Schleimer and Henry Segerman)

Title: Connecting essential triangulations

Abstract:

Let M be a 3-dimensional compact manifold with non-empty boundary. There exists a collection of tetrahedra stuck in pairs along their faces such that deleting all their vertices gives a space that is homeomorphic to the interior of M . This is called a (ideal) triangulation of M . Amendola, Matveev and Piergallini have shown that any two such triangulations of M are connected by a sequence of triangulations, where each triangulation in the sequence is obtained from the previous one by a local combinatorial change, namely a 2-3 or 3-2 move. For some applications however, we need our triangulations to have special properties. We call a triangulation essential if none of its edges is a homotopically trivial loop. Certain essential triangulations are isolated, in

the sense that any 2-3 or 3-2 move introduces an inessential edge. We have shown that when the universal cover of M has infinitely many boundary components and the two given essential triangulations of M are not isolated, then they are connected by a sequence of 2-3 and 3-2 moves through essential triangulations. If in addition, we allow V-moves and their inverses, then any two essential triangulations (including the isolated ones) are connected via essential triangulations. Our results have applications such as proving that the 1-loop invariant is independent of the choice of triangulation.

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Speaker's Name: Prafullkumar Tale

(This talk is cancelled.)

Title: Usual Structures, Unusual Results

Abstract: In this talk, we introduced the notion of parameterized algorithms and conditional lower bounds. We then expand on how usual structures (more specifically Sperner Family of Sets) from discrete mathematics is used to obtain unusual results (more specifically double exponential lower bounds) for parameterized algorithms.

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Speaker's Name: Aniket Sen

Title: Regularity results for nonlocal double phase equations

Abstract: Double phase equations arise in homogenization theory and belong to the class of non-uniformly elliptic problems with nonstandard growth conditions. We consider a nonlocal analogue of the classical double phase problem within the viscosity solution framework. In this talk we will present a new local Hölder and Lipschitz regularity result for solutions to the nonlocal double phase equation. In the process, we also obtain regularity estimates for fractional p -harmonic functions. This is joint work with Dr. Anup Biswas.

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Speaker's Name: Paramananda Das

Title: Quasilinear problems with mixed local-nonlocal operator and concave-critical nonlinearities

Abstract: In their celebrated paper, Amundsen, Brezis, and Cerami investigated a concave-convex problem with the Laplace operator, establishing the existence, non-existence, and multiplicity of positive solutions. We extend their study to a similar problem, but with a mixed operator involving the p -Laplace and fractional p -Laplace operators. This talk will provide a brief literature review, followed by a discussion of our results and the key steps of the proofs. This is based on joint work with Dr. Mousomi Bhakta and Dr. Nirjan Biswas.

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Speaker's Name: Anup Biswas (Joint work with Divyang Bhimani and Rupak Dalai)

Title: Pointwise convergence of the solutions to the initial data for the abstract heat equation

Abstract: In a recent study, Hartzstein, Torrea, and Viviani characterized all the weights v for which the solution to the classical heat equation with initial data f , where $f \in L^p_v(\mathbb{R}^n)$, converges to f as $t \rightarrow 0$, almost everywhere and for every $f \in L^p_v(\mathbb{R}^n)$. This work is, of course, in the spirit of Carleson's program, where similar investigations have been conducted for the Schrödinger operators. In this talk, we will extend the results of Hartzstein et al. to a broader class of operators on metric measure spaces with a volume doubling condition, including ϕ -nonlocal operators, mixed local-nonlocal operators, the Laplacian with a Hardy potential, the Laplacian-Beltrami operators, Laplacian on fractals and many others. This talk is going to be a mix of probability, PDE and harmonic analysis.

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Speaker's Name: Krishna Kaipa

Title: $\mathrm{PGL}_2(q)$ orbits of lines of $P^3(F_q)$ and binary quartic forms in characteristic 3.

Abstract: We consider the problem of classifying the lines of the projective 3-space $P^3(F_q)$ over a finite field F_q into orbits of the group $\mathrm{PGL}_2(q)$ of linear symmetries of the twisted cubic C . This problem has been solved in literature in characteristic different from 3, and in this talk we report on our solution of the problem in characteristic 3. We reduce this problem to another problem, which is the classification of binary quartic forms over F_q into $\mathrm{PGL}_2(q)$ -orbits. We also discuss the line-plane incidence structures of the line and plane orbits. This is joint work with Dr. Puspendu Pradhan.

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Speaker's Name: Debargha Banerjee

Title: Galois representations

Abstract: Galois representations are an important topic in the present day mathematics that connects two different worlds of algebra and analysis. Galois representations are simply continuous homomorphisms of the Galois group of the algebraic closure of rational numbers to certain finite dimensional vector spaces. In this talk, I will give a general introduction to Galois representations. We are interested in certain symmetries of these Galois representations called extra twists or inner twists. We will prove results related to the existence of these extra twists in the context of Siegel modular forms. This is a joint work with Ronit Debnath.

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Speaker's Name: Ayan Mahalanobis

Title: Symplectic Elimination

Abstract: In this talk we develop the symplectic elimination algorithm. This algorithm using simple row operations reduces a symplectic matrix to a diagonal matrix. This algorithm gives rise to a decomposition of a non-singular arbitrary matrix to a symplectic matrix and a reduced matrix. This decomposition is similar to the SR decomposition which is akin to the QR decomposition.

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Speaker's Name: Divyang Bhimani (joint work with Karishman Solanki)

Title: On the converse of Wiener-Levy theorem and applications to modulation spaces

Abstract: Wiener–Lévy theorem states that a function of an absolutely convergent Fourier series has an absolutely convergent Fourier series under some conditions. We shall establish the converse of this theorem in the weighted Wiener algebra. In analysis, the weights are frequently employed to quantify the growth and decay conditions of the functions. In the process, we shall discuss the importance of the weights and weighted spaces. We shall find some of its applications in the realm of modulation spaces and its connections to dispersive PDEs.

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Speaker's Name: Anupam Singh

Title: Chirality in finite groups of Lie type

Abstract: Given an element of the free group on d generators, called a word (say w), and a group G , we can define a map by evaluation. Such maps are called word maps. In the last 3 decades, several great results, called Waring-like results, for finite simple groups have been obtained. In general, the main question in the subject has been to understand the image $w(G)$. In this talk, we try to understand when the image $w(G)$ is symmetric under inversion for finite groups of Lie type.

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Speaker's Name: Kaustabh Mondal

Title: A Finite Linear Dependence of Discrete Series Multiplicities

Abstract: Let G be a non-compact connected semisimple Lie group with a compact Cartan subgroup and Γ be a uniform lattice in G . In this talk, we will describe that an infinite set of discrete series multiplicities in $L^2(\Gamma \backslash G)$ can be determined from any finite subset satisfying a certain condition. This result leads to a refinement of the strong multiplicity one theorem for discrete series representations. We will conclude the talk by illustrating an application of this result in the context of spaces of holomorphic cusp forms. This is a joint work with Dr. Gunja Sachdeva.

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Speaker's Name: Prachi Saini

Title: Polynomial Maps with Constants on Split Octonion Algebra

Abstract: The classical Waring problem in number theory asks whether every natural number can be expressed as a finite sum of k -th powers of natural numbers, for a fixed integer k , and seeks to determine the minimal such number of terms, denoted $g(k)$. In this work, we explore a natural generalization of the Waring problem in the context of non-associative algebras, where the coefficients and elements involved in the power sums are taken from the algebra itself. Specifically, we investigate the surjectivity of one such polynomial map evaluated over the Split Octonion algebra.

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Speaker's Name: Ramandeep Singh Arora

Title: Equivariant principal bundles on toric Deligne-Mumford stacks

Abstract: Given a complex $[G^{-1} \rightarrowtail G^0]$ of sheaves of abelian groups over a scheme S , we can associate a Picard stack $\mathcal{G}$, which is a group stack. If G^0 acts on a scheme X over S , we describe an equivalence of categories between the category of $\mathcal{G}$ -equivariant principal H -bundles on the quotient stack $[X / G^{-1}]$ and the category of G^0 -equivariant principal H -bundles on X . Furthermore, we use this equivalence to describe torus-equivariant bundles over toric Deligne-Mumford stacks. This is a joint work (in progress) with Dr. Chandranandan Gangopadhyay and Prof. Mainak Poddar.

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Speaker's Name: Subhash Ranjan Choudhary (Joint work with Dr. Divyang Bhimani)

Title: Orthonormal Strichartz estimates on waveguide manifold

Abstract: In this talk, we will explore the solutions to the system of fractional Schrödinger equations, a mathematical model used in quantum mechanics. We'll focus on the waveguide manifold (a tube-like shape). We have established orthonormal Strichartz estimates, which help us understand the well-posedness of the system. And we also improve upon an existing inequality known as the ℓ^2 decoupling inequality.

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Speaker's Name: Srijan Das

Title: On Ext group of ordinary parts in p -adic local Langlands correspondence

Abstract: In contrast to the classical Langlands correspondence ($\ell \neq p$ case), there are several new challenges that occur in formulating the p -adic Langlands correspondence ($\ell = p$ case). This has been studied by the works of Breuil, Colmez, Paskunas etc. over the last decade and successfully resolved for the case of $\mathrm{GL}_2(\mathbb{Q}_p)$. A key strategy, pioneered by Breuil and Emerton, is to seek the correspondence within the p -adic and mod p cohomology of certain geometric spaces, such as modular curves and Drinfeld towers. This shifts the problem to a new central question: which representations actually appear in the cohomology of these spaces, and how are they related? This "cohomological" approach provides an appropriate framework for studying local-global compatibility and extending the correspondence beyond $\mathrm{GL}_2(\mathbb{Q}_p)$.

In this context, I will speak on our recent work on the vanishing of some Ext groups. This indicates that a large class of representations, namely the ordinary ones, are conspicuously absent from certain parts of the cohomology of these towers. Moreover, we prove that there are no non-trivial extensions between these representations in the p -adic setting and establish a finite-dimensionality result for the corresponding extension groups in the mod p setting. This is joint work with my supervisor Dr. Debargha Banerjee.

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Speaker's Name: Clifford J. Rodrigues

Title: On Serre's Open Image Theorem for Number Fields

Abstract: Given an elliptic curve E over a number field K , for each prime p , there is an associated Galois representation $\rho(E, p): G_K \rightarrow \mathrm{GL}(2, \mathbb{F}_p)$. Here G_K denotes the absolute Galois group of K . A basic question one can ask is if this map is surjective or not. This question was answered by Serre for Elliptic curves without complex multiplication, who says that $\rho(E, p)$ is surjective for all but finitely many primes p . Thus there is a constant $c(E, K)$, such that for all primes $l > c(E, K)$, $\rho(E, l)$ is surjective. The goal is to find bounds on such a constant. In this talk, we describe the results obtained for $\mathbb{Q}$ by Mayle and Wang (2023) and describe our current progress for number fields (specifically quadratic number fields.) This is a joint work (in progress) with Dr. Debargha Banerjee, Dr. Krishna Kishore and Arup Mondal. A basic understanding of Elliptic Curves, at the level of Silverman, would be helpful (but not strictly required) to understand the talk.

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Speaker's Name: Vivek Mohan Mallick

Title: Stratification on tensor triangulated categories

Abstract: We explore the structure of tensor triangulated categories. We shall see some results classifying thick tensor ideals and localising tensor ideals; and how such constructions relate to the (classical) theory of supports. Finally, the talk will summarise similar results on equivariant tensor triangulated Categories. This is joint work with Umesh Dubey.

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