

आजादी का अमृत महोत्सव (Celebrating 75 year of Independence)



Department of Mathematics, K. J. Somaiya college of Science and Commerce
Organises

International Symposium in PDE & Geometric Analysis

March 18-19, 2022



Speaker

Professor Almut Burchard
University of Toronto

Dr. Jérôme Vétois
McGill University

Dr. Mousomi Bhakta
IISER Pune

Dr. Anoop T. V.
IIT Madras

Dr. Ali Hyder
TIFR CAM Bangalore

Dr. Saikat Mazumdar
IITB

Professor Vinayak S. Kulkarni
University of Mumbai

Contact
Prof. Subhash Krishnan
Head of Department, KJSSC
Email- subhash.k@somaiya.edu
Contact NO.-9869356555

AIM

The **Symposium** is being organized with the aim of bringing together experts working in different aspects of PDE and will highlight the possibilities in this important area of Mathematics. Stressing on the applications, the talks will provide exposure to the students and will share the excitement of research in PDE and Geometric Analysis. Masters and Research Students, Teachers and Researchers are encouraged to participate.

The lectures will be held online through zoom platform from IST 03:00 pm onwards on both the days.

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SCHEDULE

International Symposium in PDE & Geometric Analysis

March 18-19, 2022



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TIME (IST)	DAY 1: March 18, 2022
4.00 - 4.30 pm	Welcome Address

4.30 - 5.15 pm	Session Chair: Prof. Makarand Niphadkar
	<p data-bbox="596 425 1217 468">Speaker:- Prof. Saikat Mazumdar</p> <p data-bbox="596 514 996 556">Yamabe type problems</p> <p data-bbox="596 602 2323 916">I will start by surveying the Yamabe problem(1960), which asks to find a (conformal) metric with constant scalar curvature on a compact Riemannian manifold. The solution of the Yamabe problem by Trudinger(1968), Aubin(1976) and Schoen(1984) highlighted the role played by local and global geometry of the manifold, and the unexpected connection to the positive mass theorem of general relativity. I will start with the case of compact surfaces and also introduce some tools and techniques from Calculus of Variations and Nonlinear Analysis on Manifolds.</p> <p data-bbox="596 962 2219 1145">If time permits, I will end by discussing the higher-order version of the Yamabe problem: “Given a compact Riemannian manifold, does there exists a conformal metric with constant Q-curvature”? The behaviour of Q-curvature under conformal changes of the metric is governed by certain conformally covariant powers of the Laplacian called the GJMS operator.</p>

5.30 – 6.15 pm	Session Chair: Dr. Reema Khanna
	<p>Speaker:- Prof. Ali Hyder</p> <p>Non-spherical blow-up on R^4</p> <p>It is known that for a smooth non-constant non-positive function f with $f \neq 0$ and for $\lambda > 0$ small there exists a conformal metric on the 2-dimensional torus with Gaussian curvature $f + \lambda$. The corresponding metrics exhibit a spherical bubbling phenomenon as λ decreases to zero. However, in the case of the 4-dimensional torus, if all the maximum points of f are non-degenerate, then the blow-up profile could be spherical as well as non-spherical. I will talk about the construction of a family of solutions on R^4 with non-spherical blow-up profile.</p>
6.30 – 7.30 pm	Session Chair: Prof. Jyotshana V Prajapat
	<p>Speaker:- Prof. Almut Burchard</p> <p>What is the best shape? Isodiametric problems arising in aggregation models.</p> <p>Abstract: How do pair interactions shape the large-scale behaviour of a cloud of particles (animals, social agents ...)? In the most basic models, the shape of the cloud is determined by minimizing an attractive-repulsive interaction energy under suitable geometric constraints. When can we expect aggregation to occur? what is the shape of the resulting flock? I will describe recent work on isodiametric capacitor problems that occur as limiting cases.</p>

DAY-02 Schedule

TIME (IST)	Day 2: March 19, 2022
3.15- 3.30 pm	Participants joining
3.30- 4. 15 pm	Session Chair: Prof. Vinayak S. Kulkarni
	<p>Speaker:- Prof. Mousomi Bhakta</p> <p>Lane-Emden equations with Hardy potential and measure data</p> <p>I will discuss the multiplicity of positive solutions to Lane-Emden equations and systems of equations with Hardy potential and measure data, namely equation of the form</p> $-\Delta u - \frac{\mu}{\delta^2} u = u^p \quad \text{in } \Omega, \quad u = \rho v \quad \text{on } \partial\Omega,$ <p>where $\delta(x) = \text{dist}(x, \partial\Omega)$, μ and ρ are positive parameters and μ is strictly smaller than the best Hardy constant. v is a positive Radon measure on $\partial\Omega$ with norm 1 and $1 < p < N_\mu$, with N_μ being a critical exponent depending on N and μ.</p>

4.30- 5.15 pm

Session Chair: Prof. Prabhat Kumar Upadhyay

Speaker:- Prof. Vinayak S. Kulkarni

Mathematical Analysis of Fractional Order Hyperbolic Heat Equation

The parabolic heat equation which is based on the classical Fourier law of heat conduction has been successfully applied to the conventional heat transfer problems. The classical Fourier law (1807) of heat conduction assumes that the heat flux vector and the temperature gradient both appears at the same time instant and consequently implies that thermal signals propagate with an infinite speed. With the development of science and technology such as the application of ultrafast pulse-laser heating on metal films, heat conduction appears in the range of high heat flux and high unsteadiness. The drawback of infinite speed in Fourier law becomes unacceptable. In order to overcome such issues related to classical Fourier law, serious efforts are being made during last few decades and leads to the formulation of non classical theories, in which the classical Fourier law and the parabolic heat conduction equation are replaced by more general equations to frame the new constitutive relations. This is an attempt to demonstrate role of fractional calculus to qualitative analysis of such modified non classical theory. Some interesting results on the recent development will be discussed.

5.30 – 6.15 pm	<p>Session Chair: Prof. Sudha Agrawal</p>
	<p>Speaker:- Prof. Anoop T. V.</p> <p>On isoperimetric inequalities of Laplacian eigenvalues</p> <p>Abstract: We discuss some isoperimetric inequalities of the Laplacian eigenvalues under various boundary conditions.</p>
6.30 – 7.30 pm	<p>Session Chair: Dr. Saikat Mazumdar</p>
	<p>Prof. Jerome Vetois</p> <p>Blowing-up solutions for second-order critical elliptic equations on manifolds</p> <p>Abstract: We consider a class of elliptic Schrödinger-type equations with critical Sobolev exponent on a closed Riemannian manifold. A result obtained by Olivier Druet provides necessary conditions for the existence of families of positive solutions which are bounded in H^1, but unbounded in C^0. Essentially, these conditions say that for such solutions to exist, it is necessary that the Schrödinger operator coincides with the conformal Laplacian at some point in the manifold. In this talk, I will present existence results showing the optimality of Druet's conditions. I will also discuss a concept of mass for the Green's function of the operator which plays a role for this problem in the low-dimensional case. This is a joint work with Frédéric Robert (Université de Lorraine).</p>

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