Twenty-eighth Annual Conference of
The Ramanujan Mathematical Society

Supported by the National Board for Higher Mathematics

Reva Institute of Technology and Management, Bangalore

27-30 June 2013

Programme Schedule and Abstracts

Endowment Lectures

Plenary Lectures

Public Lecture

Symposia Lectures

Contributed Talks

Documentary

General Body Meeting

Schedule for Plenary Lectures, Symposia and Contributed talks

Venue for GBM, Plenary and Public Lectures and Documentary : Reva Auditorium

Time	Thursday	Friday	Saturday	Sunday
	Chairperson Gadadhar Misra	**Chairperson** C. S. Rajan	**Chairperson** W. van der Kallen	**Chairperson** Rajeeva Karandikar
9.00 9.50	Registration Inauguration	Shiva Shankar	S. G. Dani	Siva Athreya
10.00 10.50	Ravi S. Kulkarni	Kaushal Verma	Ajit Iqbal Singh	Adimurthi
11.00	Tea	Tea	Tea	Tea
11.30 12.10	CA D. Chakrabarti DG H. Seshadri PD H. Kumar	CA S. Sridharan DG A. Naolekar PD Bhupen Deka AG Sarang Sane	AG Vaibhav Vaish PT S. Ramasubramanian DS S. Bhattacharya	AG Ronnie Sebsatian PT A. Bandyopadhyay DS Riddhi Shah
12.20 1.00	CA K. Biswas DG Rukmini Dey PD S. Janakiraman	CA Indrajit Lahiri PT A. Chatterjee PD S. Raha AG Umesh Dubey	AG D. S. Nagaraj PT Mrinal Ghosh DS C. R. E. Raja	AG K. Sutar-Deshpande PT R. Karandikar DS Tarun Das
1.00	Lunch	Lunch	Lunch	Lunch
2.00 2.40	CA S. Chavan DG S. Sarkar PD S. Rajasekar	CA A. Parameswaran DG Hemangi Shah PD S. Baskar PT Parthanil Roy	AG Chanchal Kumar PT A. Chakrabarty DS Anish Ghosh	
2.45 3.45	Contributed talks	Contributed talks	Contributed talks	
3.45	Tea	Tea	Tea	
	Chairperson Kapil Paranjape	**Chairperson** S. G. Dani	**Chairperson** Ajit Iqbal Singh	
4.10 5.00	M. Ram Murty	Bimal Roy	Kapil Paranjape	
5.10 6.00	C. S. Rajan	W. van der Kallen	Mahendra G. Nadkarni	
6.00	Tea & Snacks	Tea & Snacks	Tea & Snacks	
6.30	Documentary	General Body Meeting	Public Lecture	
7.30	Dinner	Dinner	Dinner	

Presidential Address

Symmetry View-Point and Linear Algebra

Ravi S. Kulkarni, Bhaskaracharya Institute of Mathematics, Pune

Endowment Lectures

Endowment	Speaker	Title
W. H. Abdi Memorial Lecture	W. van der Kallen	Cohomological Finite Generation
M. N. Gopalan Endowment Lecture	Siva Athreya	Brownian Motion and Random Walks on R-Tree
C. S. Venkataraman Memorial Lecture	C. S. Rajan	Geometry and Arithmetic

Plenary Lectures

Speaker	Affiliation	Title
Adimurthi	TIFR-CAM, Bangalore	Profile of Entropy Solutions of Conservation Laws
S. G.Dani	IIT Bombay	Roots, Factors and Embeddings of Measures on Groups
M. Ram Murty	Queen's University	The Twin Prime Problem (aprés Yitang Zhang)
M. G. Nadkarni	Mumbai University	Generalized Riesz Products
Kapil Paranjape	IISER, Mohali	The Category of Finite Sets and Algebraic Geometry
Bimal Roy	ISI, Kolkata	Statistics, Combinatorics and Cryptology-The Interplay
Shiva Shankar	CMI, Chennai	The Fundamental Principle-from L. Euler to V. Palamadov
Ajit Iqbal Singh	ISI, Delhi	QIT
Kaushal Verma	IISc, Bangalore	Quadrature Domains - A Survey

Public Lecture

Is there a Science Behind the Opinion Polls

Rajeeva Karandikar, Chennai Mathematical Institute, Chennai

Symposia and Their Organizers

Subject	Code	Days	Orgnizer	Affiliation
Algebraic Geometry	AG	Fri, Sat, Sun	Kapil Paranjape	IISER, Mohali
Complex Analysis	CA	Thu, Fri	Kaushal Verma	IISc, Bangalore
Differential Geometry	DG	Thu, Fri	P. Sankaran	IMSc, Chennai
Dynamical Systems	DS	Sat, Sun	S. G. Dani	IIT Bombay
Numerics for PDE	PD	Thu, Fri	A.S. Vasudeva Murthy	TIFR-CAM, Bangalore
Probability Theory	PT	Fri, Sat, Sun	R. Karandikar	CMI, Chennai

Symposium on Complex Analysis

Venue: Seminar Hall 1

Chairperson: Kaushal Verma

Thu	11.30	Debraj Chakrabarti	TIFR-CAM	L^2-Cohomology of Domains
Thu	12.20	Kingsook Biswas	RKMV University	Uniformization Theorems and Algebraic Theory of Finite Type Log-Riemann Surfaces
Thu	2.00	Sameer Chavan	IIT Kanpur	Spherical Tuples of Hilbert Space Operators

Chairperson: Debraj Chakrabarti

Fri	11.30	Shrihari Sridharan	CMI, Chennai	The Hausdorff Dimension of the Survivor Set in Open Nonlinear Complex Dynamics
Fri	12.20	Indrajit Lahiri	Univ. of Kalyani	Conjectures and Questions in Value Distribution Theory
Fri	2.00	AJ Parameswaran	TIFR, Mumbai	On the Geometry of Regular Maps from a Pure Quasi-projective Surface to an Affine Curve

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Symposium on Algebraic Geometry

Chairperson: Kapil Paranjape : Venue: Reva Auditorium

Fri	11.30	Sarang Sane	Univ. of Kansas	Gersten-Witt Conjecture
Fri	12.20	Umesh Dubey	TIFR, Mumbai	Spectrum of Tensor Triangulated Categories

Chairperson: A. J. Parameswaran: Venue : Seminar Hall 1

Sat	11.30	Vaibhav Vaish	IISER, Pune	Weightless Cohomology and Invariants of Singularities
Sat	12.20	D. S. Nagaraj	IMSc, Chennai	Hartshorne Conjecture and Cohomology Groups of Line Bundles
Sat	2.00	Chanchal Kumar	IISER, Mohali	Elementary Transformation of Vector Bundles of Rank 2 on Hyperelliptic Curves

Chairperson: D. S. Nagaraj : Venue : Seminar Hall 1

Sun	11.30	Ronnie Sebastian	IISER, Pune	Smash Nilpotent Cycles on Varieties Dominated by Products of Curves
Sun	12.20	Kavita Sutar-Deshpande	CMI, Chennai	Geometry of Orbit Closures of Quiver Representations

Symposium on Differential Geometry

Venue: Seminar Hall 2

Chairperson: D. S. Nagaraj

Thu	11.30	Harish Seshadri	IISc, Bangalore	Gromov Hyperbolicity of the Kobayashi Metric
Thu	12.20	Rukmini Dey	HRI, Allahabad	Some Aspects of Minimal Surfaces
Thu	2.00	Siddhartha Sarkar	IISER, Bhopal	On Symmetries of Finite Groups of Gorenstein-Kulkarni Type

Chairperson: C. S. Rajan

Fri	11.30	A. C. Naolekar	ISI,Bangalore	On Trivialities of Chern Classes
Fri	2.00	Hemangi Shah	HRI, Allahabad	Rank of Harmonic Manifolds

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Symposium on Dynamical Systems

Venue : Seminar Hall 3

Chairperson: S. G. Dani

Sat	11.30	S. Bhattacharya	TIFR, Mumbai	Directional Invariants of Multi-parameter Actions
Sat	12.20	C. R. E. Raja	ISI, Bangalore	Spectral Gap, Equidistribution and Strong Relative Property (T)
Sat	2.00	Anish Ghosh	U. East Anglia	Measure Rigidity for Actions of Adelic Tori

Chairperson: M. G. Nadkarni

Sun	11.30	Riddhi Shah	JNU, Delhi	Affine Almost Automorphic Actions on Compact Nilmanifolds
Sun	12.20	Tarun Das	MSU, Baroda	Hyperbolicity of C^1-stably Expansive Homoclinic Classes

Symposium on Numerics for PDE

Venue: Seminar Hall 3

Chairperson: A. S. Vasudeva Murthy

Thu	11.30	Harish Kumar	IIT Delhi	Robust Finite Volume Schemes for Two-Fluid Plasma Equations
Thu	12.20	S. Janakiraman	CDAC, Bangalore	Numerical Solution of PDEs on Sphere
Thu	2.00	S. Rajasekar	Bharathidasan Univ.	Finite-difference Schemes for Numerical Solutions of Korteweg-de Vries and Sine-Gordon Equations

Chairperson: S. Janakiraman

Fri	11.30	Bhupen Deka	Tezpur Univerisity	Finite Element Methods for Parabolic Problems with Discontinuous Coefficients
Fri	12.20	Soumyendu Raha	IISc, Bangalore	DAEs: Theory, Applications and Numerics
Fri	2.00	S. Baskar	IIT Bombay	A Stable Higher Order Numerical Method for a Static Hamilton-Jacobi Equation

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Symposium on Probability Theory

Venue: Seminar Hall 2
Venue for Parthanil Roy's Lecture: Reva Auditorium

Chairperson: Mrinal Ghosh

Fri	12.20	Arindam Chatterjee	ISI, Delhi	Inference Using the Residuals in a Sparse Linear Regression Model
Fri	2.00	Parthanil Roy	ISI, Kolkata	Maximal Moments and Uniform Modulus of Continuity for Stable Random Fields

Chairperson: Rajeeva Karandikar

Sat	11.30	S. Ramasubramanian	ISI, Bangalore	On Multidimensional Ruin
Sat	12.20	Mrinal Ghosh	IISc, Bangalore	Risk Sensitive Stochastic Differential Games
Sat	2.00	Arijit Chakrabarty	ISI, Delhi	Limiting Spectral Distribution for Wigner Matrices with Dependent Entries

Chairperson: Siva Athreya

Sun	11.30	Antar Bandyopadhyay	ISI, Delhi	On the Nearest Neighbour Algorithm for the Mean Field Traveling Salesman Problem
Sun	12.20	Rajeeva Karandikar	CMI, Chennai	On Quadratic Variation of Martingale

Contributed Talks : Complex Analysis

Venue: Seminar Hall 3

Chairperson: Kaushal Verma

Thu	2.45	Sushil Gorai	ISI, Bangalore	Polynomial Convexity of the Union of Three Maximal Totally-Real Subspaces in $\mathbb{C}^n$, $n \geq 2$.
Thu	3.05	G. P. Balakumar	IMSc, Chennai	Bounds for Invariant Distances on Levi Corank One Domains and Applications
Thu	3.25	Abhijit Banerjee	Univ. of Kalyani	Fujimoto's Theorem-A Further Study

Contributed Talks : Differential Geom. & Dynamical Systems

Venue: Seminar Hall 1

Chairperson: Rukmini Dey

Thu	2.45	Atreyee Bhattacharya	IISc, Bangalore	A Gap Theorem for Ricci-Flat 4-Manifolds
Thu	3.05	Mubeena T.	IMSc, Chennai	Twisted Conjugacy Classes in Lattices in Semisimple Lie Groups
Thu	3.25	K. Ramesh	IIT Bombay	Farrell–Jones Sphere

Chairperson: A. C. Naolekar

Fri	2.45	D. Divarakaran	IISc, Bangalore	Distance Measure Spaces
Fri	3.05	Priyavrat Deshpande	CMI, Chennai	Cohomology Algebra of the Complement of a Toric Arrangement
Fri	3.25	Sharan Gopal	U. of Hyderabad	Sets of Periods and Periodic Points of Linear Operators

Chairperson: S. G. Dani

Sat	2.45	Puneet Sharma	IIT Jodhpur	Sensitivity of the Induced Map on Hyperspaces
Sat	3.05	Nikita Agarwal	IISER, Bhopal	Product Dynamics
Sat	3.25	Ali Akbar Kamal	Govt. College, Chittur	Periods of Endomorphisms

Contributed Talks : Partial Differential Equations

Venue: Seminar Hall 2

Chairperson: A. S. Vasudeva Murthy

Thu	2.45	Mrinmay Biswas	TIFR-CAM, Bangalore	On a Resonant Elliptic Problem with Exponential Non-Linearity
Thu	3.00	A. J. Das Gupta	TIFR-CAM, Bangalore	A Linear Model for the Sea Breeze Circulation Relevant for the Tropical Regions
Thu	3.15	D. Ganguly	TIFR-CAM, Bangalore	Sign Changing Solutions of the Brezis-Nirenberg Problem in the Hyperbolic space
Thu	3.30	Souvik Roy	TIFR-CAM, Bangalore	Optimal Control Approach for Estimation of Incompressible Fluid Flows using FEMs

Chairperson: Debraj Chakrabarti

Fri	2.45	M. R. Sahoo	TIFR-CAM, Bangalore	Vanishing Viscosity Approach to a System of Conservation Laws Admitting δ" Waves
Fri	3.00	S. Chowdhury	TIFR-CAM, Bangalore	Control of Linearized Compressible Navier-Stokes Equations
Fri	3.15	R. Dhanya	IISc, Bangalore	A Bifurcation Result for a Critical Exponent Problem in R^2 with a Singular Nonlinearity at the Origin
Fri	3.30	Sudarshan Kumar	TIFR-CAM, Bangalore	Multicomponent Polymer Flooding in Two Dimensional Oil Reservoir Simulation

Chairperson: Veerappa Gowda

Sat	2.45	A. P. Choudhury	TIFR-CAM, Bangalore	On a Non-Conservative System Exhibiting Parabolic Degeneracy
Sat	3.00	Tanmay Sarkar	IIT Madras	Modelling of Supply Chain Network Through PDE's
Sat	3.15	Satyanarayana Engu	NIT, Surathkal	Convergence of N-wave solutions to Heat Equation
Sat	3.30	Parul Varshney	MN NIT, Allahabad	Mathematical Modeling of Quintic Duffing Equation and Numerical Simulation Using Multiple Scales Modified Lindstedt Poincare Method

Contributed Talks : Algebra and Number Theory

Venue: Seminar Hall 3

Chairperson: J. K. Verma

Fri	2.45	Kshipra Wadikar	AISSMS, Pune	A Criterion for Matrices to be a Sum of k^{th} Powers
Fri	3.05	Rahul Kitture	BIM, Pune	Splitting Field for Representations of Groups
Fri	3.25	Vikas Jadhav	Wadia College	MDS Code Over Finite Fields Using Jacobi Sums

Chairperson: Chanchal Kumar

Sat	2.45	S. Maheshwary	PU Chandigarh	The Rational Group Algebra of a Normally Monomial Group
Sat	3.05	K. Shivashankara	Univ. Mysore	Ramanujan's Summation Formula and Related Identities
Sat	3.25	S. Bhargava	Univ. Mysore	A Recurrence Relation Related to a Certain Symmetric Product And Successors Identity Attributed to S. Ramanujan

Abstracts

Presidential Address, Endowment Lectures And Public Lecture

Presidential Address

Symmetry View-point and Linear Algebra

Ravi S. Kulkarni, Bhaskaracharya Institute of Mathematics, Pune

email: punekulk@gmail.com

After the cogent advocacy by H. Weyl, "Symmetry" is being recognised as a category of mathematical thought, the other two being "Space" and "Number". "Symmetry" is a subtle category. It goes much deeper than the vague idea of symmetry that we feel about physical forms. As mathematicians, we need to sensitize ourselves consciously to it.

In Mathematics, it is formulated in terms of "groups" and their "actions". These set-theoretic notions of "group-actions" are not just definitions. They are an expression of a much deeper thought. Its depth is derived from the remarkable classification theorems of simple Lie groups, and simple finite groups, which are two of the very high points of the 20th century Mathematics.

In this talk, I shall illustrate this thought in the all-too-familiar subject of linear algebra. This talk has implications for the ways we think about Mathematics, and how we should incorporate this thought consciously in our undergraduate and graduate teaching, and general communication of Mathematics.

W. H. Abdi Memorial Lecture

Cohomological Finite Generation

Wilberd van der Kallen, Universiteit Utrecht, The Netherlands
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View SL_2 as an algebraic group over a field k or more generally as an algebraic group scheme over a commutative noetherian ring k. Assume SL_2 acts algebraically on a finitely generated k-algebra A. Then the cohomological finite generation property (CFG) holds: The cohomology algebra $H^*(SL_2, A)$ is a finitely generated k-algebra. This result fits into a long story, going from the First Fundamental Theorem of invariant theory to strict polynomial bifunctors and good Grosshans filtrations. We will sample this story.

M. N. Gopalan Endowment Lecture

Brownian motion and Random walks on R-tree

Siva Athreya, Indian Statistical Institute, Bangalore
email: athreya@isibang.ac.in

The real trees form a class of metric spaces that extends the class of trees with edge lengths by allowing behavior such as infinite total edge length and vertices with infinite branching degree. We will discuss scaling limit of random walks along with the construction and properties of Brownian motion on locally compact R-trees.

C. S. Venkataraman Memorial Lecture

On Geometry and Arithmetic

C. S. Rajan, Tata Institute of Fundamental Research, Mumbai
email: rajan@math.tifr.res.in

In the first half of the talk I will present some speculations and evidence about the relationship between geometry of the complex points and the arithmetic of a variety defined over a number field. In the second part, I will talk about commensurability type results for representation equivalent arithmetic lattices.

Public Lecture

Is there a Science Behind the Opinion Polls

Rajeeva Karanadikar, Chennai Mathematical Institute, Chennai
email: rlk@cmi.ac.in

Is there a science behind opinion polls? How can obtaining opinion of, say, 60,000 voters be sufficient to predict the outcome in a country with over 60 crore voters? The speaker will address such questions and show that simple mathematics and statistics, lots of common sense and a good understanding of the ground reality or domain knowledge together can yield very good forecast or predictions of the outcome of elections based on opinion polls and exit polls. He will share his own experiences with opinion polls and exit polls over the last 12 years.

Abstracts of Plenary Lectures

Profile of Entropy Solutions of Conservation Laws

Adimurthi, Tata Institute of Fundamental Research, Bangalore
email: adiadimurthi@gmail.com

I consider one space dimension conservation law with convex flux. I will discuss the profile of an entropy solution and determine the number of shocks it can have for all time.

Roots, Factors and Embeddings of Measures on Groups

Shrikrishna Dani, Indian Institute of Technology Bombay, Mumbai
email: sdani@math.iitb.ac.in

Let G be a locally compact group. A probability measure on G is said to be infinitely divisible if it admits convolution roots of all orders and it is said to be embeddable if there exists a one-parameter continuous convolution semigroup containing it. While embeddability implies infinite divisibility, under what conditions the converse is true has been a much studied question, known as the embedding problem. It has been conjectured in particular that the answer is in the affirmative for all connected Lie groups.
In this talk we discuss the results on the problem, focussing on the various properties of convolution roots, and factors, involved in the results on the embedding problem.

The Twin Prime Problem (aprés Yitang Zhang)

M. Ram Murty, Queen's University, Kingston, Canada
email: murty@mast.queensu.ca

Recently, Yitang Zhang made a breakthrough in the long standing twin-prime problem by showing that there are infinitely many pairs of distinct primes (p, q) with $|p - q| < 70$ million. We will outline the basic ideas of his proof.

Generalized Riesz Products

Mahendra G. Nadkarni, University of Mumbai (retd.)
email: mgnadkarni@gmail.com

In this talk I will discuss generalized Riesz products bringing into consideration H^p theory, the notion of Mahler measure, and the zeros of polynomials appearing in the generalized Riesz product. Formula for Radon-Nikodym derivative between two generalised Riesz products is established under suitable conditions. This is then used to formulate a Dichotomy theorem and prove a conditional version of it. A discussion involving flat polynomials is given.

The Category of Finite Sets and Algebraic Geometry

Kapil Paranjape, Indian Institute of Science Education and Research, Mohali
email: kapil@iisermohali.ac.in

We shall introduce the Topos of Finite Sets and its basic properties. Then we shall see how algebraic varieties can be defined within this topos. The proofs of correct-ness of these constructions will need objects from outside the topos.

Statistics, Combinatorics and Cryptology-The interplay

Bimal Roy, Indian Statistical Institute, Kolkata
email: bimal@isical.ac.in

Cryptology is the science of hiding information. Due to recent advances in Information Technology and Communication Networks, secrecy, privacy, authenticity, non repudiation etc. have become important issues. The solutions are provided by Cryptology. The basic tools used by the Cryptologists are: Statistics, Combinatorics, Algorithms, Complexity etc. In this talk the role of Statistics and Combinatorics in designing and analyzing cryptographic systems will be discussed. Also a few real life applications will be presented.
The first part of my talk will be expository in nature and the second part will include some of our original results.

The Fundamental Principle: From L. Euler to V. Palamodov

Shiva Shankar, Chennai Mathematical Institute, Chennai
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Given a constant coefficient ordinary differential operator $p(\frac{d}{dt})$, and a space of distributions, say $\mathcal{C}^\infty(\mathbb{R})$, one can consider the corresponding map

$$p\left(\frac{d}{dt}\right) : \mathcal{C}^\infty \to \mathcal{C}^\infty,\ f \mapsto p\left(\frac{d}{dt}\right) f.$$

The first questions are: what is the kernel of this map; and what is its image? This was answered by Euler about 250 years ago.
More generally, if $P(\partial)$ is an $\ell \times k$ matrix whose entries are from the ring of constant coefficient partial differential operators $\mathbb{C}[\partial_1, \ldots, \partial_n]$, we can then consider the corresponding map

$$P(\partial) : (\mathcal{C}^\infty(\mathbb{R}^n))^k \to (\mathcal{C}^\infty(\mathbb{R}^n))^\ell.$$

The first questions again are: what is the kernel of this map; and what is its image? This problem was finally solved in the 1960s/1970s by Palamodov, building on earlier work of Ehrenpreis, Hörmander, Malgrange and others.

In this talk I will explain this circle of ideas, and how recently they have again assumed importance in the theory of control of under-determined systems.

QIT

Ajit Iqbal Singh, Indian Statistical Institute, New Delhi
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Entangled states constitute a powerful resource for quantum computation and quantum communication. Construction of an orthonormal basis of maximally entangled unit vectors in $C^d \otimes C^d$ is equivalent to that of constructing a basis $\left\{U_j : 1 \leq j \leq d^2\right\}$ of unitary matrices with trace $(U_j^* U_k) = d\delta_{jk}, 1 \leq j, k \leq d$.
Basic ones are Pauli matrices for $d = 2$, and generalised Pauli matrices, called Bell states, in terms of permutation and Fourier matrices for $d \geq 3$. Prevalent methods are (i) a combinatorial construction called Shift-and-Multiply using latin squares (equivalently, quasigroups) and Hadamard matrices well-studied by R. F. Werner in 2000 and others; and (ii) an algebraic method mainly by E. Knill in 1996 via projective unitary representation of finite groups (thoroughly studied by I. Schur in 1930s). Both include Weyl operators but are distinct as shown by A. Klappenecker and M. Roetteler in 2005.
Study is well pursued by others as well including K.R. Parthasarathy. It utilises and also adds to the theory of Clifford groups, Heisenberg groups, groups of central type etc., all finite. It is like a Quadrupole Ion Trap, so as to say, for Quantum Information Theory by a Quality Improvement Team!
The team work started in 1930s with the trio EPR of A. Einstein, B. Podolsky and N. Rosen and has got into its fold many reputed quantum physicists, computer scientists and mathematicians over the years. The talk aims at displaying *Quintessence* of this *Innovative Trend*.

Quadrature Domains - A Survey

Kaushal Verma, Indian Institute of Science, Bangalore
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A domain $D \subset \mathbb{C}$ is said to admit a quadrature identity (relative to some prescribed test class of functions on D, say for example the class of all integrable holomorphic functions on D) if there exist points $z_1, z_2, \ldots, z_m \in D$ and complex numbers $a_{j,k}$ where $1 \leq j \leq m,\ 0 \leq k \leq r_j - 1$ and $r_j \geq 1,\ a_{j,r_j-1} \neq 0$ such that

$$\int_D f = \sum_{j=1}^{m} \sum_{k=0}^{r_j-1} a_{j,k} f^{(k)}(z_j)$$

for every f in the test class. In short, such domains are called quadrature domains. The simplest example is the disc with the quadrature identity being the mean value property for analytic functions. Such domains have remarkable properties. This will be a survey talk about what is known and what is not known.

Abstracts of Symposia Lectures

Symposium on Algebraic Geometry

Elementary Transformation of Vector Bundles of Rank 2 on Hyperelliptic Curves

Chanchal Kumar, Indian Institute of Science Education and Research, Mohali
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For $g \geq 2$, a general point ω on the GIT quotient $\mathbb{P}^{2g+2}//SL(2,\mathbb{C})$ with polarization $(1,1,\ldots,1)$ represents a hyperelliptic curve $C = C_\omega$ of genus g. Using an elementary transformation of rank 2 vector bundles on the curve C we construct a birational map between the GIT quotient $\mathbb{P}^{2g+2}//SL(2,\mathbb{C})$ and a moduli space $\mathbb{S}_0^i$ of rank 2 vector bundle pairs on the curve C.

Spectrum of tensor triangulated categories

Umesh V. Dubey, Tata Institute of Fundamental Research, Mumbai
email: umesh@math.tifr.res.in

Triangulated categories appear in many branches of Mathematics. P. Balmer introduced the notion of spectrum of tensor triangulated categories to extract geometric information from the categorical data. One of problems in this direction is to compute spectrum for various examples. In this talk we present some examples coming from algebraic geometry. We will briefly give construction of the spectrum and some of its properties. We will also indicate the Balmer's method of reconstruction of certain schemes using spectrum. If time permits, we will indicate proofs of the results obtained with Vivek M. Mallick.

Hartshorne Conjecture and Cohomology Groups of Line Bundles

D. S. Nagaraj, Institute of Mathematical Sciences, Chennai
email: dsn@imsc.res.in

In this talk we discuss about an old conjecture of Hartshorne on small co-dimension smooth sub-varieties of projective space.

Gersten-Witt Conjecture

Sarang Sane, University of Kansas
ssane@math.ku.edu

We discuss derived Witt groups and the Gersten-Witt conjecture for a regular local ring. A key ingredient in this link is devissage. We hope to mention a generalized form of devissage for Witt groups over Cohen-Macaulay rings.

Smash Nilpotent Cycles on Varieties Dominated by Products of Curves

Ronnie Sebastian, Indian Institute of Science Education and Research, Pune.
email: ronnie.sebastian@gmail.com

The standard conjectures predict that numerical and homological equivalence on algebraic cycles on smooth projective varieties coincide. Voevodsky introduced the notion of smash equivalence and conjectured that it coincides with numerical equivalence. Homological equivalence lies between numerical and smash equivalence and Voevodsky's conjecture would imply that all three of these coincide. In this talk we show that this is true for one dimensional cycles on varieties dominated by products of curves.

Geometry of Orbit Closures of Quiver Representations

Kavita Sutar-Deshpande, Chennai Mathematical Institute, Chennai
email: ksutar@cmi.ac.in

Orbit closures of quiver representations are objects that occur in the study of representations of finite-dimensional algebras. These orbit closures can be viewed as a generalization of determinantal varieties. In my talk I will briefly describe the so-called Kempf-Lascoux-Weyman approach towards understanding the geometry of these orbit closures.

Weightless Cohomology and Invariants of Singularities

Vaibhav Vaish, Institute of Mathematical Sciences, Chennai
email: vaibhav.vaish@gmail.com

Given a singular algebraic variety over complex numbers one can construct a resolution of singularities, which however is not unique. Nevertheless, due to works of Stepanov, Payne, Arapura amongst others, the "combinatorial part" of (the cohomology of) each fiber is an invariant of the singularity itself, and in particular independent of the chosen resolution. Due to Thuillier this invariant can be defined even when base field is of finite characteristic, where there is no resolution of singularities yet. In this talk we explain how these circle of ideas motivate the construction of weightless cohomology, a new motivic cohomology theory of algebraic varieties satisfying several interesting properties.

Symposium on Complex Analysis

Uniformization Theorems and Algebraic Theory of Finite Type Log-Riemann Surfaces

Kingshook Biswas, Ramakrishna Mission Vivekananda University, Belur
email: kingbiswas@gmail.com

We define the notion of $log\text{-}Riemann\ surfaces$. These are Riemann surfaces with flat structures, given by pasting copies of $\mathbb{C}$ together, and have a discrete set of ramification points which may be of finite or infinite orders. We consider $finite\ type$ log-Riemann surfaces, which are log-Riemann surfaces with a finite number of ramification points and finitely generated fundamental group. These arise naturally as limits (in a suitable topology) of finite sheeted branched covers of $\mathbb{C}$ with degrees going to infinity, and with a uniformly bounded number of branch points. We show that a log-Riemann surface of finite type is biholomorphic to a punctured Riemann surface of finite type, and the flat structure is induced by a holomorphic 1-form ω with essential singularities at the punctures of exponential type: locally $\omega = e^h\alpha$, where h is a meromorphic function and α is a meromorphic 1-form.
We initiate a study of the algebraic theory of these surfaces in the simplest case, namely genus zero with one puncture, which correspond to simply connected finite type log-Riemann surfaces. We study a ring of holomorphic functions on the surface which have finite limits at the infinite order ramification points. This ring is a transcendence degree d extension of the function field $\mathbb{C}(z)$ in one variable and separates all points of the surface including the infinite order ramification points. We also prove an analogue of Torelli's theorem in this setting.

L^2-Cohomology of Domains

Debraj Chakrabarti, TIFR-CAM, Bangalore
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Just as the Dolbeault cohomology measures the obstruction to the construction of analytic objects on complex manifolds, the L^2-Dolbeault cohomology measures the obstruction in the construction of L^2-analytic objects. We review the definition and some classical results regarding the L^2-cohomology of domains in complex manifolds. We also discuss some recent results regarding the topological properties of L^2-cohomology groups. This is joint work with Mei-Chi Shaw.

Spherical Tuples of Hilbert Space Operators

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We discuss a class of operator tuples, to be referred to as, spherical tuples in complex Hilbert spaces. We present some characterizations of spherical multi-shifts and spherical multiplication tuples on RKHS. These characterizations can be used to describe various spectral parts including the Taylor spectrum. We also obtain a necessary and sufficient condition for Schatten p-class membership of cross-commutators of spherical m-shifts for $p > m$.
Specializing our results to some well-studied classes of multi-shifts, we show, in particular, that spherical jointly hyponormal and p-isometry m-shifts are always essentially normal. We further present an example of a spherical jointly hyponormal 2-shift for which none of the cross-commutators belongs to the Schatten p-class for any $p \geq 1$. On the other hand, the cross-commutators of a spherical joint q-isometry m-shift always belong to the Schatten p-class for any $p > m$. This is a joint work with Dmitry Yakubovich.

Conjectures and Questions in Value Distribution Theory

Indrajit Lahiri, University of Kalyani
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Everybody admits that conjectures and questions always give impetus to research in Mathematics. The value distribution theory is in no way an exception. In the talk we discuss some well known conjectures and questions in the value distribution theory and the research influenced by them.

On the Geometry of Regular Maps From a Pure Quasi-Projective Surface to an Affine Curve

A. J. Parameswaran, Tata Institute of Fundamental Research, Mumbai
email: ajparam@gmail.com

We explore here some consequences of the triviality of the monodromy group, using the condition of purity of the mixed Hodge structure on the cohomology of the surface X.

The Hausdorff Dimension of the Survivor Set in Open Nonlinear Complex Dynamics

Shrihari Sridharan, Chennai Mathematical Institute, Chennai
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Creating holes of positive measure in the Julia set, we kill the orbits of the corresponding hyperbolic rational map of degree at least two that falls into these holes. We shall focus, in this study on the Hausdorff dimension of the survivor set, i.e. the set that never dies. For an easier and better understanding, the simple quadratic polynomial restricted on the unit circle shall be considered.

Symposium on Differential Geometry

Some Aspects of Minimal Surfaces

Rukmini Dey, Harish Chandra Research Institute, Allahabad
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I will explain the Weierstrass-Enneper representation of a minimal surface using hodographic coordinates. I will mention the link between minimal surfaces and Born-Infeld solitons. If time permits, I will explain my on-going work (with my students) on the interpolation between two real-analytic curves by piecewise minimal surfaces.

On Trivialities of Chern Classes

A. C. Naolekar, Indian Statistical Institute, Bangalore
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A finite CW-complex is said to be C-trivial if for any (complex) vector bundle ξ over X, the total Chern class $c(\xi) = 1$. A related notion is that of W-triviality. A finite CW-complex is W-trivial if for any (real) vector bundle η over X, the total Stiefel-Whitney class $w(\eta) = 1$. A theorem of Atiyah-Hirzebruch says that for any finite CW-complex X, the 9-fold suspension $\Sigma^9 X$ is W-trivial. We show that the even dimensional spheres are not C-trivial. Thus there is no analogue of the Atiyah-Hirzebruch theorem for Chern classes. We give several examples of spaces that are C-trivial. This is joint work with Ajay Singh Thakur.

On Symmetries of Finite Groups of Gorenstein-Kulkarni Type

Siddhartha Sarkar, Indian Institute of Science Education and Research, Bhopal
email: siddhartha18@gmail.com

A genus spectrum of a finite group G is a collection of non-negative integers n such that G acts faithfully on a closed, compact, orientable surface of genus n preserving the orientation. It is a general problem to connect finite groups through their algebraic properties which share the same genus spectrum. Finite p-groups of GK-type has a strong influence on determination of the genus spectrum. This is the primal motivation towards the classification of such groups. I will try to outline the results proved so far towards the classification. Secondly I will show a recent result which shows that there are an infinite sequence of p-groups of GK-type whose sizes attains all large p powers and which share the same genus spectrum.

Gromov Hyperbolicity of the Kobayashi Metric

Harish Seshadri, Indian Institute of Science, Bangalore
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It is known that the Kobayashi metric of a strictly convex bounded domain in $\mathbb{C}^n$ is Gromov hyperbolic. In this talk we show that there are some weakly convex domains which are hyperbolic and others which are not.

Rank of Harmonic Manifolds

Hemangi Shah, Harish Chandra Research Institute, Allahabad
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In this talk we show that rank of any non-flat, simply connected non-compact harmonic manifold is one. Consequently, from a result of Knieper it follows that any non-compact harmonic manifold is Gromov hyperbolic.

Symposium on Dynamical Systems

Directional Invariants of Multi-Parameter Actions

Siddhartha Bhattacharya, Tata Institute of Fundamental Research, Mumbai
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Let α be a continuous or measure preserving action of the group $\mathbb{R}^d$. One can often find non-trivial invariants of such actions by restricting the action to suitable half-spaces. In this talk we will discuss some of these invariants, focusing mainly on directional expansiveness and directional entropy.

Hyperbolicity of C^1-Stably Expansive Homoclinic Classes

Tarun Das, M. S. University, Vadodara
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Recently many papers investigated the dynamics of diffeomorphisms with C^1-robust, C^1-stably and C^1-persistent expansivity on the homoclinic classes and characterized the sets under such C^1-open conditions, respectively. We shall discuss the notion of C^1- stably continuum-wise expansivity for a closed f-invariant subset of a C^∞ closed manifold M and shall aim to establish that the homoclinic class $H(p, f)$ of f associated to a hyperbolic periodic point p is C^1-stably continuum-wise expansive if and only if $H(p, f)$ is hyperbolic.

Measure Rigidity for Actions of Adelic Tori

Anish Ghosh, University of East Anglia, Norwich, UK
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I will discuss measure rigidity for actions of tori on homogeneous spaces of algebraic groups. The first half of the talk will be an overview of the subject and its applications, intended for a broad audience. In the second half, I will discuss some joint work with M. Björklund and M. Einsiedler in this direction.

Spectral Gap, Equidistribution and Strong Relative Property (T)

C. R. E. Raja, Indian Statistical Institute, Bangalore
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Consider a measure preserving group action of a group G on a measure space (X, m). We are interested in knowing when the orbits Gx of points in X are equidistributed, that is $f(gx) \to \int f(x)dm(x)$. We study the convolution power averages $\mu^n * \delta_x$ for a nondegenerating measure μ. The equidistribution of this sequence is obtained by showing that the corresponding average operator P_μ on $L^2(X)$ has spectral gap-spectral gap is obtained using strong relative property (T). We mainly consider certain subgroup actions on homogeneous spaces and algebraic actions on solenoids.

Affine Almost Automorphic Actions on Compact Nilmanifolds

Riddhi Shah, Jawaharlal Nehru University, Delhi
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We introduce distal and almost automorphic actions on compact spaces and locally compact groups. We also discuss conditions under which an affine automorphism of a compact nilmanifold is almost automorphic, and the structure of such automorphisms from a dynamical point of view.

Symposium on Numerics for PDE

A Stable Higher Order Numerical Method for a Static Hamilton-Jacobi Equation

S. Baskar, Indian Institute of Technology Bombay
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The fast marching method for approximating the viscosity solution of the eikonal equation governing a monotonically propagating front in a medium at rest is proven to be computationally efficient. The main assumption of this method is that the front propagates only in its normal direction, which is equivalent to the assumption that the medium of propagation is at rest. In many real time applications, the medium may be occupied with moving fluid (for instance, sonic boom propagation in atmosphere). In such cases, the governing equation is a generalized (anisotropic) eikonal equation. Both the eikonal equation and the generalized eikonal equation are particular cases of static Hamilton-Jacobi equations. The main assumption of the fast marching method does not hold in the case of the generalized eikonal equation, since the front ceases to propagate only in its normal direction and the tangential effect also has to be taken into account. This leads to instability in the fast marching method due to the violation of the upwind criteria.
In this talk, we discuss a fast marching method for the generalized eikonal equation, called the Characteristic Fast Marching Method, where the upwind criteria are achieved using the characteristic direction of the propagating wavefront at each grid point. We suitably modified the narrow band algorithm of the fast marching method so as to incorporate the anisotropic nature of the medium. We compare the results obtained from our scheme with the solution obtained using ray theory (geometrical optics theory) to show numerically the convergence of the scheme to the viscosity solution. Unlike other existing methods, our method is easy to be upgraded to any higher order approximation. We also discuss the second order version of the characteristic fast marching method. Finally, we compare the method with the first and the second order finite difference approximations to study the rate of convergence.

Finite Element Methods for Parabolic Problems with Discontinuous Coefficients

Bhupen Deka, Tezpur Univeristy
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Differential equations with discontinuous coefficients are often referred as interface problems. Due to low global regularity of the solutions, the error analysis of the standard finite element methods for parabolic problems is difficult to adopt for parabolic problems with discontinuous coefficients. In this work, we fill a theoretical gap between standard error analysis technique of finite element method for non interface problems and parabolic interface problems. Optimal $L^\infty(H^1)$ and $L^\infty(L^2)$ norms error estimates have been derived under practical regularity assumptions of the true solution for fitted finite element method with straight interface triangles. The achieved estimates are analogous to the case with a regular solution, however, due to low regularity, the proof requires a careful technical work coupled with a approximation result for the linear interpolant. Other technical tools used in

this work are Sobolev embedding inequality, approximation properties for elliptic projection, duality arguments and some known results on elliptic interface problems

A Variable Resolution Global Spectral Method Application to Numerical Solution of PDEs on the Sphere

S. Janakiraman, CDAC, Bangalore
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It is known that spherical harmonics based spectral discretisation provide an uniform resolution solution of PDEs on the sphere. A new variable resolution global spectral method is created that generates a finer resolution over the tropical regions of the sphere and coarse resolution at the polar regions, with smooth variation of resolution in between. This variable resolution method is constructed through a reparametrisation of the sphere induced by a conformal mapping between the sphere and a Riemann surface. Numerical solutionsof PDEs such as Helmholtz equation, linear advection equation and barotropic vorticity equations will be presented in this talk.

Robust Finite Volume Schemes for Two-Fluid Plasma Equations

Harish Kumar, Indian Institute of Technology Delhi
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Two-fluid plasma equations are derived by taking moments of Boltzmann equations. Ignoring collisions and viscous terms and assuming local thermodynamic equilibrium we get five moment equations for each species (electrons and ions), known as two-fluid plasma equations. These equations allows different temperatures and velocities for electrons and ions, unlike ideal magnetohydrodynamics (MHD) equations.
In this work, we present and analyze second order MUSCL schemes for two-fluid plasma equations based on Strang splitting of the flux and source terms. The source is treated both explicitly and implicitly. Both of these schemes are shown to preserve positivity of the pressure and density. In the case of explicit scheme for source term we get explicit condition on the time step for it to be positivity preserving. The implicit treatment of the source term is shown to preserve positivity unconditionally.
Furthermore, the resulting algebraic system of equation from implicit scheme is solved exactly. Benchmark numerical experiments are presented to illustrate the robustness and efficiency of the approach.

DAEs: Theory, Applications and Numerics

Soumyendu Raha, Indian Institute of Science, Bangalore
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We shall introduce science and engineering examples in which Differential Algebraic Equations (DAEs) occur. This is followed by brief discussion on existence and uniqueness of solutions. The index, a measure of difficulty of obtaining a unique solution to a DAE, is also introduced. [It may be mentioned that, for example, spatially discretized Navier-Stokes equation in any weak formulation is an index 2 and the difficulty of solving it is explained when we see that the pressure is the algebraic variable!] Numerical integration methods pertaining to DAEs will be

discussed with examples from multi-step and one step methods. Difficulties and work-arounds for high index DAEs will be pointed out. Finally we close with solving dynamic optimization problems that have DAEs as constraints.

Finite-Difference Schemes for Numerical Solutions of Korteweg-de Vries and Sine-Gordon Equations

S. Rajasekar, Bharathidasan University, Tiruchirapalli
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The nonlinear Korteweg-de Vries (KdV) and Sine-Gordon (sG) equations exhibit soliton solutions. We develop finite-difference schemes for numerically solving these two equations and obtain the stability condition on the step sizes on space and time variables. We show that the finite-difference formulas are able to capture interaction property of the two-solitary waves in the KdV equation. We describe the features of different types of solutions of sG equation through numerical solution.

Symposium on Probability Theory

On the Nearest Neighbor Algorithm for the Mean Field Traveling Salesman Problem

Antar Bandyopadhyay, Indian Statistical Institute, Delhi
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In this talk we will consider the mean field traveling salesman problem, where the intercity distances are taken to be i.i.d. with some distribution F. We consider the simplest approximation algorithm, namely, the nearest neighbor algorithm, that is to move to the nearest non-visited city. We will show that the limiting behavior of the total length of the nearest neighbor tour depends on the scaling properties of the density of F at 0 and derive the limits for all the possible cases for a general F.

Limiting Spectral Distribution for Wigner Matrices With Dependent Entries

Arijit Chakrabarty, Indian Statistical Institute, Delhi
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In this work we show the existence of limiting spectral distribution of a symmetric random matrix whose entries come from a stationary Gaussian process with covariances satisfying a summability condition. We provide an explicit description of the moments of the limiting measure. We also show that in some special cases the Gaussian assumption can be relaxed. The description of the limiting measure can also be made via its Stieltjes transform

which is characterized as the solution of a functional equation. In two special cases, we get a description of the limiting measure - one as a free product convolution of two distributions, and the other one as a dilation of the Wigner semicircular law. This is a joint work with Rajat S. Hazra and Deepayan Sarkar.

Inference Using the Residuals in a Sparse Linear Regression Model

Arindam Chatterjee
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Inference using the residuals in a sparse linear regression model. In a linear regression model with a large number of regression parameters (p) compared to the sample size (n), a commonly used tool for simultaneous model selection and estimation is the Adaptive Lasso (ALASSO) estimator. It is shown that under suitable sparsity assumptions, the residual based on the ALASSO estimator can provide asymptotically valid inference procedures for the underlying unknown error distribution function. This is in contrast to existing procedures based on the least squares estimator, which is known to fail when p is large compared to n. (Joint work with S. Gupta and S. N. Lahiri).

Risk Sensitive Stochastic Differential Games

Mrinal Ghosh, Indian Institute of Science, Bangalore
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Infinite horizon discounted payoff and ergodic payoff risk-sensitive stochastic differential zero-sum games for non-degenerate controlled diffusions are analyzed. Existence of value and saddle-point equilibrium strategies are proved for the discounted-cost game using dynamic programming principles. Under a stochastic Lyapunov-type stability assumption and a small cost criterion, existence of the value and saddle-point equilibrium strategies are proved for the ergodic payoff game via the analysis of the corresponding discounted-cost game.

On Quadratic Variation of Martingale

Rajeeva Karandikar, Chennai Mathematical Institute, Chennai
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We give a construction of an explicit function on $D[0,1]$-the space of right continuous functions with left limits such that the image of a path of a martingale is the path of the quadratic variation of the martingale. The proof only uses Doob's inequalities on martingales and thus this can be an alternate starting point for the theory of stochastic integration bypassing the classical Doob-Meyer decomposition. This is joint work with B. V. Rao

On Multidimensional Ruin

S. Ramasubramanian, Indian Statistical Institute, Bangalore
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We consider multidimensional insurance models described in terms of Skorokhod problem in an orthant. For such a set up, we discuss a natural otion of ruin.

Maximal Moments and Uniform Modulus of Continuity for Stable Random Fields

Parthanil Roy, Indian Statistical Institute, Kolkata
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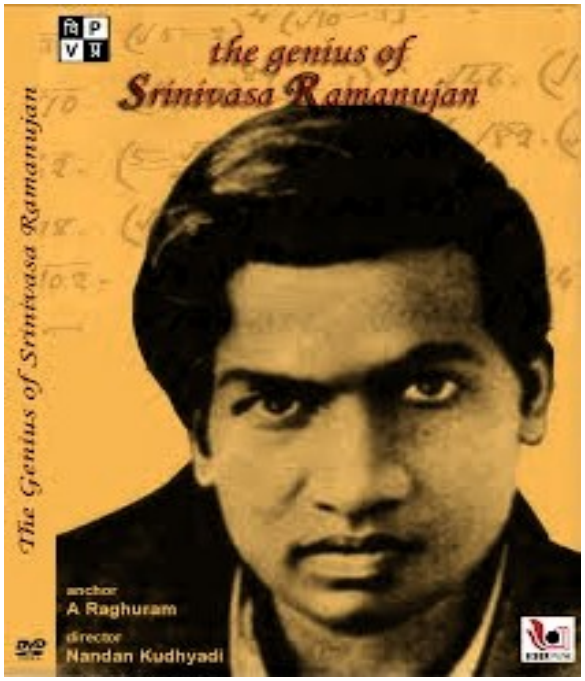
Based on two seminal works of Rosinski (1995, 2000), we have partially solved an open problem mentioned in a paper of Xiao (2010) and given sharp upper bound on the rate of growth of maximal moments for many stationary symmetric stable random fields using ergodic theoretic and group theoretic properties of the underlying action. In this talk, we shall discuss the relationship between this rate of growth and the path properties of self-similar stable random fields with stationary increments and give sharper results on uniform modulus of continuity of such fields. This talk is based on a joint work with Snigdha Panigrahi and Yimin Xiao.

Documentary : The Genius of Ramanujan

27 June, 2013: 6.30 pm: Reva Auditorium



The year 2012 was declared the National Year of Mathematics to commemorate the 125th birth anniversary of Srinivasa Ramanujan. Vigyan Prasar and IISER-Pune have co-produced an hour long documentary entitled "The Genius of Srinivasa Ramanujan" on the life and seminal contributions of the great mathematician, which was released for distribution on the 14th of March, 2013 at IISER, Pune.

The film is directed by Nandan Kudhyadi, the award winning filmmaker who 25 years ago had produced India's first Docu-drama film, "The Enigma of Srinivasa Ramanujan" to celebrate the centenary, with Raghubir Yadav and Tom Alter essaying the main roles of Ramanujan and G. H. Hardy.

"The Genius" has well-known number theorists from around the world associated with Ramanujan's oeuvre. Ken Ono of Emory University, Atlanta who very recently proved some of the Mock Theta conjectures, the last work of Ramanujan three months before his untimely death at the age of thirty two, along with A. Raghuram of IISER Pune, spent a week filming at various places related to the Ramanujan mythology Kumbakonam, Erode, Namakkal and Chennai.

The other two experts who accompanied the team were K. Srinivasa Rao of IMSc. and T. V. Venkateswaran from Vigyan Prasar. One of the highlights of the film is location shooting at Trinity College, Cambridge; Royal Society, London and at Matlock in Derbyshire. Exhaustive interviews were recorded at the international conference in New Delhi, concluding the year-long project.

Sangeet Kalanidhi R. Vedavalli has sung for the music track composed by Sushruthi Santhanam. R. V. Ramani has again wielded the camera for this Ramanujan film too, as in the past.

Vigyan Prasar screened the film at many centers across the country on 26th of April, the Remebrance Day of Ramanujan. We are happy to have with us Professor K. Srinivasa Rao who will be screening the documentary during the Annual Conference of the Ramanujan Mathematical Society at Bangalore on June 27, 2013.

Ramanujan Mathematical Society

General Body Meeting

Friday, 28 June 2013 at 6.30 pm

Venue: Reva Auditorium

There will be a General Body Meeting of the Ramanujan Mathematical Society at 6.30 pm at the above mentioned venue. All members of Ramanujan Mathematical Society are invited to attend.

Agenda

(1) Opening remarks by the President

(2) Confirmation of the minutes of the GBM held on 22 October, 2012

(3) Report of the Secretary for the year 2012–2013

(4) Report on Ramanujan-125 celebrations

(5) Regional school/UG/PG programmes and regional meetings

(6) Presentation of accounts for the FY 2012–2013

(7) Induction of new members since the last GBM

(8) Venue for the 29th Annual Conference

(9) Any other item with the permission of the Chair.

J. K. Verma
Secretary

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