Mathematics

2006-2014

IISER PUNE

Message by the Coordinator

I joined IISER Pune on December 26, 2011, as the first full-time coordinator for Mathematics. At that time, there were about a dozen mathematicians on the faculty and 3 Ph.D. students. Since that date it has been one exhilarating journey in heading a young and growing group of dedicated practitioners of Mathematics. Some of the major accomplishments in the recent years have been:

- Faculty appointments: An aggressive hiring policy is being pursued to diversify areas of expertise, as well as to complement and strengthen existing areas. We are now 21 faculty members, with two more expected to join soon. We also have two post-doctoral fellows adding weight and dimension to our research profiles.

- Ph.D. program: We have now established a Ph.D. program, the structure of which has been borrowed from proven programs like those at TIFR, Harvard, etc. We have 17 students working towards a Ph.D., with three more expected to join in Fall 2014.

- BS-MS program: The BS-MS curriculum for mathematics courses has seen a major overhauling, however, this is a task that needs a continuing effort reflecting the changing needs and expertise within the institute. Several of our students doing their 5th year projects in mathematics are getting selected in highly competitive places, although, we face the challenge of increasing the number of BS-MS students majoring in mathematics.

- Organizing several high level workshops and conferences; we have been averaging about 5 events per year. It is quite likely that in December 2016 we will be hosting a large-scale joint Indo-AMS meeting.

- Producing a documentary on Ramanujan, and hosting screenings around the world, for example, at Max-Planck-Institut für Mathematik, Bonn, Germany; at Universite Paris 13, Villetaneuse, France; at the Joint Mathematical Meeting of AMS and MAA in Baltimore, USA; and at IIT Kanpur, India. During these screenings I spoke about the role that IISER Pune has played in every aspect of the making of this documentary.

Find inside a detailed record of all the mathematics personnel and their achievements. We have come a long way these last few years, and mathematics at IISER Pune is beginning to be recognized as a young, strong, and happening group. (Let me mention what I overheard at a recent conference in TIFR: one mathematician tells another "IISER Pune is coming up very well," and pat came the reply "No, no, IISER Pune has already come up!") Be that as it may, we are also well aware of the fact that we still have a long way to go. One of my hopes is to establish IISER Pune as a National Center for Mathematics with a focus on the areas that we are strong in.

A. Raghuram
July 18, 2014

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A Brief History of the Early Years of Mathematics at IISER Pune

It is our great honor and pleasure to acknowledge the contributions of the first two Coordinators of Mathematics at IISER Pune and the continuous efforts put forward by the current coordinator, whose intense efforts have shaped the early and current years.

> 2006-2008: Prof. R. Ramachandran was the Mathematics Coordinator
> 2008-2012: Prof. L.S. Shashidhara was the Mathematics Coordinator
> 2012- : Prof. A. Raghuram is the current Mathematics Coordinator

We recall a brief history of the early development of the program.

1. Transitional Campus
IISER Pune operated out of a transitional campus during the years 2006-2012. Both Coordinators were instrumental in running a fully operational math program despite being constrained by space and other resources, and also developing facilities and appointing faculty.

2. Curriculum Development
The Math curriculum at IISER Pune was always designed to be special. The Institute has focussed very heavily on the principles of interdisciplinarity and borderless curricula from the earliest years. Such an experiment had not been conducted before, at least in India, and few guidelines were available. The curriculum was, not surprisingly, in tremendous flux for several years. With each iteration, the curriculum became better, never worse. It is noteworthy that even among the IISERs today, IISER Pune continues to boast of the lack of a departmental structure at the undergraduate level, and it is the only IISER to do so. Prof. Shashidhara's idea to run courses like Math Biology, Cryptography, and Financial Mathematics to produce better prepared students in these subjects was a remarkable initiative. Further, he encouraged us to run a "Trends in Mathematics" course where undergraduate students attended regular department seminars and colloquia for credit, which allowed them to be involved in research activity early.

3. Faculty Appointments
IISER Pune Mathematics faculty is currently considered to be among the finest among the new IITs and IISERs.

In the beginning, however, things were hard. Teaching had begun from the very first day. It was therefore an incredible challenge to run a full course load while faculty were still being appointed and the curriculum was being developed from scratch as well. The Coordinators, with the help of the faculty, exhibited a tremendous feat of leadership in that the students, even the early ones, had the least possible difficulty in choosing and taking Math classes. While we developed our own faculty, we were able to attract some of the finest senior professors to teach here, including Profs. Ramdorai, Katre, Karandikar, Bhatwadekar, Ranjan and Simha.

This is reflected in the fact that a good fraction of the students have gone on to pursue Ph.D. in mathematics at some of the finest institutes in the world, for example, University of Wisconsin, UCLA and others.

An exceptional feature of the early appointments was that in keeping with the interdisciplinary nature of the institute, faculty representation was broad across various areas of Mathematics. Appointments were always democratic, and participated in by faculty not only from Mathematics but across the Institute.

4. Ph.D. Program
The Coordinators were very conscious of developing a Ph.D. program early on, despite the difficulty that the undergraduate program was a priority. They realized that IISER could not live up to its research potential without an active graduate student population. IISER Mathematics held its first interviews in year two; our first students joined us in year three. The uniformity of selecting students through a standard exam was especially important given the multidisciplinary ethos of the Institute. After an initial couple of selections through GATE and CSIR exams, which were not as successful,

Prof. Shashidhara initiated the practice of inviting applicants from the NBHM exam. These practices have served us well, and we continue to attract excellent students.

5. The Visitors Program and Conference/Workshop Organization

The key to any Mathematics department is to have a range of visitors, seminars, colloquiums, workshops and conferences. We gratefully acknowledge the efforts of our Coordinators, especially Prof. Shashidhara, and the Director who helped us in these activities. We were able to invite distinguished mathematicians from all over country and abroad to visit the institute and give seminars and colloquia. During this period we organized several workshops and conferences which helped the department to emerge to an enviable position on the national stage. The undergraduate seminar course "Trends in Mathematics" was instrumental in developing mathematics research interest amongst students, and as an additional consequence, this was also good advertisement for our Ph.D. program as well.

7. Mentoring Young Faculty

The Coordinators encouraged an atmosphere of free interaction with the wider mathematics community in the country and abroad. Mathematicians like Sujatha Ramdorai, Dipendra Prasad, G. Rangrajan, Kapil Paranjape and others visited us regularly and interacted with all faculty members. Their input in academic as well as policy matters was useful for all of us.

8. Library

The IISER Pune Library had started completely from scratch. Prof. Shashidhara helped ensure that any paper request at all, however difficult the source, could be obtained directly by the library so that faculty research was never hindered. Our library developed rapidly in the first three years into a full-fledged resource, which includes all leading journals available in e-formats and paper, and houses one of the widest collections of textbooks. Several series of math books, such as the GTMs, GSMs, LNMs or those of London Math Society, are available in entire collections. The IISER Pune Library partners with that of TIFR Mumbai, IISc, IITs and others to help with special requirements.

IISER Pune Library today is one of the best amongst the new IITs and IISERs. It has been awarded as the best library based on usage by Elsevier during this period.

9. Postdoctoral and Fellow Program

To develop the academic program across all strata, from undergraduate to postdoctoral research, was one of the initiatives that both Coordinators supported extensively. We started to have an IISER Fellow program from year one, and this has been one of the most successful steps for us. Under this program we could appoint a promising faculty candidate right after his/her Ph.D. For example two of our current faculty members, Drs. Diganta Borah and Chandrasheel Bhagwat, came to us through this program. It has been an incredible journey and a remarkable experience for us. We feel deeply indebted to the Coordinators and to the Director, Prof. K. N. Ganesh for their vision throughout these years.

Prof. Raghuram came to us in early 2012 and the discipline has grown by bounds since then. We have nearly doubled in faculty size since, and our curriculum has been wonderfully streamlined. Prof. Raghuram has produced (and starred in!) a remarkable movie on the occasion of Ramanujan's birthday celebration, which has given us great visibility worldwide. In addition, we have organized several international meetings in this time.

We are confident that Mathematics at IISER Pune has seen a fine dawn on its day, and its best is yet to come. We look eagerly, with bated breath, to that horizon.

Anupam Singh
Ayan Mahalanobis
Pranay Goel
Rama Mishra
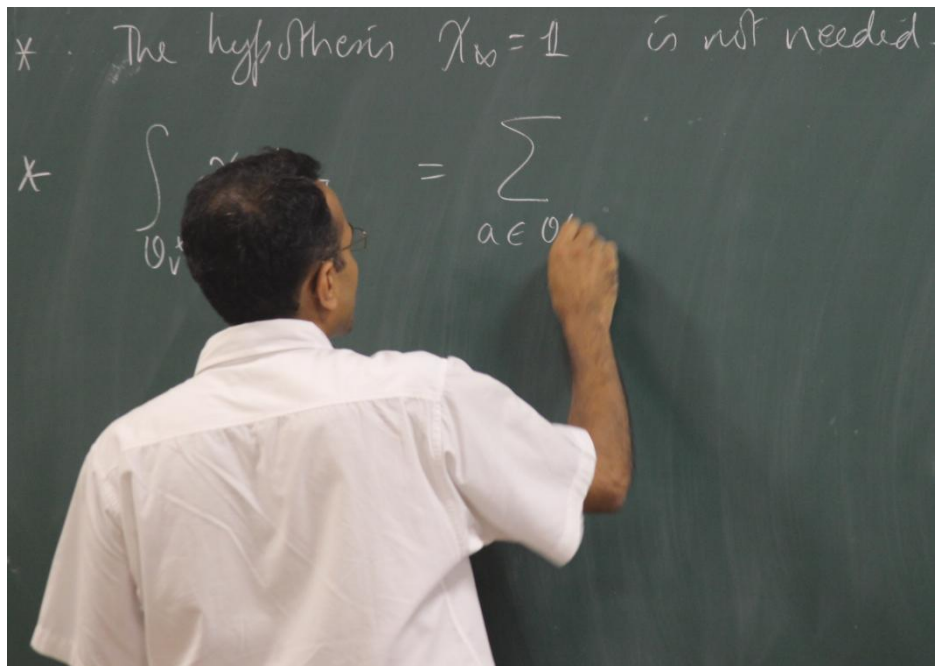
Faculty Members

Amit Pratap Hogadi

Area of Specialization: Algebraic Geometry
Position at IISER Pune: Associate Professor
Date of Joining: December 26, 2013

1. Academic Experience

2007 Ph.D. Princeton University, Supervisor: János Kollár
2007-2012 Fellow at TIFR Mumbai
2012-2013 Reader at TIFR Mumbai (currently on long term leave)

2. Select Publications

- (with Indranil Biswas) On the fundamental group of a variety with quotient singularities. To appear in **International Mathematics Research Notices** (2013).
- (with H. Esnault) On the algebraic fundamental group of smooth varieties in characteristic $p>0$. **Transactions of AMS** 364 no. 5 (2012)
- (with Vikram Mehta) Birational invariance of the S-fundamental group scheme. **Pure and Applied Mathematics Quarterly** 7 no. 4 (2011).
- (with Supriya Pisolkar) On the cohomology of Witt vectors of p-adic integers and a conjecture of Hesselholt. **Journal of Number Theory** 131 no. 10 (2011).

3. Ongoing Research Projects

- (with Lars Hesselholt) The motivic spectral sequence relates motivic cohomology of smooth varieties over a perfect field with algebraic K-theory. The goal of this project is to verify that this spectral sequence is multiplicative with the multiplication on the E2 term coinciding with the cup product in motivic cohomology. The main and perhaps the only published tool for verifying whether a spectral sequence is multiplicative is a result of W. Massey published in 1955. However, as spotted by Dold, this paper has a mistake. This mistake was recently rectified (unpublished) by a student of Hesselholt by introducing the notion of multiplicative Cartan Eilenberg systems. The main work in this project is to show that the filtration of the K-theory spectrum defined by Grayson is multiplicative in a suitable sense and hence gives rise to a multiplicative Cartan Eilenberg system.

- (with Vivek Mallick) Motivicco homology has been defined for smooth varieties over a perfect field K. This definition starts by constructing a category Cork whose objects are smooth projective varieties and morphisms from X to Y are finite correspondences and defining the notion of a Nisnevich sheaf with transfers. In order to make the results work for imperfect fields, one needs to know that an $\mathbf{A}^1$-invariant sheaf with transfers is strongly $\mathbf{A}^1$-invariant, i.e. all its cohomology presheaves are $\mathbf{A}^1$- invariant. In this project we are trying to overcome the technical hurdles by working with a category where finite correspondences are replaced by finite flat coherent sheaves. The idea is to work with all regular k-schemes and try to construct a Gersten complex for $\mathbf{A}^1$ - invariant sheaves in question.

4. Teaching at IISER Pune

- Spring 2014: Vector Spaces, Rings and Modules

5. Service to IISER Pune

- Member of Ph.D. Committee, 5th year Project Viva Committee
- Served on the Interview Panel for selecting Ph.D. students (2014)

6. Awards, Grants, Citations

- INSA Young Scientist Award (2014)

Anindya Goswami

Area of Specialization: Stochastic Control and Mathematical Finance
Position at IISER Pune: Assistant Professor
Date of Joining: August 29, 2011

1. Academic Experience

2008 Ph.D. IISc Bangalore, Semi-Markov Processes in Dynamic Games and Finance, Supervisor: Prof. M.K. Ghosh
2009 Postdoc at Universiteit Twente
2010 Postdoc at INRIA, Rennes (Rennes I)
2011 Postdoc at Technion-IIT, Haifa

2. Select Publications

- (with M.K. Ghosh) Partially observable semi-Markov games with average payoff, **Journal of Mathematical Analysis and Applications** 345 (2008) 26-39.
- (with M.K. Ghosh) Risk minimizing option pricing in a semi-Markov modulated market, **SIAM Journal on Control and Optimization** 48 (2009) 1519-1541.
- (with M.K. Ghosh and Suresh K. Kumar) Portfolio optimization in a semi-Markov modulated market, **Applied Mathematics & Optimization** 60 (2009) 275-296.
- (with M.K. Ghosh and G. K. Basak) Risk minimizing option pricing for a class of exotic options in a Markov modulated market, **Stochastic Analysis and Applications** 29 (2011) 259-281.
- (with Rami Atar and Adam Shwartz) Risk-sensitive control for the parallel server model, **SIAM Journal on Control and Optimization** 51 (2013), 43634386.
- (with Rami Atar and Adam Shwartz) On the risk-sensitive cost for a Markovian multiclass queue with priority, **Electronic Communications in Probability** 19 (2014), no. 11, 113.

3. Ongoing Research Projects

I work on various topics in Applied Probability. Those include generalization of Black-Sholes-Merton PDE for option prices in some general markets, equilibrium of noncooperative semi-Markov games under ergodic cost, optimal control under risk sensitive cost, portfolio optimizations, fluid limit in queuing networks, PDE techniques in stochastic control and differential games etc.

In a paper with Rami Atar and Adam Shwartz (2013), we address a risk sensitive cost optimization problem with parallel server model in finite time horizon settings. In practice, a cost functional, linear w.r.t. the terminal queue lengths, is of special interest. In a paper with Rami Atar and Adam Shwartz (2014) we restricted to this class with homogeneous servers to study asymptotic performance of a given priority rule for such case by considering its fluid limit. Due to the risk sensitive cost structure, a large deviation limit arises. Next I'ld like to study the above problem with a relaxed assumption, namely semi-Markov arrival in the queue. This would be mathematically challenging.

Black-Schole-Merton PDE is a widely accepted tool to find price of a European option in an idealistic market assumption. Since this discovery, an enormous amount of research is being carried out in the field of mathematical finance to meet the need of practitioners as well as the quest of theoreticians. Recently we have considered a generalized market assumption where we propose a new way of finding price function by solving an integral equation instead of a PDE. Apart from proving the validity of the claim, i.e., equivalence between the two, we also examine the computational benefit of this approach. This also leads to an alternative way of finding optimal hedging strategy in the same setup. I have engaged students to work on these topics and submitted two papers in peer reviewed

journals. I am currently mentoring three different Master's projects. The topics include study of implied volatility in a generalized market, statistical inference of semi-Markov processes, and pricing in semi-Markov modulated Lévy process.

Presently I am also working on *Stability of stochastic delay differential equations with semi-Markov switching*.

4. Teaching at IISER Pune

Spring 2014	Semester Project	Introduction to Option Pricing
Spring 2014	Elective course	Functional Analysis (BS-MS) [4.5/5]
Fall 2013	Elective course	Analysis I (Ph.D.)
Fall 2013	Semester Project	Investment Science II
Spring 2013	Semester Project	Pricing bit rate in noisy channel
Spring 2013	Compulsory course	Multivariate Calculus (BS-MS) [3.6/5]
Spring 2013	Semester Project	Investment Science I
Fall 2012	Elective course	Measure theory and integration (BS-MS) [4.5/5]
Fall 2012	Semester Project	Introduction to probability measure
Spring 2012	Elective course	Topology (BS-MS) [4.4/5]
Spring 2012	Semester Project	Non-cooperative Game Theory
Fall 2011	Elective course	Measure theory and integration (BS-MS) [4.2/5]
Fall 2011	Semester Project	Crank-Nicholson implicit scheme for parabolic system of PDEs

[∗] : Course evaluation score determined by participating students. For more details about my teaching, go to https://sites.google.com/site/anindyagoswami/teaching

5. Service to IISER Pune

- Active participation in research scholar selection for Jan 2012 and Aug 2014
- Chairing the research profile committee
- Designing and maintaining the online list of research publications from the entire Math discipline
- Member of Counseling Committee for academically weak students

6. Service to Mathematical Community; Mentoring and Outreach Activities

- Referee work for journals such as: Statistics and Probability Letters, Differential Equations and Dynamical Systems, Queueing Systems etc.
- I have mentored the following

2014	Minor Thesis	Itô Calculus without Probabilities
2014	Minor Thesis	Theory of Rational Option Pricing
2013	Summer Project	Computation of optimal hedging and cash flow in a Markov modulated market
2013	MSc Project	Computation of Implied Volatility in a General Market
2012	MS Project	Pricing and Hedging in a GBM Market with Markov Switching: A Survey
2012	Summer Project	Introduction to Option Pricing

7. Awards, Grants, Citations

- SPMF 2005 (http://csirhrdg.res.in/RESULTS SPMF 2005.htm)
- Viterbi PDF 2011 (http://webee.technion.ac.il/pages/5)

Anisa Chorwadwala

Area of Specialization: PDEs on Riemannian Manifolds, Calculus of Variations
Position at IISER Pune: Assistant Professor
Date of Joining: April 1, 2011 (as Assistant Professor on Contract) and January 1, 2013 (as Assistant Professor)

1. Academic Experience

2007: Ph.D. from University of Mumbai, Supervisor: A.R. Aithal
August 1, 2007-September 22, 2009: Postdoctoral Fellow at IMSc Chennai
June 9, 2008-September 8, 2008: Visiting Scientist at ICTP, Trieste, Italy
September 30, 2009-March 31, 2011: Visiting Fellow at TIFR Mumbai
April 1, 2011-December 31, 2012: Assistant Professor (on contract) at IISER Pune
January 1, 2013-till date: Assistant Professor at IISER Pune

2. Select Publications

- Anisa M.H.C., A. R. Aithal, "On Two Functionals Connected to the Laplacian in a Class of Doubly Connected Domains over Space Forms", **The Proceedings of the Indian Academy of Sciences – Mathematical Sciences** Vol. 115. No. 1, Feb. 2005, pp. 93-102.
- Anisa M. H. Chorwadwala, A. R. Aithal, "Convex Polygons and the Isoperimetric Problem in Simply Connected Space forms $M_\kappa{}^2$", **The Mathematical Intelligencer**, Accepted.
- Anisa M. H. Chorwadwala, M. K. Vemuri, "Two Functionals Connected to the Laplacian in a Class of Doubly Connected Domains on Rank One Symmetric Spaces of non-compact type", **Geometriae Dedicata**, December 2013, Volume 167, Issue 1, pp. 11-21.
- Anisa Chorwadwala, Rajesh Mahadevan and Francisco Toledo, "On the Faber-Krahn Inequality for the Dirichlet p-Laplacian", ESAIM: Control, **Optimisation and Calculus of Variations**, Accepted.
- Anisa Chorwadwala, Rajesh Mahadevan, "A shape optimization Problem for the p-Laplacian", **Proceedings of the Royal Society of Edinburgh**, Accepted.

3. Ongoing Research Projects

- With Rajesh Mahadevan, on strong comparison principle for the p-Laplacian.

- With Prof. Antoine Henrot, we are studying a mixed eigenvalue value problem for the Laplacian on a domain having a puncture. We fix either the shape of the puncture as a circle or the shape of the domain as a circle. We try to analyze for what shape of the other boundary and for which configuration the first eigenvalue will be maximum or minimum. Our conjecture is that the optimal configuration will be where both the boundaries are circular and concentric ones.

- With Souvik Roy, we are studying the behaviour of the Dirichlet eigenvalue of the Laplacian over a family of planar circular punctured domains where the puncture has D_n-symmetry for some n and has a fixed area.

4. Teaching at IISER Pune

- Full Courses Taught:

  - BS-MS level: (1) Fall 2011: MTH310, Analysis, 3.7/5.0 (2) Spring 2012: MTH320, Complex Analysis, 4.1/5.0 (3) Fall 2012: MTH434, Advanced Topics in Differential Equations-Partial Differential Equations, 4.3/5.0; (4) Spring 2013: MTH420, Functional Analysis, 4.6/5.0.
  - Graduate Level: (1) Fall 2013: MTH614, Differential Equations I, (2) Spring 2014: MTH624,

Differential Equations II.
- Mentor: (1) for two BS-MS level Theory Projects titled (a)"Sobolev Spaces and Embedding Theorems" (b) "The Faber-Krahn Theorem"; (2) Adviser for a Graduate Level minor thesis titled "Extremal First Dirichlet Eigenvalue".

- Short Courses/Seminars Given: Gave a series of lectures
- on Linear Lie Groups and its Lie Algebra as part of the "Analysis Lecture Series on Representation Theory and Linear Lie Groups"
- on "Maximum Principles in Differential Equations and its applications to Shape Optimization Problem" as part of the Analysis Seminar
- on "The Isoperimetric Problem on Certain Geometric Spaces with Historic Background".

5. Service to IISER Pune

- Within the Discipline: (1) Served on the following committees: Mathematics Day Committee, Mathematics Ph.D. committee, Mathematics Cosmetic Committee, Mathematics Happiness Committee. Brought out Mathematics Profile booklet for 2013 and 2014. (2) Initiated and co-ordinating the Analysis Seminar.
- Within the Institute: (1) Member of the Academic courses/evaluation committee for 3 years; (2) Served on the KVPY interview panel; (3) Served on the Annual Convocation Committee; (4) Counselor for KVPY/IIT Counseling Meet; (5) Served on the Inter IISER Sports Meet Committee.

6. Service to Mathematical Community; Mentoring and Outreach Activities

A. (1) Conducted Mathematics lectures and workshops for students and teachers not only in Schools of Pune and Shirur, but also in villages of Maharashtra and Gujarat. (2) Gave lectures and Mathematical demonstrations (a) at three different INSPIRE Science Camp under Scheme for Early Attraction of Talent for Science (b) at the NCL Venture Centre as part of "Popular Science Talks" by the Exciting Science Group

B. Major Events/Conferences Organization at IISER Pune: (1) Organized (a) The Mathematics Day 2013; (b) the Women in Math Showcase competition on the Mathematics Day 2014. (2) (a) Organizing the 29th Annual Meeting of Ramanujan Mathematical Society at IISER Pune in June 2014; (b) organizing (as convener and member of the scientific committee) the Young Women and Mathematics Symposium happening in July 2014.

7. Awards, Grants, Citations, Invited Talks

- Was invited (a) to give an interview to Doordarshan Girnar channel as part of Minority Welfare Awareness Program, (b) to speak at a Felicitation Program organized by Veraval Muslim Education and Welfare Society. (3) to be a main speaker at an Annual function of the All Muslim Education Committee in Mangrol. The content of the lecture was covered in major newspapers of Gujarat.
- Invited talks given since joining IISER Pune: (a) Seminaire de Geometrie of IMJ-Universite Paris Diderot; (b) 29th annual conference of the RMS; (c) Thirteenth Discussion Meeting on Harmonic Analysis held at IMSc, Chennai; (d) Invited Young Researcher's talk in the Indian Women and Mathematics Symposium held at IISER Pune; (e) INSPIRE Science Camps in Garhwal and in Pune; (f) Workshop on Elliptic and Parabolic PDEs and Related Topics: Theory and Numerical Methods held at IIT Gandhinagar; (g) ATMW Riemannian Geometry 2012 held at TIFR-CAM; (h) Universidad de Concepci´on, Chile; (i) ATML School on Ordinary Differential Equations at M S University, Baroda.

Anupam Kumar Singh

Area of Specialization: Linear Algebraic Groups
Position at IISER Pune: Assistant Professor
Date of Joining: July 28, 2008

1. Academic Experience

2007-2008 Postdoctoral Fellow, The Institute of Mathematical Sciences, Chennai
2006-2007 Postdoctoral Fellow, Tata Institute of Fundamental Research, Mumbai
2007 Ph.D. Indian Statistical Institute

2. Select Publications

- Strongly Real Classes in finite Unitary groups of odd characteristic (with Zachary Gates and Ryan Vinroot), appeared online in the **Journal of Group Theory**.
- Real elements and Schur indices of a group (with Amit Kulshrestha), **The Mathematics Student**, Vol 80, No.s 1-4 (2011) 73-84.
- Real and Strongly Real Classes in $PGL_n(q)$ and quasi-simple Covers of $PSL_n(q)$ (With Nick Gill), **Journal of Group Theory** 14 (2011), 461-489.
- Real and Strongly Real Classes in $SL_n(q)$ (with Nick Gill), **Journal of Group Theory** 14 (2011), 437-459.
- Conjugacy Classes of Centralizers in G_2, **Journal of the Ramanujan Mathematical Society**, 23 no. 4 (2008), 327-336.
- Reality Properties of Conjugacy Classes in Algebraic Groups (with Maneesh Thakur), **Israel Journal of Mathematics** 165 (2008), 1-27.
- Reality Properties of Conjugacy Classes in G_2 (with Maneesh Thakur), **Israel Journal of Mathematics** 145 (2005), 157-192.

3. Ongoing Research Projects

- **Real Conjugacy Classes in Spin Groups**: This is ongoing project with my Ph.D. student Sushil Bhunia where we want to characterize real and strongly real conjugacy classes in Spin groups.

- **MOR Cryptosystem and Chevalley Groups**: This project is part of SERB proposal jointly with Ayan Mahalanobis and Baskar Balasubramanyam where we want to use automorphisms of Chevalley groups and Galois groups to construct new crptosystem.

- **Chevalley Groups and 2-generation**: In this project I am interested in proving how big is the subgroup generated by certain two elements which are described using simple roots.

- **Chevalley Groups and K-theory**: In this project I am exploring certain decomposition over Euclidean ring which can be used to compute K_1 of classical groups.

- **Conjugacy Classes of centralisers in Classical Groups**: In this project I want to explore conjugacy classes of centralisers using the description of these groups as an automorphisms of central simple algebras with involution.

4. Teaching at IISER Pune
Undergraduate Teaching:
(a) MTH 410 Galois Theory (August-November 2013) 4.5/5
(b) MTH 312 Elementary Geometry (August-November 2012) 4.2/5
(c) MTH 202 Multi Variable Calculus (Jan-April 2012) 4.2/5
(d) MTH 311 Algebra -Group Theory (August-November 2011) 4.1/5
(e) MTH 421 Number Theory (January-April 2011) (taught half course)
(f) MTH 413 Differential Topology (August-November 2010)
(g) MTH 320 Complex Analysis (January-April 2010)

(h) MTH 411 Representation Theory of Finite groups (August-November 2009)
(i) MTH 390 Module Theory (January-April 2009)
(j) MTH 321 Galois Theory (January-April 2009)
(k) MTH 311 Abstract Algebra (August-November 2008)

Graduate Teaching:
(a) Algebra-II (January-April 2013)
(b) Topology I (January-April 2011)
(c) Algebra (January-April 2010)

5. Workshops/Conferences Organized

- ATM school on Classical Groups 5-26 December 2013 at IISER Pune
- Conference on Groups, representations and related topics 24-26 May 2013 at IISER Pune
- ATM school on Chevalley Groups 13-24 May 2013 at IISER Pune
- National Initiative in Mathematical Education (NIME) -west zone conference 26-28 December 2011 at IISER Pune
- Summer Workshop in Mathematics 26 -31 July 2010 held at IISER Pune
- Summer Workshop in Mathematics 27 July -1 August 2009 held at IISER Pune
- Classification of Algebraic Groups 9-12 March 2009 at IISER Pune

6. Awards, Grants, Citations

- The MOR Cryptosystem, Chevalley groups and Galois action, proposal for SERB grant worth Rs. 52 lakhs

Ayan Mahalanobis

Area of Specialization: Finite Group Theory and Cryptography
Position at IISER Pune: Assistant Professor
Date of Joining: April 2009

1. Academic Experience

2005 Ph.D. Florida Atlantic University, Thesis Advisor: Spyros Magliveras
2005-2009 Visiting Assistant Professor; Stevens Institute of Technology

2. Select Publications

- Mahalanobis, Ayan The MOR cryptosystem and finite p-groups (to appear) **Contemporary Mathematics**, *Special Issue on Computational Group Theory and Cryptography*.
- Mahalanobis, Ayan Are matrices useful in public-key cryptography? **International Mathematical Forum** Vol. 8, no. 39, 1939-1953, 2013.
- Mahalanobis, Ayan and Shah, Jay[1] A new guess-and-determine attack on the A5/1 stream cipher, **Computer and Information Science** Vol. 7, No. 1; 2014. ([1]Paper with BS MS student)
- Mahalanobis, Ayan The discrete logarithm problem in the group of non-singular circulant matrices, **Groups-Complexity-Cryptology** 2(2010), 83-89.
- Mahalanobis, Ayan A simple generalization of the ElGamal cryptosystem to non-abelian groups II **Communications in Algebra** 40(9)2012 3583-3596.
- Mahalanobis, Ayan A simple generalization of the ElGamal cryptosystem to non-abelian groups, **Communications in Algebra** 36(10) (2008) 3878-3889.

3. Ongoing Research Projects

- (with Anupam Singh and Baskar Balasubramanyam) This is a continuation of the ongoing research project in MOR cryptosystem. The MOR cryptosystem uses the discrete logarithm problem in the automorphism group of a finite group. This cryptosystem is a natural generalization of the most prolific cryptosystem of all times, the ElGamal cryptosystem. In this project, we are looking at the MOR cryptosystem with Chevalley groups and other solvable groups.

- This project is a continuation of my work with circulant matrices. In 2009 I was able to show that a long standing result of Menezes and Wu is wrong. They claimed that matrices have no hope in public key cryptography. I showed that circulant matrices do have very interesting and nice cryptographic properties. The follow-up work is now in collaboration with the center of interdisciplinary computing, University of Pune.

- (Supported by NBHM 2010-2013) This project is a study of finite p-groups for the MOR cryptosystem. In this case I was able to prove that the best case scenario for finite p-groups using p'-automorphisms is the extra-special p-groups. The case of p-automorphisms is still open.

4. Teaching at IISER Pune

- 2014 Graph Theory; 2013 Introduction to Proofs (Fall); 2013 Introduction to Cryptography (Spring)
- Taught one course every semester. Taught core courses (Probability and Statistics, Calculus) to a class of hundred as well as more advanced courses to the BS-MS program.

5. Service to IISER Pune

- IT Committee (2010-2014)
- Library Committee (2010-2014)

6. Service to Mathematical Community; Mentoring and Outreach activities

- Mentored three students in the BS-MS program
- Mentoring one student for the Ph.D. program
- Performed several outreach activities. Recent one was in Ramanujan College in New Delhi. It was a refresher course for undergraduate teachers organized by the Ramanujan Mathematical Society.
- Worked as reviewer for several journals and crypto conferences

7. Awards, Grants, Citations

- NBHM grant-in-research award from NBHM (2010-2013)
- Awarded a certificate in recognition for his excellent service to the institute, IISER Pune (2012)

Baskar Balasubramanyam

Area of Specialization: Number Theory
Position at IISER Pune: Assistant Professor
Date of Joining: August 10, 2010

1. Academic Experience

2007 Ph.D. from Brandeis University, Supervisor: Fred Diamond
2007-08 Postdoctoral Fellow at Ben Gurion University of the Negev
2008-10 Bateman Instructor at California Institute of Technology

2. Select Publications

- Baskar Balasubramanyam, Matteo Longo. Λ-adic modular symbols over totally real fields. **Commentarii Mathematici Helvetici**, Volume 86 Issue 4 2011.
- Baskar Balasubramanyam, Eknath Ghate, Vinayak Vatsal. On local Galois representations associated to ordinary Hilbert modular forms. **Manuscripta Mathematica**, March 2013.

3. Ongoing Research Projects

- (With A. Raghuram) A prime p is called a congruence prime for a modular form f if there exists a modular form g different from f such that $f \equiv g$ mod p. A classical theorem of Hida says that, outside a finite set of primes depending only on the weight of f, any primes dividing the algebraic part of the special value of the adjoint L-function of a cusp form f at $s = 1$ is a congruence primes for f. This result has been generalized by Ghate, Dimitrov, Urban and Namikawa to cover all automorphic forms for GL_2 over any number field F. In this project, we prove a generalization of Hida's theorem to all automorphic forms for GL_n over any number field F.

- (With Debargha Banerjee and Dipramit Majumdar) Reduzzi has given a purely algebraic construction of congruences between quaternionic automorphic forms over totally real fields using relations in the Grothendieck ring of $GL_2/\mathbb{F}_q$. In this project, we hope to generalize this approach to Hilbert-Siegel modular forms by looking for relations in the Grothendieck ring of $Gsp_4/\mathbb{F}_p$.

- (With Kaneenika Sinha) Let f be a cuspidal eigenform of weight k and level N. Let a_p denote the pth Hecke eigenvalue. The normalized eigenvalue $a°_p = a_p/p^{(k-1)/2}$ lies in the interval $[-2, 2]$. A theorem of Serre from the 90s says that as k and N vary over positive integers with k even and N coprime to p these normalized eigenvalues are equidistributed with respect to a measure μ (which depends only on p). Knightley and Li have generalized this result to Hilbert modular forms. In this more general setting, we are interested in finding explicit bounds on the discrepancy between the number of eigenforms with normalized eigenvalues in a specific subinterval of $[-2, 2]$ and the expected value.

- (With Ayan Mahalanobis and Anupam Singh) We are interested in systematically constructing groups which could be used to build secure MOR cryptosystems. We will be looking for candidates among various matrix groups and their subgroups. The security of such cryptosystems depends on solving the word problem in such groups and this is the underlying mathematical problem we will be studying.

4. Teaching at IISER Pune

- Fall 2010: Field Extensions and Galois Theory
- Spring 2011: Complex Analysis
- Fall 2011: Field Extensions and Galois Theory
- Spring 2012: Algebraic Number Theory
- Fall 2012: Real Analysis

- Spring 2013: Algebraic Number Theory
- Fall 2013: Graduate Algebra I
- Spring 2014: Cryptography

5. Service to IISER Pune

- 2010-2011: Member of the Courses and Evaluation Committee at IISER Pune which is responsible for smooth conduct of all examinations at IISER Pune
- 2011-present: Member of the Ph.D. Committee at IISER Pune
- 2012-present: Chair of the Mathematics Ph.D. committee

6. Service to Mathematical Community; Mentoring and Outreach Activities

- Referee work for *International Journal of Number Theory*
- Advising Ph.D. students: Manidipa Pal
- Advising 5th year students: Mihir Sheth

Chandrasheel Bhagwat

Area of Specialization: Representation Theory, Number Theory
Position at IISER Pune: INSPIRE Faculty Fellow
Date of Joining: March 1, 2012

1. Academic Experience

2011 Ph.D. TIFR, Advisor: C. S. Rajan
August 2011-February 2012 Postdoctoral Fellow, IISER Pune
March 2012 onwards INSPIRE Faculty, Mathematics, IISER Pune

2. Select Publications

- Bhagwat C., and Rajan C. S., On a spectral analogue of the strong multiplicity one theorem, **International Mathematics Research Notices** (2010), doi: 10.1093/imrn/rnq243
- Bhagwat C., and Rajan C. S., On a multiplicity one property for the length spectra of even dimensional compact hyperbolic spaces, **Journal of Number Theory**, (2011), doi: 10.1016/j.jnt.2011.05.009
- Bhagwat C., Pisolkar S., and Rajan C. S., Commensurability and representation equivalent arithmetic lattices, **International Mathematics Research Notices** (2013), doi: 10.1093/imrn/rns282
- Bhagwat C., and Raghuram A., Ratios of periods for tensor product motives, **Mathematical Research Letters**, 20 (2013) No.4, 615-628

3. Ongoing Research Projects

- I am interested in studying period relations for motives associated to cuspidal automorphic representations of algebraic groups like GL_n, $Sp(2n)$. In a joint work with A. Raghuram, we have proved certain results for the ratios of Deligne periods of tensor product motives. When at least one of the motives is of even rank, these results together with the Deligne conjecture predict the rationality results for ratios of critical values for Rankin-Selberg L-functions of Raghuram and Harder. I hope to prove more such results for other groups and also for various other motives obtained functorially. (e.g. motives corresponding to symmetric square $Sym^2(\pi)$ of a representation π.)

- (With A. Raghuram) The aim of this project is to prove rationality results for ratios of critical values for Rankin-Selberg L-functions. In a joint work, Raghuram and Harder have used the rank-one Eisenstein Cohomology for GL_n over a totally real field to prove such results. This project is in parallel to the above project; where we would study Eisenstein Cohomology for certain classical groups and hope to prove the arithmetic property of Langlands L-functions, with an emphasis especially on those L-functions which are not captured by the work of Raghuram and Harder.

- (With C. S. Rajan) In an earlier joint work, we have proved various analogues of the classical strong multiplicity one theorem in the context of compact locally symmetric Riemannian spaces. We are interested in proving some results for representation spectra (e.g. whether a finite set of spherical parameters determines the full spectrum of the corresponding space $\Gamma \backslash G / K$.) using tools like Paley-Wiener theorems.

- (With Supriya Pisolkar) In a joint work with Rajan and Pisolkar, we have proved some of the results of Prasad and Rapinchuk in the context of weak commensurability of S-arithmetic lattices under different hypotheses like characteristic equivalence and representation equivalence. We hope to address some more questions (e.g. about cocompactness of lattices in real semisimple Lie groups) in terms of these criteria.

4. Teaching at IISER Pune

- Fall 2012: Multivariable Calculus (Second year BS-MS students)
- Spring 2012: Ordinary Differential Equations (Third and fourth year BS-MS students + Integrated Ph.D. students from Physics and Biology)
- Fall 2013: Group Theory (Third and fourth year BS-MS students)
- Spring 2014: Measure theory and Integration (Third year BS-MS students)

5. Service to IISER Pune

- Served as a member of the IISER Pune Curriculum Development Committee from November 2013.
- Served as a member of various internal committees in Mathematics department, IISER Pune (Ph.D. committee, Undergraduate committee, Happiness committee, Mathematics day committee etc.)

6. Service to Mathematical Community; Mentoring and Outreach Activities

- Mentored various undergraduate students for summer projects and semester projects in Mathematics.
- Mentored two of IISER Pune Mathematics graduate students Neha Prabhu and Manidipa Pal for their minor theses.
- Worked as an associate teacher in Madhava summer programme for undergraduate students in Bhaskaracharya Pratishthana, Pune in 2010 and 2013.
- Gave talks on research and career in mathematics for students in schools and colleges.
- Worked as a member of the organizing committee for the Mathematics day (a program in IISER Pune where many students/people from outside and IISER Pune participate in mathematical activities) in 2013 and 2014.
- Working as a member of the local organizing committee for Annual Meeting of Ramanujan Mathematical Society (to be held in June 2014 at IISER Pune).

7. Awards, Grants, Citations and Invited Talks

- DST-INSPIRE faculty award in mathematics (with research grant) for a period of five years (December 2011 onwards).
- I have given invited talks on my research work at TIFR-CAM, Bangalore and Indo-French conference on automorphic forms at IISER Pune.

Debargha Banerjee

Area of Specialization: Number Theory, Arithmetic Geometry
Position at IISER Pune: Assistant Professor
Date of Joining: November 1, 2013

1. Academic Experience

2010 Ph.D. TIFR, Endomorphism algebras of modular motives, Supervisor: Prof. Eknath Ghate
September, 2010-August, 2012 Postdoctoral Fellow; Australian National University; Supervisor Prof.
   James Borger
September, 2012-December, 2012 Guest Scientist; IMSC, Chennai
September, 2012-December, 2012 Guest Scientist; MPIM, Bonn, Germany

2. Select Publications

- Crossed product algebras attached to weight one forms, joint work with Eknath Ghate, 10 pages, **Mathematical Research Letters**, Volume 18, issue 1, January 2011.
- Adjoint lifts and modular endomorphism algebras, joint work with Eknath Ghate, 38 pages, **Israel Journal of Mathematics**, June 2013, Volume 195, Issue 2, pp 507-543.
- A note on the Eisenstein elements of prime square level, to appear in the **Proceedings of the American Mathematical Society**, 12 pages.
- Differential modular forms on Shimura curves over totally real fields, **Journal of number Theory**, Volume 135, February 2014, Pages 353-373.
- Λ-adic forms and the Iwasawa main conjecture, 40 pages, expository article, appeared in **Ramanujan Mathematical Society Lecture Notes Series**, joint with V. G. Narasimha Kumar Cheraku and Eknath Ghate.

3. Ongoing Research Projects

My research is centered on modular motives, automorphic forms and Langlands conjecture. I am working on three projects.

- **Modular symbols and p-adic L-functions**: In mathematics, modular symbols are bridges between the cohomologies of modular curves and the special values of L-functions. I wish to understand the modular symbols corresponding to the Eisenstein series. I proved the explicit version of Manin-Drinfeld theorem for some congruence subgroups [To appear in Proceedings of the American Mathematical Society]. More generally, I wish to understand the Eisenstein cohomology classes. In joint work with Prof. A. Raghuram, I wish to construct the p-adic L-functions for the Sym^n automorphic forms. In another direction, I am interested to understand Harder's construction of Hida's control theorem and its application to understand special value results.

- **p-adic and mod p modular forms**: p-adic modular forms are invented by Katz following initial breakthrough by Serre. Following Buium, I introduced the differential modular forms for the Shimura curves over totally real fields. These are the modular forms obtained by applying the arithmetic p-jet space functor to the ring of p-adic modular forms. I wish to construct more differential modular forms and prove Hida type results in these setting. I wish to define U_p operator for the differential modular forms. In future joint work with Baskar Balasubramanyam and Dipramit Majumdar, we wish to understand the cohomological interpretation of the Hasse invariant. More specifically, we wish to generalize the recent work of Reduzzi by producing congruence using relation in the Grothendieck ring of $Gsp_4/\mathbb{F}_p$. This will produce mod p eigen system for Siegel modular forms of genus 2. In other work on p-adic modular forms, I wish to study Exceptional zero conjecture. These are analogue of the BSD conjecture for the p-adic settings.

- **Modular motives**: In the first two publications listed above, we answered a question of Ribet about ramifications of endomorphism algebras of modular motives and give complete descriptions of the class of these endomorphism algebras in terms of the slopes of functorial lifts of

the automorphic representations π_f, under finiteness hypothesis on these slopes. I wish to extend the results to endomorphism algebras of other motives. As an immediate goal, I wish to understand endomorphism algebras of modular abelian varieties over totally real fields as constructed by S. W. Zhang under the Jacquet-Langlands type hypothesis.

4. Teaching at IISER Pune

- Spring 2014 MTH 420 (Algebraic Number Theory)
- Fall 2014 MTH 430 (Modular forms). I introduced this course at IISER Pune.

5. Service to IISER Pune

- I am in the library committee and the fifth year project committee.
- I am organizer of the number theory symposium of the 29th Ramanujan mathematical society meeting at the IISER, Pune.
- I am the organizer of the Pune-Mumbai number theory seminar and the number theory seminar at the IISER, Pune.
- I am in the fifth year Research advisory committee of Mr. Shiva Chidambaram and Mr. Nishad Mandlik.

6. Service to Mathematical Community; Mentoring and Outreach Activities

- Supervising the summer project of Mr. Gopinath Sahoo (elliptic curves and modular forms) and Mr. Akash Ghevade (elementary number theory).
- Supervised the fifth year honours thesis of Ms. Jessie Hutchison at the ANU.
- Referee for papers in *Documenta Mathematica*, *Proceedings of the American Mathematical Society*, *Journal of Number Theory*.

7. Awards, Grants, Citations

- I got a grant to visit MPIM, Bonn for 9 months starting from January 2013.
- I received the Australian Research Council Discovery Fellowship for 2 years.
- I was selected for the programme "ARCUS", an Indo-French exchange program under the French ministry. Under the programme, I visited the Department of Mathematics, University of Paris, Orsay with full fellowship.
- I attended "Galois Quater on p-adic Hodge Theory", IHP, Paris, March 2010 with a scholarship from the organizer.

Diganta Borah

Area of Specialization: Several Complex Variables
Position at IISER Pune: Assistant Professor
Date of Joining: December 24, 2013

1. Academic Experience

2005–2010: Ph.D. from IISc Bangalore; Supervisor: Kaushal Verma
2010–2011: Research Associate, IISc Bangalore
2012-2013: IISER Fellow, IISER Pune
2013 Fall: INSPIRE Faculty Fellow, IISER Pune
24-Dec-2013 to date: Assistant Professor, IISER Pune

2. Select Publications

- Remarks on the metric induced by the Robin function II, **Michigan Mathematical Journal** 62 (2013), 581–630.
- (With Kaushal Verma) Remarks on the metric induced by the Robin function, **Indiana University Mathematics Journal** 60 (2011), 751–802.

3. Ongoing Research Projects

- Geodesic spirals of the Robin metric: In this project, I have proved the existence of geodesic spirals of the Robin metric on a strongly pseudoconvex domain whose universal cover is infinitely sheeted. This work was motivated by the work of Gregor Herbort on the Bergman metric. The preprint-in-preparation would be ready for circulation by June 2014.

- Boundary behaviour of geodesics of the Robin metric: In his breakthrough article, "The Bergman kernel and biholomorphic mappings of pseudoconvex domains", Charles Fefferman proved that a biholomorphic mapping between two strongly pseudoconvex domains extends smoothly up to the boundary. A key idea in the proof is that a geodesic of the Bergman metric on a strongly pseudoconvex domain, that starts very close to the boundary with initial velocity along the normal direction, can be extended smoothly up to the boundary. In this long project, I was trying to prove a similar extension result for the Robin metric. However, towards the end of the project, I found that this work cannot progress unless we prove a conjecture by Norman Levenberg and Hiroshi Yamaguchi about the regularity of the normalized Robin function. They proved that the normalised Robin function is C^2-smooth up to the boundary and conjectured that it is C^∞-smooth up to the boundary. I am now planning to prove this conjecture.

- (With Sushil Gorai and G.P. Balakumar) Boundary behaviour of invariant volume forms: The aim of this project is to generalise some results of Daowei Ma on invariant volume forms on strongly pseudoconvex domains. By adapting a scaling technique of D. D. Thai and N.V. Thu, we are trying to obtain similar results on a pseudoconvex domain near a point of finite type at which the Levi co-rank is 1.

4. Teaching at IISER Pune

- Fall 2012: Analysis-I for Ph.D. students
- Spring 2013: Complex Analysis for 3rd year BS-MS students; student evaluation score: 4.2/5.0
- Fall 2013: Analysis for 3rd year BS-MS students; student evaluation score: 4.7/5.0
- Spring 2014: Multivariable Calculus for 1st year BS-MS students; student evaluation score: 4.0/5.0

5. Service to IISER Pune

- I am a member of the undergraduate committee of the Mathematics department at IISER Pune.

6. Service to Mathematical Community; Mentoring and Outreach activities

- Minor thesis advisor for Yasmeen Akhtar, Rohit Joshi
- Invited talks at Annual Foundation School (AFS) III in 2013 and 2014

7. Awards, Grants, Citations

- INSPIRE Faculty Award, 2013

Krishna Kaipa

Area of Specialization: Coding Theory
Position at IISER Pune: Assistant Professor
Date of Joining: June 23, 2014

1. Academic Experience
2009 Ph.D. University of Maryland, Topological charge of real finite gap sine-Gordon solutions, Sergey Novikov and Niranjan Ramachandran
Past July 2009-June 2012: Assistant Professor (contract), IIT-Bombay
Past July 2012-June 2014: Assistant Professor, IISER Bhopal
Past June 2014-present: Assistant Professor, IISER Pune

2. Select Publications
- (with Peter Grinevich) Multiscale limit for finite-gap solutions of the sine-Gordon equation and the calculating of topological charge by theta functional formulas. **Proceedings of the Steklov Institute of Mathematics** 266 (2009), no. 1, 4958
- (with Sudhir Ghorpade) Automorphism groups of Grassmann codes. **Finite Fields and Their Applications** 23 (2013), 80102.
- (with Harish Pillai) Weight spectrum of codes associated with the Grassmannian G(3, 7)., **IEEE Transactions on Information Theory** 59 (2013).
- An asymptotic formula in q for the number of [n, k] q-ary MDS codes. **IEEE Transactions on Information Theory** (2014, accepted)

3. Ongoing Research Projects

- **Number of MDS codes/arcs in Galois geometries**: We are working on improving our previous results on the bounds as well as asymptotic formulas for the number q-ary MDS codes of length n and dimension k.

- **Codes associated to the Lagrangian Grassmannian**: In this project we study linear codes associated the Symplectic (or isotropic) Grassmannian $LG(k, 2n)$ of k dimensional isotropic subspaces of a $2n$ dimensional symplectic vector space. We have corrected the formula for the dimension of this code appearing in literature and are working on determining the minimum distance.

- **Higher weights of Grassmann codes**: The geometric version of this problem is to study the number of $\mathbb{F}_q$ rational points of linear sections of the Grassmannian in the projective space given by the Plücker embedding. Only very few of the higher weights are known in literature. We have determined a few more and are working on determining more of these.

- **Normality of hyperplane sections of the Grassmannian**: In this project we try to prove that the singular locus of any hyperplane section of the Grassmannian (in the Plücker embedding) has codimension at least two. Using such a result we try to prove that all these hyperplane sections are normal varieties.

4. Teaching at IISER Pune: (IISER Bhopal)

- MTH505 Differentiable Manifolds and Lie groups (Spring 2014)
- MTH101 Calculus (Autumn 2013) Freshman course (150 students)
- MTH406 Differential Geometry (Spring 2013)
- MTH605 Topology I (Autumn 2012) Ph.D. course
- Courses at IIT Bombay: 400 level: ODEs (twice), Complex Analysis. 500 level: Theory of Analytic functions. 100 level: Freshman Linear Algebra (500 students)

5. Service to Mathematical Community; Mentoring and Outreach Activities

- Refereeing work for the journal *IEEE Transactions on Information Theory*
- Advisor for 5th year BS-MS student Aranya Lahiri for the final year thesis (at IISER-Bhopal)
- Outreach talks for 10th grade students (at IISER-Bhopal)

6. Awards, Grants, Citations, Invited Talks

- Co-investigator of DST-RFBR Indo Russia Project INT/RFBR/P-114: *Algebraic Varieties over Finite Fields and Linear Error Correcting Codes*
- Invited talks in 2013: Arithmetic/Coding theory seminar at Independent University of Moscow, Novikov seminar at Moscow state university, Int'l Conference on Algebraic Geometry and Coding theory at IIT-Bombay

Kaneenika Sinha

Area of Specialization: Analytic Number Theory
Position at IISER Pune: Assistant Professor
Date of Joining: December 20, 2012

1. Academic Experience

2006 Ph.D. Queen's University, Canada; Supervisor: M. Ram Murty
2006-2008, Postdoctoral Fellow, University of Toronto Mississauga
2008-2010, Postdoctoral Fellow, Pacific Institute of Mathematical Sciences and University of Alberta
January -May 2011, Postdoctoral Fellow, Mathematical Sciences Research Institute, Berkeley
2010-2012, Assistant Professor, IISER Kolkata
2012-present, Assistant Professor, IISER Pune

2. Select Publications

- (with Alina Bucur, Chantal David, Brooke Feigon, Matilde Lal´ın)Distribution of zeta zeroes of Artin-Schreier curves, **Mathematical Research Letters** 19 (2012), no. 6, 1329–1356.
- (with Matilde Lal´ın)Higher Mahler measure for cyclotomic polynomials and Lehmer's question, **Ramanujan Journal** 26 (2011), no. 2, 257–294.
- (with M. Ram Murty) Effective equidistribution of eigenvalues of Hecke operators, **Journal of Number Theory**, Vol. 129, No. 3 (2009), 681-714.

3. Ongoing Research Projects

- (with Sudhir Pujahari) The Sato-Tate conjecture, originally stated as a law about the distribution of the number of points of an elliptic curve over finite fields as we vary the fields, can also be interpreted in the language of modular forms. For a fixed N and k, it predicts the distribution of the p-th Fourier coeffcients of a normalized newform of weight k and level N as we vary primes p. In previous research work, I have studied quantitative versions of the vertical analogues of the Sato-Tate conjecture, that is, for a fixed prime p, the equidistribution of families $a_{f_i}(p)$ of the p-th Fourier coeffcients of normalized newforms f_i as we vary k and N. Together with Sudhir, I am currently investigating multidimensional analogues of the above equidistribution results.

- (with Baskar Balasubramanyam) Let f be a cuspidal eigenform of weight k and level N. Let a_p denote the pth Hecke eigenvalue. The normalized eigenvalue $a°_p = a_p/p^{(k-1)/}$ lies in the interval $[-2, 2]$. A theorem of Serre from the 90s says that as k and N vary over positive integers with k even and N coprime to p these normalized eigenvalues are equidistributed with respect to a measure μ (which depends only on p). Knightley and Li have generalized this result to Hilbert modular forms. In this more general setting, we are interested in finding explicit bounds on the discrepancy between the number of eigenforms with normalized eigenvalues in a specific subinterval of $[-2, 2]$ and the expected value.

- (with Henryk Iwaniec) Let f and g run over all normalized newforms of wt 2, level N, let $\otimes$ denote the Rankin-Selberg convolution and let $L(f \otimes g, s)$ denote the corresponding L-function. We are currently investigating the proportion of $(f, g) \in S^*_2(N) \times S^*_2(N)$ for which $L(f \otimes g, s)$ does not vanish at the central point $s = 1/2$, where $S^*_2(N)$ denotes the set of normalized newforms of weight 2 and level N.

4. Teaching at IISER Pune

- MTH 621, Analysis II (Spring 2013): A course in Complex Analysis for Ph.D. students in Mathematics
- MTH 413, Measure Theory and Integration (Autumn 2013): A course in Measure Theory for BS/MS students in Semester 7

- MTH 621, Analysis II (Spring 2014): A course in Complex Analysis for Ph.D. students in Mathematics

5. Service to IISER Pune

- Co-organizer, Number Theory Seminar, September-December, 2013
- Member of Mathematics Ph.D. Committee, September 2013-January 2014
- Member of Mathematics Undergraduate Committee, February 2014-present
- Member of Departmental Exchange Programmes Committee, September 2013-present
- Member of Local Organizing Committee for the Annual Meeting of the Ramanujan Mathematical Society, to be held from June 23 to 27, 2014 at IISER Pune
- Faculty Coordinator, IISER Pune Career Development Center, September 2013-May 2014
- Member, Committee for Student Activities, May 2014-present

Pranay Goel

Area of Specialization: Mathematical Biology
Position at IISER Pune: Assistant Professor
Date of Joining: February 24, 2009

1. Academic Experience

1998–2003: Ph.D. University of Pittsburgh, The use of maps in the analysis of networks of coupled neuronal oscillators, Ph.D. Advisor: G. B. Ermentrout, Ph.D. Co-advisor: R. D. Coalson

2003–2006: Postdoctoral Researcher, Mathematical Biosciences Institute (MBI), The Ohio State University, Mentors: James Sneyd and Avner Friedman

2006–2008: Research Fellow, Laboratory of Biological Modeling, NIDDK, U.S. National Institutes of Health, Mentor: Arthur Sherman

2009–till date: Assistant Professor, Indian Institute of Science Education and Research Pune, India

2. Select Publications

- Rashmi Kulkarni, Jhankar Acharya, Saroj Ghaskadbi and Pranay Goel, Thresholds of oxidative stress in newly diagnosed diabetic patients on intensive glucose-control therapy, **PLoS ONE**, (in press, 2014).
- Pranay Goel and Anita Mehta, Learning theories reveal loss of pancreatic electrical connectivity in diabetes as an adaptive response, **PLoS ONE**, (2013), 8(8): e70366
- Pranay Goel and Arthur Sherman, The Geometry of Bursting in the Dual Oscillator Model of Pancreatic beta-cells, **SIAM Journal on Applied Dynamical Systems (SIADS)**, (2009), 8(4), 1664-1693.
- Pranay Goel, Arthur Sherman, and Avner Friedman, Multiscale Modeling of Electrical and Intracellular activity in the Pancreas: The Islet Tridomain Equations, **SIAM Multiscale Modeling and Simulation**, (2009), 7(4), 1609-1642.
- Erin R. Higgins, Pranay Goel, Jose L. Puglisi, J. L., Donald M. Bers, Mark Cannell, and James Sneyd, Modeling Calcium Microdomains using Homogenisation, **Journal of Theoretical Biology**, (2007), 247(4), 623-44.
- Pranay Goel, James Sneyd, and Avner Friedman, Homogenization of the Cell Cytoplasm: The Calcium Bidomain Equations, **SIAM Multiscale Modeling and Simulation**, (2006), 5(4), 1045-1062.
- P. Goel and B. Ermentrout, Synchrony, stability, and firing patterns in pulse-coupled oscillators, **Physica D**, (2002), 163(3-4), 191216.

Impact: My papers have been cited a total of 367 times (270 of which are since 2009) as reported by Google Scholar (July 2014). My h–index is 6 and i10–index is 6. Two papers, (g) and one other, have each been cited more than a 100 times, while paper (e) is 'highly saved' (metric from Impactstory) and paper (b) is 'highly viewed' (statistics from PLoS).

3. Ongoing Research Projects

- Quantitative characterization of oxidative stress in type 2 diabetes. This is a long-term collaboration with Saroj Ghaskadbi of the University of Pune. We are working on the (relatively novel) hypothesis that oxidative stress is important in the development of diabetes. Not only does this have fundamental implications for our understanding of the disease but we have also uncovered interesting clinical applications aimed at a better management of antidiabetic therapy. This work was begun at IISER Pune and has resulted in 2 papers and a grant (see below) so far. A Ph.D. student in my lab, R. Kulkarni, also carries out biological experiments in this connection.

- Physiological modeling of glucose–stimulated insulin secretion. We work with some of the most advanced mathematical models of the insulin-secreting pancreatic islets of Langerhans. This is work that was begun with my postdoc mentor, Arthur Sherman, at NIH and we continue to pursue it. Recent work in this direction is being carried out with postdoc Amlan Barua.

- Mathematical models of the progression to diabetes. Recently, we have been interested in exploring models that can be used to study the development of diabetes. Few such models exist at the moment. This is work together with Arthur Sherman.

4. Teaching at IISER Pune
- Mathematical Biology, Spring 2014; Freshman Calculus, Fall, 2013 (Student feedback rating: 4.6/5); Mathematical Biology, Spring 2013; Ordinary Differential Equations, Spring 2012; Linear Algebra, Fall 2011; Dynamical Systems, Spring 2011; Mathematical Biology (Graduate Course), Fall 2010; Introduction to Scientific Computing, Spring 2010; Mathematical Modelling, Spring 2010; Mathematical Biology, Fall 2009

5. Service to IISER Pune
- (Co–)organized several conferences and workshops: (a) IASCT – IISER Pune Workshop on Applications of Bayesian Statistics in Clinical Trials and Biology, Pune, Novemeber 16, 2013; (b) National Conference on Nonlinear Systems and Dynamics (NCNSD 2012), Pune, July 12–15, 2012; (c) International Conference on Mathematical and Theoretical Biology, Pune, India, January 23–27, 2012; (d) IISc – IISER Pune Workshop and Symposium on Mathematical Physiology, Indian Institute of Science Education and Research, Pune, India, January 15–23, 2011; (e) CCMB – IISER Pune – NCL National Symposium on Theoretical and Mathematical Biology, Indian Institute of Science Education and Research, Pune, India, October 10–11, 2009; (f)Co-organizer: IISc International Conference on Mathematical Biology, Indian Institute of Science, Bangalore, India, July 4 -7, 2011; (g) Designed and run a mathematical biology course for several years, both at undergraduate as well as graduate levels; (h) Served in the institute's Library Committee.

6. Service to Mathematical Community; Mentoring and Outreach Activities
- (a) Contribute to the development a local and national level network for Mathematical Biology. In Pune we have an active local network of mathematical biologists who meet each month to discuss latest developments. The national level programme has evolved into a full fledged National Network for Mathematical and Computational Biology. I maintain its website at www.iiserpune.ac.in/ nnmcb, and help coordinate the activities of the Pune Node; (b) Reviewed for PLOS Computational Biology, Journal of Theoretical Biology, SIAM Journal on Applied Dynamical Systems, Biophysical Journal, Journal of Computational Neuroscience, Indian Journal of Pure and Applied Mathematics, American Mathematical Society Mathematical Reviews and others
- (a) Mentoring Postdoctoral Research Associate Dr. Amlan Barua; (b) Advisor for Ph.D. student Rashmi Kulkarni, who is currently finishing four years with me; (c) Advisor for MS theses : (i) Varun Karamshetty. Will soon join INSEAD, Fontainebleau, France; (ii) Ankita Sharma; (iii) Ankit Diwedi. Currently pursuing Ph.D. at Universit´e Montpellier 2 with an Erasmus Mundus scholarship (Svagata program). Has a student paper under my guidance: Ankit Dwivedi; Sponsor: Pranay Goel, A Stochastic Version of the Pedersen-Sherman Insulin Secretion Model, SIAM Undergraduate Research Online (SIURO), (2014), vol. 7, http://dx.doi.org/10.1137/12S011994; (iv) Anand Pathak. Currently pursuing Ph.D. at the Institute for Mathematical Science, Chennai; (v) Mentoring various (over half a dozen) summer interns and research project students.

7. Grants, Invited Talks

- Recently (2013) awarded a Department of Biotechnology grant (INR 6.5 million) to study the "Quantitative characterization of threshold behavior of oxidative stress towards the development of insulin resistance", jointly with Saroj Ghaskadbi of the University of Pune.

  Since joining IISER Pune I have given over two dozen talks in national and international fora. Please see my CV for more details.

Rabeya Basu

Area of Specialization: Classical Algebraic K-Theory
Position at IISER Pune: Assistant Professor
Date of Joining: August 2, 2010

1. Academic Experience

2007 Ph.D. Tata Institute of Fundamental Research, Mumbai
   Title of the thesis: Results on Classical Algebraic K-Theory, Supervisor: Prof. Ravi A. Rao
January-July, 2007 Postdoctoral position, Harish Chandra Research Institute, Allahabad
August, 2007-March, 2008; Postdoctoral position, Indian Statistical Institute, Kolkata (as an NBHM Postdoctoral Fellow)
April 2008-July 2010 Assistant Professor, IISER Kolkata

2. Select Publications

- R. Basu, Ravi A. Rao & R. Khanna; On Quillen's local-global principle. **Commutative Algebra and Algebraic Geometry** (Bangalore, India, 2003), Contemp. Math. 390, Amer. Math. Soc., Providence, RI, 2005.
- R. Basu, Raja Sridharan; An Exposition: On Forster's conjecture and related results. **Pb. University Research Journal (Sci.)**, Vol. 57, 2007, pp 13–66.
- A. Bak, R. Basu & Ravi A. Rao; Local-global principle for transvection groups. **Proceedings of the American Mathematical Society** Vol. 138 (2010), 1191–1204.
- R. Basu, Ravi A. Rao; Injective stability for K1 of regular rings. **Journal of Algebra** Vol. 323 (2010) 367–377.
- R. Basu; Absence of torsion for NK1(R) over associative rings**; Journal of Algebra and Its Applications** Vol. 10, No. 4 (2011) 793–799.

3. Ongoing Research Projects

- (Submitted) We have established an analog of Quillen-Suslin's local-global principle for the general quadratic and the general Hermitian groups. It has been proved that the structure of the K_1 group of the general Hermitian is nilpotent-by abelian, which generalizes the previous results of A. Bak, N. Vavilov, R. Hazrat.

- The aim of this paper is to show that to establish K_1 stabilization of the general quadratic groups of quadratic modules (or any other classical type groups), it is enough to study the problem for the free module case, by using the local-global principle for the transvection subgroup of the general quadratic groups.

4. Teaching at IISER Pune

- Linear Algebra, BS-MS year I
- Vector Spaces, Rings and Modules, BS-MS year III
- Group Theory, BS-MS year III
- Galois Theory, BS-MS year IV
- Basic Commutative Algebra, Graduate Course
- Advanced Linear Algebra, Graduate Course
- Elementary Number Theory, BS-MS year III
- Algebraic Topology, BS-MS year IV

5. Service to IISER Pune

- Served in curriculum evaluation committee
- Served in mathematics seminar committee
- At present in library committee
- At present in summer program committee

6. Service to Mathematical Community; Mentoring and Outreach activities

- M.Sc. Thesis advisor for Integrated BS-MS programme at IISER Pune. Student: Mr. Anuj More. Currently at Indian Institute of Technology, Kanpur, as a senior research scholar. He was a 12th rank holder in CSIR-UGC JRF/NET Exam in 2011.
- Refereed papers for International Journals.
- Proofreading, typing and editing: (1) Commutative Algebra by M.P. Murthy (2) Commutative Algebra by N.S. Gopalkrishnan.

7. Awards, Grants, Citations

- Visiting fellowship, University of Bielefeld, Germany, July 1–20, 2011
- Research grant funded by DST for Indo-Russian collaboration, October 10–21, 2011
- POMI (St. Petersburg Department of Steklov Mathematical Institute Russian Academy of Sciences), October 2011
- AGMP (The 7th Algebra Geometry Mathematical Physics International Conference), Mulhouse (France), October 2011
- Visiting fellowship, University of Bielefeld, Germany, June–July, 2012
- K-Theory Conference, Chinese Academy of Sciences, Beijing, September 2013
- DST–INSPIRE CAMP-2014 at Jaysingpur (Kolhapur), Maharashtra, January 5, 2014
- Department of Mathematics, Central Michigan University, USA, on April 29 and 30, 2014
- Emory University, Atlanta, USA, on May 2, 2014
- Invited participant (with full support) for the workshop on "Projective modules and A1-homotopy theory" held from May 5 to 9, 2014, at American Institute of Mathematics (AIM), Palo Alto, California, USA

A. Raghuram
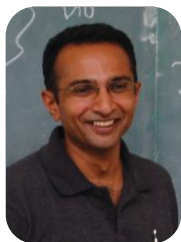
Area of Specialization: Number Theory & Representation Theory
Position at IISER Pune: Professor and Coordinator for Mathematics
Date of Joining: December 26, 2011

1. Academic Experience

2001 Ph.D. from TIFR, University of Mumbai; Supervisors: Dipendra Prasad and M. S. Raghunathan
1999–2001: Postdoctoral Fellow, University of Toronto, Canada
2001–2002: Postdoctoral Fellow, TIFR, Mumbai
2003 Spring: Visiting Assistant Professor, Purdue University, USA
2003–2006: Visiting Assistant Professor, University of Iowa, USA
2006–2011: Assistant Professor (tenure track), Oklahoma State University, USA
2011 Fall: Associate Professor (with tenure), Oklahoma State University, USA
26-Dec-2011 to date: IISER Pune

2. Select Publications

- (With Harald Grobner) On the arithmetic of Shalika models and the critical values of L-functions for $GL(2n)$. With an appendix by Wee Teck Gan. **American Journal of Mathematics** 136 (2014) 1–54.
- (With Chandrasheel Bhagwat) Ratios of periods for tensor product motives. **Mathematical Research Letters** 20 (2013) No. 4, 615–628.
- (With Günter Harder) Eisenstein Cohomology and ratios of critical values of Rankin-Selberg L-functions. **C. R. Math. Acad. Sci. Paris** 349 (2011), no. 13-14, 719–724.
- On the special values of certain Rankin-Selberg L-functions and applications to odd symmetric power L-functions of modular forms. **International Mathematics Research Notices** 2010, no. 2, 334–372.
- (With Freydoon Shahidi) On certain period relations for cusp forms on $GL(n)$. **International Mathematics Research Notices** 2008, Art. ID rnn 077, 23 pp.

For a complete list of publications go to https://sites.google.com/site/math4raghuram/home

3. Ongoing Research Projects

- (With Günter Harder) We study rank-one Eisenstein Cohomology for GL_n over a totally real field and use this to prove rationality results for ratios of critical values for Rankin-Selberg L-functions. The key idea is to interpret Langlands's constant term theorem in terms of the cohomology of arithmetic groups. An announcement of early versions of our results was published in 2011; see the third entry under "select publications." The long version of the paper will be submitted for publication in 2014.

- (With Baskar Balasubramanyam) A famous theorem of Hida says that if a prime p divides the algebraic part of the value at $s = 1$ of the adjoint L-function attached to a modular form f then there is another modular form g which is congruent to f modulo this prime p. This was generalized to various GL_2-contexts by Eknath Ghate, Mladen Dimitrov, Eric Urban and Namikawa. In this project we have proved such a result for automorphic forms on GL_n over any number field generalizing all the previous results on the theme. Our preprint-in-preparation should be ready for circulation later in 2014.

- (With Ronnie Sebastian) The aim of this project is to refine and generalize some results of Michael Harris on the special values of L-functions attached to Hilbert–Siegel modular forms; this will be done by studying the coherent cohomology of Shimura varieties attached to GSp_4 over a totally real field.

- (With Chandrasheel Bhagwat) This project is in parallel to the above project with Harder. We seek to study Eisenstein cohomology for certain classical groups with a hope to study the arithmetic

property of Langlands *L*-functions, with an emphasis especially on those *L*-functions which are not captured by the work with Harder.

4. Teaching at IISER Pune

- Fall 2012: Topology-I for Ph.D. students
- Fall 2013: Linear Algebra for 2nd year BS-MS students; student evaluation score: 4.8/5.0

5. Service to IISER Pune

- As Coordinator for Mathematics, some of the major tasks I have accomplished:
  - Faculty appointments and promotion; since I joined IISER, the mathematics faculty strength has nearly doubled.
  - Setting up the graduate program; since I joined IISER, the number of Ph.D. students has gone up from 3 to 21.
  - A complete overhauling the undergraduate mathematics curriculum.
- I serve on many institute level committees: Curriculum Committee, Committee on Faculty and Research, Academic Ethics Committee, Academic Committee, Senate, and the Board of Governors.
- Represented IISERs in the "Young Researchers Meet" in Stanford in 2012 to attract young Indian talent to return to India.

6. Service to Mathematical Community; Mentoring and Outreach Activities

- Referee work for journals such as: *Inventiones Mathematicae*, *American Journal of Mathematics*, *Compositio Mathematicae*, *International Mathematics Research Notices*, etc
- Made a documentary "The Genius of Srinivasa Ramanujan." Hosted world-wide screenings: Max Planck-Institut für Mathematik, Bonn, Germany; Universite Paris 13, Villetaneuse, France; and the Joint Mathematical Meeting of AMS and MAA in Baltimore, USA
- Advising Ph.D. students: Rohit Joshi, Makarand Sarnobat, and Gunja Sachadeva
- Advising 5th year project student: Punya Satpathy; he is going to U. Michigan for his Ph.D.

7. Awards, Grants, Citations, Invited Talks

- 2011–2013: Alexander von Humboldt Fellowship for experienced researchers.
- Since joining IISER, I have given invited talks on my research at several places: Max Planck Institut für Mathematik, Germany; University of Cologne, Germany; University of Göttingen, Germany; Mathematisches Forschungsinstitut Oberwolfach, Germany; Universite Paris 13, Villetaneuse, France; University of Maryland, USA; American University, USA; IIT Kanpur; IIT Bombay; TIFR Mumbai; IMSc. Chennai; Kerala School of Mathematics, Kozhikode; Legacy of Ramanujan Conference, Delhi University.

Rama Mishra

Area of Specialization: Knot Theory
Position at IISER Pune: Associate Professor
Date of Joining: August 3, 2007

1. Academic Experience

1994 Ph.D. from Indian Institute of Technology, Bombay, Supervisor: Akhil Ranjan
1994-1996 Postdoctoral position, Mehta Research Institute, Allahabad
1996-1998 Postdoctoral position, Indian Statistical Institute, Delhi
March 1998-December 1999 Assistant Professor, Indian Institute of Technology, Kharagpur
January 2000-January 2007 Assistant Professor, Indian Institute of Technology, Delhi
August 2006-July 2007 Visiting Assistant Professor; Boise State University, Boise, Idaho, USA
August 2007-till date Associate Professor, IISER Pune

2. Select Publications

- Nodal Parity Invariants for Knotted Rigid Vertex Graphs, **Journal of Knot Theory and its Ramifications**, Vol. 22, Issue 4, joint with Louis H Kauffman, 2013.
- Knot theory in understanding proteins, **Journal of Mathematical Biology**, December 2012, Volume 65, Issue 6-7, pp 1187-1213, joint with Shantha Bhushan.
- Polynomial Unknotting and Singularity Index, to appear in **Kyungpook Mathematical Journal**, 2013.

3. Ongoing Research Projects

- (With Louis Kauffman) A rigid vertex 4-valent graph (briefly, an RV4 graph)is a 4-valent graph whose vertices are replaced by rigid 2-disks or 3-balls. By a (possibly) knotted RV4 graph we mean an embedding of a RV4 graph into $\mathbb{R}^3$. Such a graph is said to be unknotted if the embedding is rigid vertex isotopic to an embedding of the graph in the plane. It is desirable to look for invariants for RV graphs which are easy to find and can detect the properties of the graphs. We are trying to find a way of grouping the nodes in many classes based on properties that are preserved under *rigid vertex isotopy* and replace each type of node by different tangles so that we obtain much more refined and stronger invariants. We hope that any strong invariant for oriented rigid vertex graphs will be useful in the *classification of Protein folds*.

- (With Alan Durfee and Don O'Shea) We are interested in looking at algebraic parametrization of all knots in $\mathbb{R}P^3$. Using similar approximation theorems as in the case of polynomial knots, we can prove that all of them can be realized as projective closure of maps given by rational functions. I am working on the explicit parametrization of these knots.

- (With Hitesh Raundal) We study the topology of the space of polynomial knots defined by the map $t \to (f(t),g(t),h(t))$. If deg $f = d_1$, deg $g = d_2$ and deg $h = d_3$ then the triple (d_1, d_2, d_3) is called the degree sequence of the polynomial knot. We can assume that deg $f <$ deg $g <$ deg h. We are interested in observing difference in the topology on these spaces by putting various restriction on the degree of the polynomials f, g and h. In particular we would like to estimate the minimal polynomial degree of few knots and use this to infer few important knot invariants.

4. Teaching at IISER Pune

- Abstract Algebra and Matrix Theory, Fall 2007
- Introduction to Real analysis, Spring 2008
- Analysis on $\mathbb{R}^n$, Fall 2008
- Special topics in Analysis, Topology , spring 2009
- Measure Theory and Integration ,Coordinated and tutored Linear Algebra, Fall 2009

- Introduction to Real Analysis, Spring 2010
- Functional Analysis, Fall 2010
- Multivariable Calculus, Spring 2011
- Algebraic Topology, Spring 2012
- Calculus I-Fall 2012
- Point Set Topology, Spring 2013
- Topology I (Ph.D. Course), Fall 2014
- Point Set Topology, Spring 2014

5. Service to IISER Pune

- Member of fifth year project committee: 2010 onwards
- Member of faculty hiring committee
- Resident warden of IISER hostel: 2009 onwards
- Member of Senate at IISER Pune: 2011-2014
- Member of Disciplinary Committee at IISER Pune: 2011 onwards
- Member of COSA, 2013-2014
- Member of Women Cell at IISER Pune: 2011 onwards
- Member of Student Welfare Committee at IISER Pune: 2011 onwards
- Member of counseling committee at IISER Pune: 2012 onwards

6. Service to Mathematical Community; Mentoring and Outreach Activities

- Coordinated the mathematics section in Scifest organized by students at IISER Pune, 2010
- Have been a judge in Mimamsa, an all-India Science quiz for Science / Engineering / Medical undergraduates, IISER Pune, 2009-2012
- Organized a month long workshop and lectured also, for post graduate students from across India. Annual Foundation School level 1, funded by NBHM Dec 2011
- Invited speaker at KVPY Camp, IISER Pune, 2009
- Organized a symposium Indian Women and Mathematics, funded by NBHM, at Indian Institute of Science Education and Research, July 2013
- Member of Organizing Committee and Scientific Committee for the Advanced School and Discussion Meeting on Knot Theory and its applications, funded by ICTS, at IIT Ropar and IISER Mohali, India, Dec 2013
- Member of Math Reviews

7. Awards, Grants, Citations

- Mentor for Dr. Shantha Bhushan under DST grant for Women mathematicians, 2010-2012

Ronnie Sebastian

Area of Specialization: Algebraic Geometry
Position at IISER Pune: INSPIRE Faculty Fellow
Date of Joining: April 25, 2013

1. Academic Experience

2011 Ph.D. TIFR, Mumbai; Supervisors: V. Srinivas and Indranil Biswas
August 2011 to February 2012 Postdoctoral position at IMSc, Chennai
March 2012 to November 2012 Postdoctoral position at Humboldt University, Berlin, in the group of Gavril Farkas
December 2012 to April 2013 Visiting Scientist at Indian Statistical Institute, Bangalore
April 2013 to present INSPIRE Faculty Fellow, IISER Pune

2. Select Publications

- Smash nilpotent cycles on abelian 3-folds, joint with Bruno Kahn, **Mathematical Research Letters**, 2009, 1007-1010
- Torelli theorems for moduli of logarithmic connections and parabolic bundles, **Manuscripta Mathematica** 136, 249-271, 2011
- Smash nilpotent cycles on varieties dominated by products of curves, **Compositio Mathematica** 149 (2013), 1511-1518
- On the rationality of some moduli spaces of vector bundles, joint with Indranil Biswas -**Proceedings of Indian Academy of Sciences, Mathematical Sciences** Volume 123, Number 2, May 2013, pp. 213-223(11)
- Smash nilpotent cycles on 3-folds and 4-folds, Preprint

3. Ongoing Research Projects

- Degenerating modified diagonal cycles (with Prof. Ramesh Sreekantan, Indian Statistical Institute, Bangalore) -A result of Collino says that if we degenerate the Ceresa cycle, then we get nontrivial higher Chow cycle. Recently, Jaya Iyer and Stefan Muller-Stach have proved some results concerning degenerating the modified diagonal cycle on a triple product of curves to get examples of higher Chow cycles. An earlier work of mine uses modified diagonal cycles on n-fold products of curves. It would be interesting to see how these degenerate and whether they give some interesting elements in the higher Chow groups.

- Special Values of L-functions (with Prof. A. Raghuram) -This project involves proving a Shimura type result on the critical values of regular algebraic cuspidal automorphic representation of $GSp_4(\mathbb{A}_F)$ for a totally real number field F. Shimura gives a description of how critical values of L-functions associated to certain Hilbert modular behave when acted on by $\sigma \in Aut(\mathbb{C})$, and we are trying to prove similar results in the case of $GSp_4(\mathbb{A}_F)$.

4. Teaching at IISER Pune

- Fall 2013, MTH412 Differential geometry -A course for BS/MS students in Semester 7
- Spring 2014, MTH 620 Algebra 2 -Course for Ph.D. students in Semester 2

5. Service to IISER Pune

- Co-organizer, the mathematics seminar at IISER Pune
- Member, MRAC committee

6. Service to Mathematical community; Mentoring and Outreach Activities

- Resource person for Annual Foundation School-2, May 2014
- Talks in the representation theory seminar and number theory seminar at IISER, Pune; Expository talks on representation theory of the Lie algebra sl(2, C) at IISER, Trivandrum

7. Awards, Grants, Citations

- TIFR Alumni Association Best Thesis Award
- IMU-Einstein Foundation Postdoctoral Fellowship to visit Berlin for 9 months
- DST INSPIRE Fellowship
- Invited talks at Ramanujan Mathematical Society meet at IISER Trivandrum

Soumen Maity

Area of Specialization: Discrete Mathematics and Combinatorics
Position at IISER Pune: Associate Professor
Date of Joining: July 23, 2009

1. Academic Experience

2002 Ph.D. from Indian Statistical Institute, Kolkata; Supervisor: Prof. Bimal K. Roy
Feb 2002-Aug 2002: Postdoctoral Fellow, Lund University, Sweden
September 2002 -April 2003: NBHM Postdoctoral Fellow, IIM Calcutta
May 2003-December 2003: Postdoctoral Fellow, University of Ottawa, Canada
January 2004 -May 2007: Assistant Professor, Indian Institute of Technology, Guwahati
May 2007 -July 2009: Assistant Professor, Indian Institute of Technology, Kharagpur
July 2009 -Dec 2012: Assistant Professor, Indian Institute of Science Education & Research, Pune
Dec 2012 onwards: Associate Professor, Indian Institute of Science Education & Research, Pune

2. Select Publications

- Maity, S., Chrisil Arackaparambil, and Kezhasono Meyase, A new construction of resilient Boolean functions with high nonlinearity, **Ars Combinatoria**, Vol. 109, 2013, 171-192.
- Maity, S., 3-Way software testing with budget constraints, **IEICE Trans. Information and Systems**, Vol. E95-D, No. 9, 2012, pp. 2227-2231.
- Akhtar Y. and Maity, S., Mixed covering arrays on hypergraphs, **Communications in Computer and Information Science**, Vol. 305, 2012, pp. 327-338.
- Maity, S. and Maitra, S., Minimum distance between bent and 1-resilient Boolean functions, **Ars Combinatoria**, Vol. 97, 2010, pp. 351-375.
- Maity, S., Nayak, A., and Ramsundar, S., Characterization, testing and reconfiguration of faults in mesh networks, **INTEGRATION, the VLSI Journal**, Vol. 40, 2007, pp. 525-535.
- Maity, S., Nayak, A., and Roy, B.K., Characterization of catastrophic faults in two-dimensional reconfigurable systolic arrays with unidirectional links, **Information Processing Letters**, Vol. 92 (4), 2004, pp. 189-197.
- Maity, S., Nayak, A., and Roy, B.K., On characterization of catastrophic faults in two-dimensional VLSI arrays, **INTEGRATION, The VLSI Journal**, Vol. 38, 2004, pp. 267-281.
- Maity, S., Roy, B.K., and Nayak, A., On enumeration of catastrophic fault patterns, **Information Processing Letters**, Vol. 81(4), 2002, pp. 209-212.

3. Ongoing Research Projects

- (With Yasmeen Akhtar) *A covering array of size N, degree k, order g and strength t is a k × N array with* entries from a set of g symbols such that in any $t \times N$ subarray every $t \times 1$ column occurs at least once. Covering arrays have been studied for their applications to hardware and software testing. We study explicit constructions and give constructive upper bounds for the size of a covering array of strength three.

- (With Jaikumar Radhakrishnan and Yasmeen Akhtar) We consider a generalization of covering arrays that allows mixed orders as well as a hypergraph structure that specifies the interactions that need to be tested. Let k and N be positive integers, and let G be a 3-uniform hypergraph with k vertices $v_1, v_2, ..., v_k$ with respective vertex weights $g_1 \leq g_2 \leq ... \leq g_k$. *A mixed covering arrays of strength three on 3-uniform hypergraph G is a k × N array such that row x corresponds to vertex v_x, cells in row x are filled with elements from* $\mathbb{Z}g_x$ *and every triple of rows x, y, z corresponding to a hyperedge* $\{v_x, v_y, v_z\}$ in G has every possible triple from $\mathbb{Z}g_x \times \mathbb{Z}g_y \times \mathbb{Z}g_x$. The number of columns in such array is called its size. Given a weighted 3-uniform hypergraph G, a strength three mixed covering array on G with minimum size is called optimal. We study upper and lower bounds on the size of strength three mixed covering arrays on 3-uniform hypergraphs based on hypergraph homomorphisms. We construct optimal strength three mixed covering arrays on 3-uniform hypertrees, interval, cycle hypergraphs, etc.

4. Teaching at IISER Pune

- Fall 2009: Probability and Statistics, and Introduction to Algorithms; Spring 2010: Cryptography; Fall 2010: Probability and Statistics; Spring 2011: Discrete Mathematics; Fall 2011: Introduction to Algorithms; Spring 2012: Graph Theory; Fall 2012 & 2013: Discrete Mathematics-I for Ph.D. students Spring 2013 & 2014: Discrete Mathematics-II for Ph.D. students

5. Service to IISER Pune

- As Associate Dean for Graduate Studies, we (dean and myself) manage the BS-MS dual degree programme of the institute, including all issues connected with courses, examinations, degree, attendance and academic leave.
- I serve on many institute level committees: Senate, Academic Committee, Committee on Graduate Studies, Women's Cell, Semester Committee II (chair), Course and Evaluation Committee (chair), Ph.D. Committee (Maths).

6. Service to Mathematical Community; Mentoring and Outreach Activities

- Advising Ph.D. students: Yasmeen Akhtar (started in January 2011) and Pralhad Shinde (started in January 2012)
- 5th Year Project Students Supervised at IISER Pune: Reshma C. Chandrasekharan (ongoing), Sourajit Basu, Kumar Vasu Mitra, Ankur Pariwal, Ruchi Gupta, Navi Prasad, Gourav Chauhan, Local Coordinator for Avi Prasanna, Kapil Kumar Gupta, R. Vinay Yadav
- Minor Thesis Supervised: Gunja Sachdeva and Sudhir Pujahari
- Referee work for journals such as: International Journal of Parallel, Emergent and Distributed Systems, IEICE Trans. Information and Systems, Journal of Mathematical Cryptology
- Program committee / organizing committee member for NSC 2013 at IIT Jodhpur, ICMC 2013, IWMS 2012 at IISER Thiruvananthapuram, Pan Asian Number Theory workshop and conference 2012 at IISER Pune, Indocrypt 2008 at IIT Kharagpur, IPSA 2007 at Canada
- Ph.D. thesis examiner for the thesis entitled "Communication schemes using visual cryptography and CRT", 2014, University of Hyderabad

7. Awards, Grants, Citations, Invited Talks

- I have given talks on my research at several international conferences / workshops: IWMS 2012; ISSRE 2009; Indo-French workshop on Cryptology 2007 (invited talk), ICDCN 2006, ICDCIT 2006, IWDC 2004, FSE 2004, Indocrypt 2002.
- Development of Video Course on Regression Analysis (Completed in 2012), Sponsor: MHRD, Govt. of India. For more details visit http://nptel.iitm.ac.in
- Development of Web Course on Regression Analysis (Ongoing), Sponsor: MHRD, Govt. of India

Steven Spallone

Area of Specialization: Representation Theory, Number Theory
Position at IISER Pune: Associate Professor
Date of Joining: July 2012

1. Academic Experience

June 2004 Ph.D. in Mathematics, University of Chicago. Thesis Title: "Arthur's Trace Formula for SO(5) and Individual Discrete Series Matrix Coeffcients", Thesis Adviser: Robert Kottwitz
Fall 2012-present Associate Professor, IISER Pune
Fall 2011-Spring 2012 Visiting Scientist, TIFR
Fall 2008-Spring 2011 Visiting Assistant Professor, University of Oklahoma
Fall 2005-Spring 2008 Research Assistant Professor, Purdue University
Fall 2004-Summer 2005 Postdoctoral Fellow, Max-Planck Institute

2. Select Publications

- "Similarity of matrices over local rings of length two" (with Amritanshu Prasad and Pooja Singla), **Indiana University Mathematics Journal**, to appear.
- "Stable Trace Formulas and Discrete Series Representations", **Pacific Journal of Mathematics** 256 (2012), no. 2, 435-488.
- "Local Analytic Conjugacy of Semi-hyperbolic Mappings in two variables, in the non-archimedean setting" (with Adrian Jenkins), **International Journal of Mathematics** 23 (2012), no. 6, 1250059, 21 pp.
- "Residues of Intertwining Operators for SO(6) as Character Identities" (with Freydoon Shahidi), **Comp. Math**. 146 (2010), no. 3, 772-794.
- "Stable Discrete Series Characters at Singular Elements", **Canadian Journal of Mathematics** 61 (2009), no.6, 1375-1382.
- "Residues of Intertwining Operators for Classical Groups", **International Mathematics Research Notices** (2008), article ID rnn 056, 37 pages.

3. Ongoing Research Projects

- Residues of Intertwining Operators, with Arnab Mitra, Freydoon Shahidi, and Sandeep Varma. We study the residues of intertwining operators on reductive groups vis-a-vis the norm correspondence between a unipotent radical and Levi subgroup of a parabolic subgroup. This project originated with Shahidi and Goldberg-Shahidi.

- Stable Trace Formulas and Traces of Hecke Operators. We study a formula of Kottwitz, which seems to express the traces of Hecke operators in terms of orbital integrals and asymptotic values of discrete series characters, refining a formula of Arthur.

4. Teaching at IISER Pune

- Algebra I, Ph.D. level, Fall 2012
- Intro to Proof, Spring 2013
- PDEs, Fall 2013
- ODEs, Spring 2014

5. Service to IISER Pune

- Math Day 2014 Coordinator
- Mimamsa (IISER Pune Science Quiz) Judge, 2013, 2014
- IISER Pune Hostel Warden, 2013-14 academic year
- Faculty Adviser, Pune Jugglery club

6. Service to Mathematical Community; Mentoring and Outreach Activities

- Supervised BS-MS reading projects: Sameer Kulkarni, Shiva Chidambaram
- Workshop for INSPIRE students, May 2014, speaker
- Popular Science Talk, Exciting Science Group, Sept. 2013, speaker
- Co-organizer, Representation Theory Seminar, Fall 2013

7. Awards, Grants, Citations, Invited Talks

- Mumbai-Pune Number Theory Seminar, IIT Bombay, April 2014, Speaker
- Popular Talk, IISER Bhopal, Nov. 2013, Speaker
- Workshop on Ramanujan Graphs, Univ. Pune, March 2013, Speaker

Supriya Pisolkar

Area of Specialization: Number Theory
Position at IISER Pune: Assistant Professor
Date of Joining: December 26, 2013

1. Academic Experience

2010, Ph.D. from Harish-Chandra Research Institute-Allahabad, Supervisor-Chandan Singh Dalawat
Oct 2009-Oct 2011, Postdoctoral Fellow at TIFR, Mumbai
Oct 2011-Oct 2013, N.B.H.M. Postdoctoral Fellow at TIFR, Mumbai
Oct 2013-Dec 2013, Visiting faculty at Center for excellence in Basic Science, Mumbai University
Dec 2013 to date, Assistant Professor at IISER Pune

2. Select Publications

- The Chow group of zero-cycles on certain Châtelet surfaces over local fields **Indag. Math. (N.S.)** 19 (2008), no. 3, 427–439.
- On the cohomology of Witt vectors of p-adic integers and a conjecture of Hesselholt. (Joint with A. Hogadi)-**Journal of Number Theory** 131 (2011), no. 10, 1797–1807.
- Equi-characteristic analogue of Hesselholt's conjecture on cohomology of ring of Witt vectors. (Joint with A. Hogadi) -**Acta Arithmetica** 158 (2013), no. 2, 165–171.
- Commesurability and representation equivalent arithmetic lattices. (Joint with C. Bhagwat and C. S. Rajan) Appeared online in **International Mathematical Research Notices (IMRN)**

3. Ongoing Research Projects

- (With C. S. Rajan): For i = 1, 2, consider the absolutely almost simple algebraic groups G_i and the compositum say F_i of splitting fields of the characteristic polynomials of the strongly regular elements of Zariski dense subgroups Γ_i w.r.t. the adjoint representation of G_i. We consider the question of how different are these fields depending upon the structure of the corresponding Weyl groups. The questions are in analogy to the work of Gopal Prasad and A. S. Rapinchuk, where they consider the corresponding question for fields generated by lengths of closed geodesics on Riemannian locally symmetric spaces.

- (With Chandrasheel Bhagwat): We are looking at the question about the co-compactness of two lattices in an absolutely almost simple real algebraic groups given that these lattices are characteristically equivalent -the notion that we have introduced in our previous work with C. S. Rajan.

4. Teaching at IISER Pune

- Spring 2014: Introduction to proofs-Second year BS-MS students

- Fall 2014: Will be teaching Group Theory-Third year BS-MS students

5. Service to IISER Pune

- I am serving on various committees at IISER Pune-Colloquium and Seminars committee, Research Profile committee, Dining committee.

6. Service to Mathematical Community; Mentoring and Outreach Activities

- I am one of the organizers and speakers of series of lectures in Analysis Seminar.
- I am supervising a Summer project in Number theory of a second year BS-MS student.
- I was one of the judges in Mimamsa Competition.

Tejas Kalelkar

Area of Specialization: Low-dimensional Topology
Position at IISER Pune: Assistant Professor
Date of Joining: December 2, 2013

1. Academic Experience

February 2010 Ph.D. from Indian Statistical Institute, Supervisor: Siddhartha Gadgil
November 2008 to June 2010 Postdoctoral Fellow, Institute of Mathematical Sciences, Chennai, India
September 2010 to May 2013 Chauvenet Postdoctoral Fellow, Washington University in St Louis, USA
December 2013 to present Assistant Professor, IISER Pune

2. Select Publications

- (With Rachel Roberts) Taut foliations in surface bundles with multiple boundary components; arXiv:1211.3637, Accepted in **Pacific Journal of Mathematics**
- (With Siddhartha Gadgil) A Chain complex and Quadrilaterals for normal surfaces; **Rocky Mountain Journal of Mathematics**, Volume 43, Number 2, 2013
- Incompressibility and normal minimal surfaces, **Geometriae Dedicata**, Volume 142, Number 1 / October, 2009
- Euler characteristic and quadrilaterals of normal surfaces, **Proceedings Mathematical Sciences, Indian Academy of Science**, Volume 118, Number 2 / May, 2008

3. Ongoing Research Projects

- (With Rachel Roberts) A codimension-1 foliation of a 3-manifold is called taut if there exists a simple closed curve that intersects each leaf of the foliation transversely. A surface-bundle over a circle has an obvious taut foliation given by the fibers. In our recent paper we showed that this fiber structure can be perturbed to taut foliations that realize all boundary slopes in a neighourhood of the boundary slopes of the fiber. This shows, in particular, that Dehn-filling a surface-bundle along slopes sufficiently close to the slope of the fiber produces closed 3-manifolds which also have taut foliations. In the case of a surface bundle with pseudo-Anosov monodromy, we are now attempting to pin down such an interval explicitly expressed in terms of the slope of the fiber.

- A Heegaard splitting of a closed 3-manifold M is a closed embedded surface S in M such that $M \setminus S$ consists of two handlebodies. Every 3-manifold has a Heegaard splitting. All known examples of 3-manifolds with infinitely many irreducible Heegaard splittings have splittings of the form $H + nK$ where H is a fixed splitting surface, nK is n parallel copies of an incompressible surface K and where addition denotes their Haken sum. Using branched surface techniques developed by Tao Li, an ongoing project is to prove a weaker version of this observation. In particular, we attempt to show that whenever a 3-manifold has infinitely many irreducible Heegaard splittings, infinitely many of them are of the form $H + K_n$ where H is a (fixed) Heegaard splitting surface and K_n are incompressible surfaces all carried by a fixed branched surface B.

4. Teaching at IISER Pune

Spring 2014: Topology -II for Ph.D. Students

5. Service to IISER Pune
- Am a co-organizer for math seminars/colloquium
- Am on the Research Advisory Committee of a Ph.D. Student (Hitesh Raundal)
- Guided the Minor Thesis of a Ph.D. Student (Makarand Sarnobat)
- Organized the RMS Symposium on "Topology and Geometry of Surfaces"

6. Service to Mathematical Community; Mentoring and Outreach Activities

- Referee for the American Mathematical Monthly
- Reviewer for Zentralblatt MATH
- Reviewer for MathSciNet

7. Awards, Grants, Citations

Since accepting my job at IISER Pune I have given invited talks on my research at: Indian Statistical Institute-Kolkata, Indian Institute of Technology-Kharagpur, Indian Statistical Institute-Delhi

Vivek Mohan Mallick

Area of Specialization: Algebraic Geometry
Position at IISER Pune: Assistant Professor
Date of Joining: August 3, 2012

1. Academic Experience

Ph.D. in 2008 from TIFR under Prof. V. Srinivas
Postdoctoral fellow during 2008-2010 at IMSc
Postdoc during 2010-2012 at Centre de Recerca Matematica, Barcelona

2. Select Publications

- Dubey, Umesh V.; Mallick, Vivek M. Reconstruction of a superscheme from its derived category, **Journal of the Ramanujan Mathematical Society**, Vol27, no4(2012),411–424
- Dubey, Umesh V.; Mallick, Vivek M. Spectrum of some triangulated categories. **Journal of Algebra** 364 (2012), 90–118.
- Mallick, Vivek Mohan. Roitman's theorem for singular projective varieties in arbitrary characteristic. **Journal of K-Theory** 3(2009), no. 3, 501–531.

3. Ongoing Research Projects

- (With Dr. Umesh Dubey) Tensor triangulated categories crop up in various fields of mathematics and they carry a lot of structure. In a series of papers, Paul Balmer has studied the geometry associated with such categories. In a recent paper he has studied the notions of separability and degree of separable ring objects in such categories. In this project, we are trying to extend these notions to tensor differential graded (dg) categories.

- (with José Ignacio Burgos) Hodge numbers for toric varieties had been computed for toric varieties by Danilov and Khovanskii. In this project, we are trying to study the hodge numbers of T-varieties of complexity one, that is variety admitting an effective torus action by a torus. Here complexity one refers to the assumption that the dimension of the torus is one less than the dimension of the variety.

- (with Amit Hogadi) Very recently I have started working on a project on motivic cohomology with Dr. Amit Hogadi. We are studying motivic cohomology over possibly non-perfect fields.

4. Teaching at IISER Pune

- Spring 2014 : MTH103 : Introduction to Computing
- Fall 2013 : MTH312 : Elementary Geometry
- Spring 2013: MTH622 : Topology II (Graduate Course)
- Fall 2012 : MTH 413 : Differential Geometry

5. Service to IISER Pune

- I was a colloquium coordinator last year.
- I am a member of the departmental IT committee.
- I am also a member of the institute IT committee.
- I am currently a part of the cosmetic committee, whose job is to beautify the department and its surroundings.

6. Service to Mathematical Community; Mentoring and Outreach Activities

- Advising a Ph.D. student : Jatin Majithia
- Co-organized an ATM Workshop on "Algebraic Curves and Riemann Surfaces" along with Prof. Nitin Nitsure, TIFR in IISER Pune from June 03 -June 22, 2013

7. Awards, Grants, Citations

- TIFR Alumni Association: Harish Chandra Memorial Award (2008-9)

S. A. Katre

Professor & Head
Department of Mathematics
University of Pune, Pune

S. A. Katre received Masters degree in Mathematics from University of Pune and Ph.D. from Panjab University, Chandigarh, India. He began his academic career from SP College of Pune and moved to University of Pune in 1988 as a faculty member and has been there since. Prof. Katre's work is in the area of Algebra and Number Theory, in particular, cyclotomy, number of points on curves over finite fields, Waring's problem for matrices, coding theory, and group theory. His pedagogical interests include contributing to mathematics olympiads, open source mathematical software, and e-learning in mathematics. Prof Katre had served as the editor of pedagological journal *Bona Mathematica* and has organized the NBHM sponsored ATM Schools in Mathematics during 2004-2012.

Sujatha Ramdorai

Canada Research Chair, Department of Mathematics
University of British Columbia, Canada

Sujatha Ramdorai obtained her Ph.D. in TIFR/Bombay University in 1992 and was with TIFR till January 2012. She currently holds a Canada Research Chair at the Department of Mathematics, University of British Columbia. Her research interests include Iwasawa theory and the theory of motives. Prof. Ramdorai is a recipient of the Shanti Swarup Bhatnagar Award and the ICTP Ramanujan Award. She was a Member of the National Knowledge Commission and is a Member of the Scientific Advisory Council to the Prime Minister, and also the National Innovation Council. She is also interested in broader educational issues and in policy matters related to Higher Education and Research.

Amlan K. Barua

Area of Specialization: Applied Mathematics
Position at IISER Pune: Postdoctoral Research Associate
Date of Joining: June 20, 2013

1. Academic Experience

2012 Ph.D. Illinois Institute of Technology, Supervisors: Xiaofan Li and Shuwang Li

2. Select Publications

- A. Barua, S. Li, X. Li, J. Lowengrub, Self-Similar of evolution of a precipitate in inhomogeneous elastic media, **Journal of Crystal Growth**, 351, 62-71, 2012
- A. Barua, S. Li, H. Feng, X. Li, An efficient rescaling algorithm for simulating the evolution of multiple elastic precipitates, **Communications in Computational Physics**, 14(4), 940–959, 2013
- H. Feng, A. Barua, S. Li and X. Li, Aparallel adaptive treecode algorithm for evolution of elastically stressed solids, **Communications in Computational Physics** (2013) 15(2), 365–387

3. Ongoing Research Projects

- Understanding functional networks in islets of β-cells -In this work we aim to understand the characteristics the functional network of β-cells in islets of Langerhans. Characterization of such network is important because the functional network controls the emergent activity of the islets, which in turn controls secretion of hormone insulin. Recent experimental works suggest that the networks of β-cell belong to the class of small world networks. We would like to validate this claim through simulations using highly accurate models of β-cells. This is a joint work with Pranay Goel at mathematics department, IISER Pune.

- Solving tridomain equations -In this work we expect to capture the dynamics of Ca^{2+} waves by solving tridomain equations using operator splitting approach. The tridomain equations accurately model the membrane potential and Ca^{2+} dynamics in a continuum of β-cells. This problem is of interest because of its direct relation to the rhythmic contraction of excitable β-cells. This is a joint work with Pranay Goel at mathematics department, IISER Pune.

4. Teaching at IISER Pune

- Teaching assistant for Single Variable Calculus (Math 101), Fall 2013 and Probability and Statistics (Math 202), Spring 2014
- Will teach Ordinary Differential Equations (Math 324) Fall 2014

5. Awards, Grants, Citations

- Givens Fellowship, Summer 2011, Argonne National Laboratory

Dipramit Majumdar

Area of Specialization: Number Theory
Position at IISER Pune: Postdoctoral Research Fellow
Date of Joining: April 11, 2014

1. Academic Experience

2013 Ph.D. from Brandeis University, Supervisor: Joël Bellaïche
July 2013 to April 2014 Postdoctoral position at ISI, Bangalore

2. Preprints

- Geometry of the eigencurve at critical Eisenstein series of weight 2, available at arXiv:1307.4846.
- (With M. Kulkarni and B. Sury) ℓ-Class groups of cyclic extensions of prime degree ℓ, available at arXiv:1404.1813.

3. Ongoing Research Projects

- In the field of Langlands program important progresses have been made concerning automorphic form for definite unitary groups $U(n)$, in most cases, we know the existence of an endoscopic transfer, which takes a sequence (π_1, π_2) of automorphic forms for $U(n_1)$, $U(n_2)$ respectively to an automorphic forms π for $U(n_1+n_2)$. Eigenvariety for definite unitary groups, constructed by Chenevier, is a p-adic family of automorphic forms for $U(n)$. We construct a rigid analytic map between eigenvarieties, which at classical points interpolates endoscopic transfer. This work was done during my thesis, a preprint version will be available soon. In the future I'm planning to look in the case of Base Change.

- (With Somnath Jha and Aprameyo Pal) A functional equation for the characteristic ideal of the 'big' Selmer group $(\mathcal{T}_F/F_{cyc})$ associated to an ordinary Hida family of elliptic modular forms over the cyclotomic $\mathbb{Z}_p$ extension of a general number field F was proved by S. Jha and A. Pal. We hope to generalize and extend their approach for the case of Hilbert modular forms.

- (With B. Baskar and Debargha Banerjee) Reduzzi has given a purely algebraic construction of congruences between quaternionic automorphic forms over totally real fields using relations in the Grothendieck ring of $GL_2/\mathbb{F}_q$. In this project, we hope to generalize this approach to Hilbert-Siegel modular forms by looking for relations in the Grothendieck ring of $Gsp_4/\mathbb{F}_p$.

BS-MS Program

Akash Krishna

- Supervisors: Dr. Anindya Goswami, IISER Pune; Prof. M.K. Ghosh, IISc, Bangalore
- Title: Pricing in a Semi-Markov modulated jump diffusion model

K. Hariram

- Supervisors: Dr. Ayan Mahalanobis, IISER Pune; Dr. Baskar Balasubramanyam, IISER Pune
- Title: Recent advances in the index-calculus attacks on the discrete logarithm problem

Mandlik Nishad Devendra

- Supervisors: Dr. Rabeya Basu, IISER Pune; Dr. Debargha Banerjee, IISER Pune
- Title: Constructive proof of Quillen-Suslin theorem for projective modules

Preeti

- Supervisors: Dr. Ayan Mahalanobis, IISER Pune; Dr. Baskar Balasubramanyam, IISER Pune
- Title: Secret sharing schemes and applications

Reshma C Chandrasekharan

- Supervisors: Dr. Soumen Maity, IISER Pune; Prof. S.A. Katre, University of Pune
- Title: Group construction of converting Arrays

Sanket Nandan

- Supervisors: Dr. Anindya Goswami, IISER Pune; Prof. M.K. Ghosh, IISc, Bangalore
- Title: Statistical inference of Semi-Markov process and application in Finance

Shiva Chidambaram P.

- Supervisors: Prof. A. Raghuram, IISER Pune; Dr. Debargha Banerjee, IISER Pune
- Title: Cohomology of GL(2)

Career Choices of BS-MS Students upon Graduation

Batch 2006

Adimoolam Santhosh Arvind	MTech, IIIT Hyderabad
Ankur Gupta	MBA, Goa Institute of Management
Avi Prasanna	Hey Math, Chennai
Gaurav Chauhan	Hey Math, Chennai
Kapil Kumar Gupta	Zues Numerics, Bangalore
Lakshmi Priya M. E.	Ph.D. Maths; University of Wisconsin, USA
Navi Prasad	Hey Math, Chennai
Shambhavi Vashishtha	MS – Engineering management- Duke University
Rajesh Kumar Yadav	MBA in IIM, Kozhikode
Ruchi Gupta	MBA, Goa Institute of Management
Vivek Anand	MS –Operations Research-Columbia University

Batch 2007

Akshaa B. Vatwani	Queen's University at Kingston, Canada; Ph.D. Maths
Anuj Kumar More	Ph.D. Maths, IIT Kanpur
Anup Mahesh Savale	Not available
Ayesha Fatima	Ph.D. Maths, IISER Pune
H. Guhan Venkat	Ph.D. Maths-Erasmus Mundaus Fellowship CRM, Canada & Bordeaux, France
Jay Jitesh Shah	Project assistant, ISI, Kolkata
Kartik Devdatta Hambardikar	IIM, Indore
Mohammad Zuhair M. M.	Ph.D. Maths, Los Angeles (UCLA), USA
Rahul Kumar	Azim Premji Foundation
Sandeep Suman	Not available
P. Venkata Raghu Tej	NBHM , IMSc, Chennai
R. Vinay Yadav	Hey Math, Chennai

Batch 2008

Hardik Gajera	ISI, Kolkata
Vivek Pradhan	Not Available
Jeeten Patel	Project in Mathematics, IISER Pune
Gaurav Prabhakar Sawant	Ph.D. in Mathematics, IISER Pune
Ankur Paliwal	Junior Content Developer, Hey Math
Kumar Vasumitra Singh	Hey Math

Batch 2009

Ankita Sharma	Appearing for entrance exams to Ph.D. Programs
Ashwin T.A.N	Joining University of Washington, Seattle, USA for Ph.D. in Mathematics
Karamshetty Varun	PhD in Technology and Operations Management, INSEAD
Patil Roshni Namdeo	Continuation of project along with GRE preparation
Punya Plaban Satpathy	Joining University of Michigan, Ann Arbor, USA for Ph.D. in Mathematics
Purvi Tiwari	Applying for Jobs
Sheth Mihir Dilip	Offered admission to IISER Pune Ph.D. Program in Mathematics
Sourajit Basu	Off Campus: Analyst, E&Y, Hyderabad
Tarun Ayitam	Has started his own foundation called "Sciensation"

BS-MS Curriculum

Core Courses in the First Two Years of the BS-MS Program

Very basic mathematics, by which one means the bare minimum that any scientist should be familiar with, is treated in the following six core courses in the first four semesters: Single Variable Calculus, Multi Variable Calculus, Introduction to Computing, Linear Algebra, Probability & Statistics, and Introduction to Proofs.

> *Philosophy is written in that great book which ever lies before our eyes — I mean our universe — but we cannot understand it if we do not first learn the language and grasp the symbols in which it is written. The Book is written in the mathematical language... without which one wanders in vain through a dark labyrinth.* Galileo Galilei

The Ideology behind the Mathematics Program

Mathematics, or at least basic Mathematics, very broadly interpreted, has five themes or subjects: Algebra, Analysis, Geometry & Topology, Discrete Mathematics and Applicable Mathematics. In reality, these subjects seamlessly and indistinguishably blend into each other and such a coarse classification is purely for didactic purposes. The courses in the third and fourth year of the BS MS program as well as the courses for the PhD program are all based on this ideology.

Courses in the Third and Fourth Years of the BS-MS Program

For each of the above themes, there is a sequence of four courses through the four semesters in the third and fourth years. They are as follows:

1. Algebra: Group Theory; Vector Spaces, Rings and Modules; Galois Theory; Algebraic Number Theory

2. Analysis: Analysis (which means basic analysis); Measure Theory & Integration; Functional Analysis; Complex Analysis

3. Geometry & Topology: Elementary Geometry; Point Set Topology; Differential Geometry; Algebraic Topology

4. Discrete Mathematics: Combinatorics & Number Theory; Graph Theory; Algorithms; Cryptography

5. Applicable Mathematics: Statistics; Ordinary Differential Equations; Mathematical Biology; Partial Differential Equations

Suggestions to Students wanting to "Major in Mathematics"

Students wanting to major in Mathematics should choose four out of the above five sequences and go through all the courses in that sequence for a solid foundation in that theme. All the courses in each of these 5 sequences are for 4 credits. Some examples:

1. A student wanting to focus on what is traditionally called Pure Mathematics could choose Algebra, Analysis, Geometry & Topology, and Discrete Mathematics sequences.

2. A student wanting to focus on what is traditionally called Applied Mathematics could choose Analysis, Geometry & Topology, Discrete Mathematics, and Applicable Mathematics sequences.

The above examples are mere suggestions because the epithets of pure and applied are totally artificial: there is nothing impure about applicable mathematics and much of pure mathematics has evolved out of applications.

Some clusters or prerequisites:

1. Applicable Mathematics sequence needs the Analysis sequence.

2. Geometry & Topology sequence can benefit from the Analysis sequence.

3. Discrete Mathematics sequence can benefit from the Algebra sequence.

For more details about prerequisites see the flowchart below and/or the individual course descriptions.
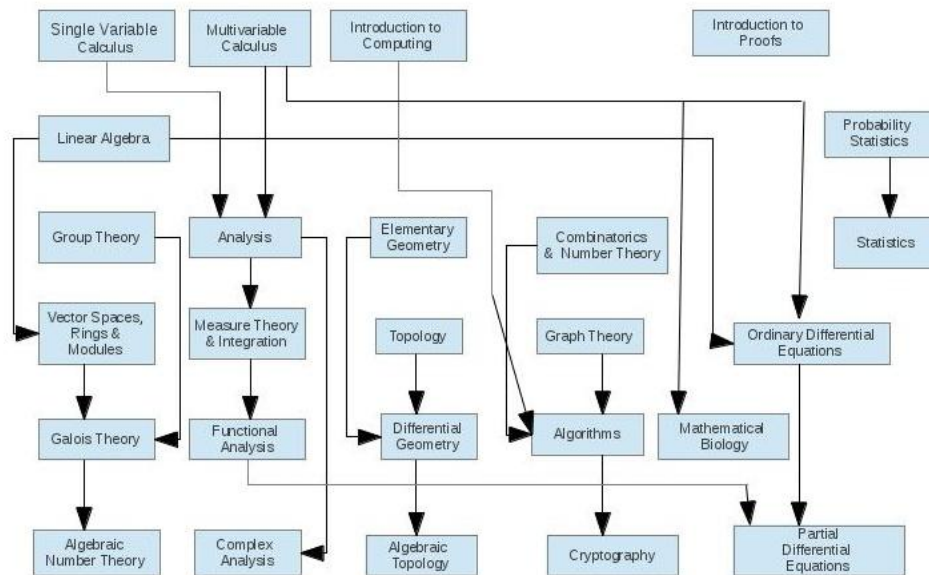
The bottom line: Students should choose sequences based on what excites them the most in Mathematics.

Students also have one reading project course per semester where they can diversify and explore other subjects within mathematics. Reading projects are all for 3 credits.

Based on students' interests, and available faculty, the course structure has the provision for topics courses. For example, one can have a course on "Representation Theory" under "Topics in Algebra", or a course on "Lie Theory" under "Topics in Analysis" in the 7 or 8 semesters. Topics courses will often have certain prerequisites that will be announced by the instructor well ahead of time. All topics courses are for 3 credits.

Students are also required to take courses from at least two different disciplines in their 5 and 6 semesters (= third year).

Students need a minimum of 84 credits in the third and fourth years. For a student majoring in mathematics, we have for each of the four semesters: 4 x 4 + 3 = 19 credits. For four semesters, this adds to 76 credits. The remaining 8 credits may be taken from other disciplines.

List of Courses in the BS-MS Program

Semester I
1.	MTH 100	Introduction to Proofs	[2 credits]
2.	MTH 101	Single Variable Calculus	[3 credits]

Semester II
1.	MTH 102	Multi Variable Calculus	[3 credits]
2.	MTH 103	Introduction to Computing	[3 credits]

Semester III
1.	MTH 201	Linear Algebra	[3 credits]

Semester IV
1.	MTH 202	Probability and Statistics	[3 credits]

Semester V
1.	MTH 310	Group Theory	[4 credits]
2.	MTH 311	Analysis	[4 credits]
3.	MTH 312	Elementary Geometry	[4 credits]
4.	MTH 313	Combinatorics & Number Theory	[4 credits]
5.	MTH 314	Statistics	[4 credits]
6.	MTH 301	Reading Project	[3 credits]
7.	MTH 330	Topics in Algebra	[3 credits]
8.	MTH 331	Topics in Analysis	[3 credits]
9.	MTH 332	Topics in Geometry & Topology	[3 credits]
10.	MTH 333	Topics in Discrete Mathematics	[3 credits]
11.	MTH 334	Topics in Applicable Mathematics	[3 credits]

Semester VI
1.	MTH 320	Vector Spaces, Rings and Modules	[4 credits]
2.	MTH 321	Measure Theory and Integration	[4 credits]
3.	MTH 322	Point Set Topology	[4 credits]
4.	MTH 323	Graph Theory	[4 credits]
5.	MTH 324	Ordinary Differential Equations	[4 credits]
6.	MTH 302	Reading Project	[3 credits]
7.	MTH 340	Topics in Algebra	[3 credits]
8.	MTH 341	Topics in Analysis	[3 credits]
9.	MTH 342	Topics in Geometry & Topology	[3 credits]
10.	MTH 343	Topics in Discrete Mathematics	[3 credits]
11.	MTH 344	Topics in Applicable Mathematics	[3 credits]

Semester VII
1.	MTH 410	Galois Theory	[4 credits]
2.	MTH 411	Functional Analysis	[4 credits]
3.	MTH 412	Differential Geometry	[4 credits]
4.	MTH 413	Algorithms	[4 credits]
5.	MTH 414	Mathematical Biology	[4 credits]
6.	MTH 401	Reading Project	[3 credits]
7.	MTH 430	Topics in Algebra	[3 credits]
8.	MTH 431	Topics in Analysis	[3 credits]
9.	MTH 432	Topics in Geometry & Topology	[3 credits]
10.	MTH 433	Topics in Discrete Mathematics	[3 credits]
11.	MTH 434	Topics in Applicable Mathematics	[3 credits]

Semester VIII

1.	MTH 420	Algebraic Number Theory	[4 credits]
2.	MTH 421	Complex Analysis	[4 credits]
3.	MTH 422	Algebraic Topology	[4 credits]
4.	MTH 423	Cryptography	[4 credits]
5.	MTH 424	Partial Differential Equations	[4 credits]
6.	MTH 402	Reading Project	[3 credits]
7.	MTH 440	Topics in Algebra	[3 credits]
8.	MTH 441	Topics in Analysis	[3 credits]
9.	MTH 442	Topics in Geometry& Topology	[3 credits]
10.	MTH 443	Topics in Discrete Mathematics	[3 credits]
11.	MTH 444	Topics in Applicable Mathematics	[3 credits]

Semester IX-X

MS Thesis

Ph.D. Program

Ayesha Fatima

Date of Joining: August 1, 2013

BS-MS Dual Degree-2012, IISER Pune

Debangana Mukherjee

Date of Joining: August 1, 2013

B.Sc. 2010 University of Calcutta
M.Sc. 2013 Mount Carmel College (Under Bangalore University)

Girish M. Kulkarni

Date of Joining: August 1, 2013

B.Sc. 2008 University of Pune
M.Sc. 2010 Indian Institute of Technology Madras; 2012 University of Western Ontario, Canada

Gunja Sachdeva

Date of Joining: August 1, 2012

B.Sc. 2009 Dayalbagh Educational Institute, Agra
Int M.Sc.-M.Phil 2011, December, Dayalbagh Educational Institute, Agra

- Publications/Current projects: Finished a minor thesis titled "Membership problem in the Bit Probe Model" under the guidance of Dr. Soumen Maity. Currently I am reading the following books with Prof. A. Raghuram: Basic Number Theory -Andre Weil Introduction to Lie Algebras and Representation Theory -James Humphreys
- Teaching/other academic organizational activities: Have done T.A for the past 3 semesters for the courses Multivariate Calculus, Introduction to proofs and Introduction to Computing.

Raundal Hitesh Ramesh

Date of Joining: January 3, 2011

B.Sc. 2005-2008, University of Pune
M.Sc. 2008-2010, University of Hyderabad

- Publications / Current Projects: Minor Thesis: Title : Newton Polyhedra and an Algorithm for Computing Hodge-Deligne Numbers Adviser : Dr. Vivek Mohan Mallick.

- Ongoing Research Projects: My work is mostly concerned with the minimal polynomial representations and the polynomial degree of knots, spaces of polynomial embeddings and their topological properties.

  The main research projects are as follows:

  i)   " Minimal Polynomial Representations of Knots up to Six Crossings " and
  ii) " Topology of the Various Spaces of Polynomial Embeddings (Knots) "

- Teaching / Other Academic Organizational Activities: I was teaching assistant for the following courses.

Course	Semester	Course Coordinator
Introduction to Probability and Statistics	Fall 2011	Dr. Ayan Mahalanobis
Single Variable Calculus	Spring 2012	Dr. Suneeta Vardarajan
Single Variable Calculus	Fall 2012	Dr. Rama Mishra
Introduction to Computing	Spring 2014	Dr. Vivek Mohan Mallick

Jatin Majithia

Date of Joining: August 1, 2012

B.Sc. 2008 Ravajisa Yamasa Kshatriya (RYK) Science College, Nasik
M.Sc 2012 University of Pune

- Publications/Current projects: I did my Minor thesis project with Dr. Anindya Goswami on Black-Scholes model. I also started reading algebraic geometry with Dr. Vivek Mallick. Currently, I am preparing for my Analysis comprehensive exam.

- Teaching/other academic organizational activities: I did TA for Linear algebra in Fall 2013 and Graph theory in spring 2014.

Jyotirmoy Ganguly

Date of Joining: August 1, 2013

B.Sc. 2011 University of Calcutta
M.Sc. 2013 University of Hyderabad

Makarand Sarnobat

Date of Joining: August 1, 2012

B.Sc. 2010 Sir Parshurambhau College, Pune
M.Sc. 2012 Sir Parshurambhau College, Pune

- Publications/Current projects: Finished a minor thesis titled "A topological proof of Grushko's Theorem" under the guidance of Dr. Tejas Kalelkar in which I read a paper of John Stallings which was published in 1965. Currently I am reading the following books with Prof. Raghuram: Introduction to Lie Algebras and Representation Theory -James Humphreys Basic Number Theory -Andre Weil

- Teaching/other academic organizational activities: Have done T.A for the past 3 semesters for the courses Introduction to proofs, Linear Algebra and Multivariate Calculus.

Manidipa Pal

Date of Joining: January 2, 2012

B.Sc. 2008 Jadavpur University, Kolkata
M.Sc. 2011 IIT Bombay, Mumbai

- Publications/Current projects: I have done my minor thesis "Can one hear the shape of a drum?"under the supervision of Chandrasheel Bhagwat. I am currently reading Klingen's book "Introductory Lectures on Siegel modular forms ".

- Teaching/other academic organizational activities: I have been TA for "Introduction to Proofs" (Spring 2013 and Spring 2014) and for "Single Variable Calculus" (Fall 2013).

Milan Kumar Das

Date of Joining: 1st August 2013

B.Sc. 2010 Vidyasagar University
M.Sc. 2012 Vidyasagar University

Neha Prabhu

Date of Joining: August 1, 2012

B.Sc.2010 Stella Maris College, Chennai
M.Sc. 2012 IIT Bombay

- Minor Thesis: Read the following paper: A. Lubotzky, R. Phillips and P. Sarnak, Ramanujan Graphs, Combinatorica, 8(3), 1988. Minor thesis supervisor: Dr. Chandrasheel Bhagwat. Currently reading topics in Representations of Compact Lie Groups under Dr. Steven Spallone.

- Been a Teaching Assistant for the courses Single Variable Calculus, Multivariable Calculus and Introduction to Proofs offered to the BS-MS students.

Prabhat Kumar Kushwaha

Date of Joining: January 2, 2012

B.Sc. 2009 Banaras Hindu University, Varanasi
M.Sc. 2011 Banaras Hindu University, Varanasi

- Publications/Current projects: I have done the minor thesis, titled " Iˆto Calculus Without Probabilities", under Dr. Anindya Goswami. At present, I am trying to obtain more information about "Discrete Logarithm, Diffie-Hellman and Reductions".

- Teaching/other academic organizational activities: I have been Teaching Assistant for the courses "Introduction to Proofs"(Spring sem-2013, Fall sem-2013) and "Multi Variable Calculus" (Spring sem, 2014).

Pralhad Mohan Shinde

Date of Joining: January 2, 2012

B.Sc. 2009 University of Pune
M.Sc. 2011 University of Pune

- Current projects: (with Dr. Soumen Maity) A k-group divisible covering design, a k-GDCD for short is a triple (V, G, B), where V is a set of elements, G is a partition of V into subsets, called groups, and B is a collection of k-subsets of V, called blocks, such that for any $g \in G$ and any $b \in B$, $|g \cap b| \leq 1$, and any pair of elements in V which does not belong to a group is contained in at least one block. A k-GDCD with minimum number of blocks is called optimal. The aim of this project is to construct optimal 5-GDCDs.

- Minor thesis: (with Dr. Anisa Chorwadwala) Extremal first Dirichlet eigenvalue.

- Teaching/other academic organizational activities: I have been teaching assistant for the courses:-Multivariable calculus (Fall semester 2012, Spring semester 2014), Single variable calculus (Fall semester 2013).

Rohit Joshi

Date of Joining: October 1, 2009

M.Sc. Integrated Finished in 2009 from IIT Kanpur

- Publications/Current projects: Finished a minor thesis titled "A Theorem on analytic continuation of functions of several complex variables " under the guidance of Dr. Diganta borah in which I read a paper of S. Bochner which was published in 1938. Currently I am reading the following book and a paper with Raghuram: Automorphic forms and representations -Daniel Bump Representations of the group GL(n,F) where F is a non -archimedean local field -Bernstein And Zelevinskii

- Teaching/other academic organizational activities: Have done T.A for the past 4 semesters for the courses Introduction to proofs, Linear Algebra, measure theory, Calculus of one variable.

Sushil Bhunia

Date of Joining: January 2, 2012

B.Sc. 2008 Jadavpur University, Kolkata
M.Sc. 2010 Jadavpur University, Kolkata

- Publications/Current projects: Finished a minor thesis titled "Whitehead Graphs on Handlebodies" under the supervision of Dr. Anupam Singh. My current project is on "Reality properties of Spin Group".

- Teaching/other academic organizational activities: I have done 2 T.A's for the courses Introduction to proofs and one T.A for the Calculus.
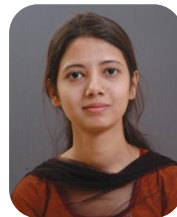
Tathagata Mandal

Date of Joining: August 1, 2013

B.Sc. 2010 Visva-Bharati University
M.Sc. 2012 Visva-Bharati University

Yasmeen Akhtar

Date of Joining: January 3, 2011

B.Sc. 2008 University of Pune
M.Sc. 2010 University of Pune

- Publication: Yasmeen and Maity, S., Mixed covering arrays on hypergraphs, Communications in Computers and Information Science, Vol. 305, 2012, pp. 327-338

- Current projects: Finding optimal covering arrays for different families of hypergraphs. 4-Way Software Testing with Budget Constraints (using group construction). Membership problem in bitprob model.

- Minor thesis: (with Dr. Diganta Borah) Characterization of the unit ball in $\mathbb{C}^n$.

- Teaching assistant for the courses: Linear Algebra (Fall 2011), Multivariable Calculus (Spring 2012), Multivariable Calculus (Fall 2012), Algorithm (Fall 2013).

Structure of the Ph.D. Program

Coursework

Each semester, five courses will be offered during the first year in the following topics:

- Algebra
- Analysis
- Topology
- Discrete Mathematics
- Differential Equations

The minimum requirement is to complete two courses in each semester of the first year (16 credits in total). It is recommended that every student complete a minimum of three of these five courses each semester. At the end of the first year, students must have a CGPA of 6.5 or above in order to continue in the program. Apart from this, students are also encouraged to take a reading project with one of the faculty on a topic of their interest.

Minor Thesis

Students are required to write a minor thesis in their second year. Minor thesis should be in an area other than the intended area of specialization. This thesis should be completed within two months. At the end, the student should give a satisfactory departmental seminar on the topic of his/her thesis.

Comprehensive Examination

Comprehensive exams will be held in July and December every year. After successfully completing their coursework students can attempt this exam. Every student must clear this exam before the end of his or her second year. Each student will get two attempts in each topic and a total of six attempts to do so. After a student has passed the Comprehensive exam he/she must choose a faculty member to be his/her research supervisor.

Annual Evaluations

The research supervisor, in consultation with the Departmental Coordinator, will constitute a Research Advisory Committee (RAC) composed of the supervisor and two additional members (who need not be an IISER Pune faculty) for each student. Students are expected to present an annual report to their RAC for evaluation. The RAC will review research progress of the Ph.D. candidate every year until completion of the degree.

Synopsis

The RAC will also advise the student when to write and submit the thesis. Before writing the thesis, the candidate must prepare a synopsis of his/her thesis and provide a copy to the RAC and to the Dean of Doctoral Studies at IISER Pune.

Final Year Seminar

The student must present a Thesis Seminar before submission of the thesis. This seminar will be a one-hour talk to the Mathematics Department.

Thesis Submission & Validation

Once the thesis is written by the student and subsequently accepted by the IISER Pune Academic Committee (IAC), it will be sent out for peer review to at least two external referees. Referees will be selected by the IAC from a panel of five or more experts suggested by the Ph.D. supervisor, out of which one expert has to be from India.

Thesis Defense

Once the thesis reports are received by IISER Pune and the IAC is in favor of granting a Ph.D. to the candidate, he/she should defend the thesis in presence of a committee that includes one external referee. The thesis

defense is a 45min presentation aimed at a general audience followed by a 45min question and answer session. A successful thesis defense constitutes the final requirement for granting the Ph.D. degree by IISER Pune.

Teaching Assistantship

All students in their 2nd, 3rd or 4th year are expected to assist in teaching one of the undergraduate courses per semester. TA duties include conducting tutorial sessions once per week, correcting assignments/exams/quizzes, and helping to set and invigilate exams/quizzes. This program is aimed at giving Ph.D. students teaching experience, which will be very helpful to them in their future careers. This also benefits the BS-MS students since it provides them with additional help.

Scholarship

All applicants who have been selected through the interview process will be provided with an Institute Research Fellowship if they do not have an external source of funding (like NBHM, CSIR, etc.). All students on the Institute Fellowship are strongly advised to get an external Fellowship as soon as possible after joining IISER Pune.

First Year Courses

The following courses will be offered for first year graduate students. The course description is also given below. This is also the syllabus for the Comprehensive Exam.

1.	MTH 610	Algebra I	[4 credits]
2.	MTH 611	Analysis I	[4 credits]
3.	MTH 612	Topology I	[4 credits]
4.	MTH 613	Discrete Mathematics I	[4 credits]
5.	MTH 614	Differential Equations I	[4 credits]
6.	MTH 601	Reading Project	[3 credits]
7.	MTH 620	Algebra II	[4 credits]
8.	MTH 621	Analysis II	[4 credits]
9.	MTH 622	Topology II	[4 credits]
10.	MTH 623	Discrete Mathematics II	[4 credits]
11.	MTH 624	Differential Equations II	[4 credits]
12.	MTH 602	Reading Project	[3 credits]

MTH 610: Algebra I

Topics: Group Theory: Group Actions, Sylow's theorems, Free Groups and Relations, Composition Series, Vector Spaces, Bilinear Forms, GLn, On and Spn. Modules and Linear Algebra: Free Modules, Algebras, Tensor Product, Multilinear Algebra, Structure Theory of modules over PID, Jordan Canonical forms, Rational Canonical Forms.

MTH 611: Analysis I

Topics: Measures, construction of the Lebesgue measure, measurable functions, integration. Lp-spaces, Hilbert spaces, orthonormal sets, trigonometric series, spectral theorem for compact self-adjoint operators, Banach spaces, Riesz representation theorem, Hahn-Banach theorem, open mapping theorem, closed graph theorem, Fourier series, signed measures, Radon-Nikodym theorem, product measures and Fubini's theorem, Fourier transforms, Fourier inversion theorem, Plancherel theorem.

MTH 612: Topology I

Topics: Basic Homotopy theory: Homotopy of maps; Fundamental group and Covering spaces; The Lifting theorem; Action of the fundamental group on the Fiber; Deck transformations; Properly discontinuous actions; Classification of covering spaces; The Seifert-Van Kampen theorem. Singular Homology: Definition and Examples; Eilenberg-Steenrod axioms for Homology; Homology groups of spheres and corollaries; Computation of degrees; CW complexes; Cellular Homology; Euler-Poincare theorem; Homology groups of projective spaces; The cross product; Excision theorem for singular homology; The Mayer-Vietoris sequence; The Jordan Curve theorem; The Borsuk-Ulam theorem; Simplicial complexes and simplicial maps; Lefschetz-Hopf fixed point theorem. Homological Algebra: Ext and Tor functors.

MTH 613: Discrete Mathematics I

Topics: Set Systems: Representing Sets, Hall's Theorem, Sperner systems, Intersecting set systems, Helly families, Relations, Partially ordered sets, Dilworth's Theorem. Combinatorics: Permutation and Combinations: Permutation of multi sets, Combination of multi sets, The Pigeonhole Principle (strong form), Theory of Ramsey, Generating permutation and combinations, The Inclusion and Exclusion Principles and Applications, Mobius Inversion, Recurrence Relations and (exponential) Generating Functions, Polya Counting. Graph Theory: Eulerian Cycle, Hamiltonian Graph, Matching and Covers, Maximum Bipartite Matching Algorithms, Matching in General Graphs, Tutte's 1-factor Theorem.

MTH 614: Differential Equations I

Topics: Existence and uniqueness of initial value problems. Linear equations. Boundary value problems and Sturm-Liouville theory. Asymptotic behavior of nonlinear systems. Perturbation theory and Poincare-Bendixson theorems. Numerical methods. Introductory bifurcation theory.

MTH 620: Algebra II

Topics: Field Theory: Separable and Normal extensions, Finite Fields, Algebraic and Transcendental extensions, Galois' theorem, Infinite Galois Groups, Hilbert 90. Commutative Algebra: Localization, DVR, Noetherian, Hilbert Basis Theorem, Dedekind domains, Integral extensions, Hilbert's Nullstellensatz, spec of a ring. Homological Algebra: Projective and Injective Modules, Ext and Tor functors, connecting homomorphism.

MTH 621: Analysis II

Topics: Complex analytic functions, Cauchy's integral formula, power series representation, open mapping theorem, Cauchy's theorem, Calculus of residues. Harmonic functions mean value property, Poisson integral, Harnack's principle, Schwarz reflection principle. Maximum modulus theorem, Schwarz lemma, automorphisms of the unit disc. Runge's theorem, simply connected domains, Mittag-Leffler theorem. Conformal mappings, linear fractional transformations, Normal families, Riemann mapping theorem, Weierstrass factorization theorem, gamma function, Riemann zeta function.

MTH 622: Topology II

Topics: Cohomology: Differential forms and deRham cohomology; Stokes' Theorem; Singular cohomology; Universal coefficients theorems; Excision, Homotopy and Mayer-Vietoris for cohomology; Poincare' Lemma and deRham's theorem; The Cross product and the Kunneth formula; Cup and Cap products; Duality theorems, Cech cohomology, Poincare-Alexander-Lefschetz duality; Duality on compact manifolds with boundary; Applications of duality; Example: cohomology rings of projective spaces. Homological Algebra: The Leray-Serre spectral sequence; The Gysin sequence; Example: cohomology of SU(n).

MTH 623: Discrete Mathematics II

Topics: Graph Theory: Cuts and Connectivity: 2-connected Graphs, Menger's Theorem. Planar Graphs: drawing, Euler's Formula, Kuratowski's theorem, plane duality; Coloring: coloring maps and planar graphs, coloring vertices, coloring edges. Algorithms: Asymptotic order of growth: big O notation and its relatives, Divide and Conquer and Recurrences: The master theorem, application to the complexity of recursive algorithms. Data Structures: Priority queues, heaps, queues, stacks, Union-Find. Basic Algorithms: breadth first search, depth first search, DAGs (directed acyclic graphs) and topological ordering, strongly connected components. Greedy Algorithms: interval scheduling, Dijkstra's algorithm for finding shortest paths in a graph, minimum spanning trees, Huffman codes for data compression. Dynamic Programming: weighted interval scheduling, subset sums and knapsacks. Network Flow: Max-Flow Min-Cut and the Ford-Fulkerson algorithm.

MTH 624: Differential Equations II

Topics: First-order equations, methods of characteristics, conservation laws, weak solutions, wave equations, the heat equation, the fundamental solution, diffusion and Brownian motion; Laplace's equation, maximum principle, fundamental solutions, Dirichlet and Neumann problems; Fourier methods.

Events & Activities

## RMS Symposium on Topology and Geometry of Surfaces
June 30–July 7, 2014

Organizers
Ravi Kulkarni, S.A. Katre, A. Raghuram, Tejas Kalelkar

Invited Speakers
Moira Chas (Stonybrook University), Ara
Basmajian(CUNY)

This symposium was part of the 29th Annual
Conference of the Ramanujam Math Society, held in the
week after the conclusion of the main events. It
consisted of a minicourse on "Computer driven
theorems and questions in geometry" by Prof. Moira
Chas and a minicourse on "Identities of Hyperbolic
surfaces" by Prof. Ara Basmajian.
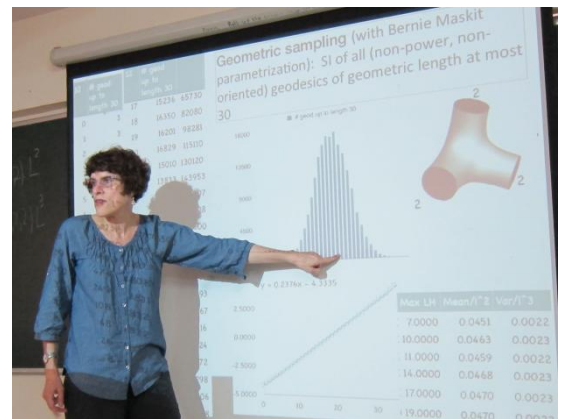
Homepage 29ac.ramanujanmathsociety.org

Annual Meeting of Ramanujan Mathematical Society
June 23-27, 2014

Organizers
(Global) Ramanujan Mathematical Society
(Local) Prof. A. Raghuram, Prof. S.A. Katre, Dr. Anisa Chorwadwala, Dr. Kaneenika Sinha,
Dr.Chandrasheel Bhagwat

Invited Speakers
Prof. Hyman Bass, Prof. V. Suresh, Prof. K. B. Athreya, Prof. S. Weintraub, Prof. Dinesh Thakur, Prof.
G. Rangarajan, Prof. S. Sane, Prof. K. Shiohama, Prof. S. Thangavelu and Prof. Amiya Mukherjee

The Ramanujan Mathematical Society (RMS), founded in 1985, has the main purpose of promoting
Mathematics at all levels. The 2014 annual meeting at IISER Pune was funded by NBHM and was
attended by around 150 people from various places in India with a few speakers and participants
from Japan and USA. There were ten plenary lectures by eminent mathematicians and many
subject-specific symposia in which about 80 mathematicians gave talks and presented papers.

Homepage 29ac.ramanujanmathsociety.org

Number Theory Symposium at the 29th Annual Ramanujan Mathematical Society Meeting
June 23-27, 2014

Organizer
Debargha Banerjee

Invited Speakers
M. Manickam (KSOM), V. G. Narasimha Kumar (IIT,H), Supriya Pisolkar (IISER,P), Baskar
Balasubramanyam (IISER,P), B. Ramakrishnan (HRI), K. Srinivas(IMSC), S. Katre (UoP).

The number theory symposium started this year as part of the annual Ramanujan Mathematical
Society meeting. This conference was supported by NBHM.

Homepage 29ac.ramanujanmathsociety.org

ICTS Program on p-adic Aspects of Modular Forms
June 10-20, 2014

Organizers
Baskar Balasubramanyam, Haruzo Hida, A. Raghuram, Jacques Tilouine

Invited Speakers
(a) For the workshop: R. Sujatha, Jacques Tilouine, Baskar Balasubramanyam, David Geraghty, Mladen Dimitrov, Haruzo Hida, A. Raghuram and Debargha Banerjee
(b) For the advanced discussion meeting: Jeanine van Order, Haruzo Hida, Baskar Balasubramanyam, Olivier Fouquet, Chandrakant Sharma, Giovanni Rosso, Riccardo Brasca, Denis Benois, Mahesh Kakde, David Geraghty, Ming-Lun Hsieh, Devika Sharma, Fabian Januszewski, Eknath Ghate, Tadashi Ochiai, Mladen Dimitrov, Sudhanshu Shekhar, Ashay Burungale, Jacques Tilouine

The aim of this program was to focus on the p-adic aspects of modular forms and related topics. The program consisted of two components, an instructional workshop followed by a discussion meeting. There were seven mini-courses in the workshop that focussed on two broad themes: on p-adic families of automorphic forms with some modularity lifting applications in mind and on the construction of p-adic L-functions in various situations and their applications.

The final part of the program was a three day discussion meeting in which the state of current research in these topics were discussed.

Homepage http://www.icts.res.in/program/PAMF2014
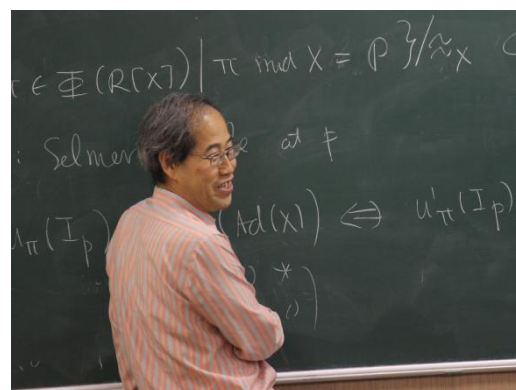
Pune-Mumbai Number Theory Seminar
### April 4-5, 2014

Organizers
Debargha Banerjee, Ravi Raghunathan, Eknath Ghate

Invited Speakers
Jyoti Sengupta (TIFR), Amiya Kumar Mondal(IIT,B), Debargha Banerjee(IISER,P), Steven Spallone(IISER,P), Ravi Raghunathan (IIT,H), C. S. Rajan (TIFR)

The inaugural Pune-Mumbai number theory meeting was organized at the Department of Mathematics, IIT Bombay. The aim of this seminar was to increase collaboration and interaction among the number theorists at IISER Pune, IITB and TIFR. This event has provided an opportunity for young number theorists to interact and collaborate with established mathematicians and is planned to be organized regularly every year/semester.

Homepage https://sites.google.com/site/punebombaynumbertheoryseminar/
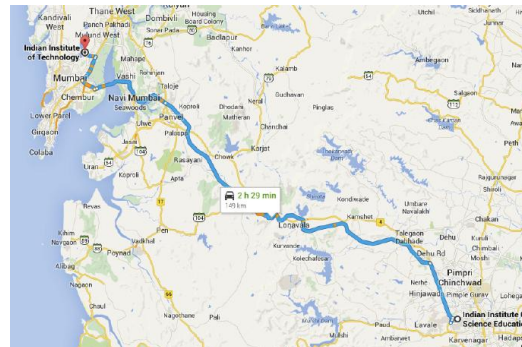
AIS on Classical Groups and Introduction to K-theory
December 5-26, 2013

Organizers
Anupam Singh and Shripad Garge

Invited Speakers
Shripad Garge, Amit Kulshrestha, Anupam Singh, Anuradha Garge, B. Sury, K. N. Raghavan, Upendra Kulkarni, Dipendra Prasad, G. Lusztig, M. S. Raghunathan, Pratyush Chattopadhyay, I. A. Panin

The subject of Classical Groups is a very fundamental topic in mathematics. These are certain groups of matrices or their quotients by small central subgroups, and can be described in terms of linear algebraic objects such as bilinear forms. The terminology is due to Hermann Weyl. Most of the classical groups are subgroups of the Her all embracing majesty, the General linear group GL(n). These groups can be defined over an arbitrary field. Taken over the field of real numbers they provide an important class of examples for Lie groups. As they are defined over arbitrary fields they are natural examples of Algebraic Groups defined over a base field. Studying these groups over finite fields gives rise to finite groups which provide a large number of finite simple groups. In this AIS, the intention was to learn classical groups from the group theoretic point of view in the line with the well known book on Geometric Algebra by Emil Artin.

Homepage https://sites.google.com/site/clgpkt/

IASCT -IISER Pune Workshop on Applications of Bayesian Statistics in Clinical Trials and Biology
November 16, 2013

Organizers
Local Organizers: Jayant Deshpande and Pranay Goel

Invited Speakers
Prof. Madhuchhanda Bhattacharjee, Department of Mathematics and Statistics, University of Hyderabad Dr. Jayanti Gupta, Founder-Parinita,IASCT Treasurer Dr. Debjit Biswas, Vice President Primal Enterprises Ltd; IASCT Vice President

This meeting was organized in collaboration with the Indian Association for Statistics in Clinical Trials (IASCT). It was designed to introduce the participants to Bayesian ideas in science and industry. Speakers stressed, in particular, the application of Bayesian statistics in clinical trials and in biological research. This meeting was, significantly, one of the few Mathematics meetings aimed at bridging the gap between academia and industry.

Indian Women and Mathematics
July 26-28, 2013

Organizers
Rama Mishra, Rabeya Basu and Shantha Bhushan

Invited Speakers
Indira Chatterjee (Univ. Orleans, France), Seema Nanda (TIFR-CAM, Bangalore), Somdatta Sinha (IISER-Mohali),Geetha Venkatraman (Ambedkar Univ., Delhi).

This was a scientific meeting in Mathematics aiming to bring together women students, College and University teachers and researchers, to enable exchange of ideas and provide information.

Homepage https://sites.google.com/site/iwmiiserpune/home

Conference on Groups and Representations
May 24-26, 2013

Organizers Anupam Singh, Shripad Garge

Invited Speakers Maneesh Thakur, Amit Kulshrestha, K N Raghavan, Dipendra Prasad, Preena Samuel, Pratyusha Chattopadhyay, Anirban Bose, Anuradha Ahuja, Pooja Singla, Dilpreet Kaur, Sandip Singh

The conference had expository lectures by experts which introduced the current research in and around Lie Theory. There were also lectures by young mathematicians working in and around the subject of Lie Theory. This Conference was follow up of the workshop on Chevalley groups.

Homepage https://sites.google.com/site/chevalleygroups/conference

AIS on Algebraic Curves and Riemann Surfaces
June 3 -June 22, 2013

Organizers
Prof. Nitin Nitsure, TIFR, and Dr. Vivek Mohan Mallick, IISER Pune

Invited Speakers
Prof. Bhatwadekar, Dr. Amit Hogadi, Dr. Steven Spallone

The workshop was aimed as undergrads and early graduate students. It introduced them to the study of complex curves using complex analytic and algebraic geometric techniques.

Homepage: http://atmschools.org/2013/ais/ac

Workshop on Chevalley Groups
May 13-24, 2013

Organizers Anupam Singh, Shripad Garge

Invited Speakers Anuradha Garge, Shripad Garge, B. Sury, K. N. Raghavan, R. P. Shukla, Maneesh Thakur, Upendra Kulkarni.

In 1955, Chevalley in his seminal paper 'Sur certains groupes simples constructed certain groups starting from semisimple Lie algebras. The idea allowed him to construct certain algebraic groups over arbitrary fields and the Fq points of these groups turned out to be related to (finite) simple groups. The work of Chevalley was further generalised by Steinberg in 1959, Variations on a theme of Chevalley. Here he discovered many previously unknown finite simple groups. Chevalley groups are examples of algebraic groups defined over a base field. In fact, they constitute all semisimple algebraic groups over an algebraically closed field and all semisimple quasi-split groups over a base field. Thus the theory of Chevalley groups helps to understand algebraic groups better via some explicit examples. In another path breaking paper, 'Generateurs, relations et revtements de groupes algbriques', Steinberg described presentations of Chevalley groups and their central extensions, which led to the definition of K2 by Milnor thus opening a whole new chapter in K-theory. The aim of this workshop was to learn the subject following Steinberg's notes 'Lectures on Chevalley Groups'.

Homepage https://sites.google.com/site/chevalleygroups/
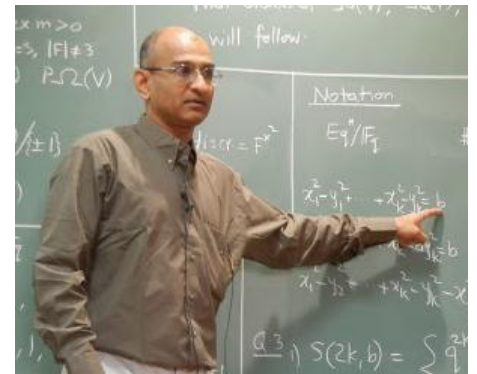
One Day Symposium on Linear Algebra and K-Theory
May 15, 2013

Organizers Ravi A. Rao (TIFR Mumbai), Rabeya Basu (IISER Pune)

Invited Speakers
(a) S.M. Bhatwadekar (Bhaskaracharya Pratisthana, Pune)
(b) R.A. Rao (TIFR Mumbai)
(c) Anuradha Garge (Mumbai University)
(d) Pratyusha Chatterjee (ISI Bangalore)

In the first half of this one-day symposium we highlighted how K-theory is related to linear algebra and module theory. The talks were accessible to graduate students. We had dedicated the afternoon session in honor of Late Amit Roy, a former Professor in the School of Mathematics of Tata Institute.

Indo-French Symposium on Automorphic forms, Galois Representations and L-functions
September, 3-7, 2012

Organizers
A. Raghuram (Indian Coordinator), Jacques Tilouine (French Coordinator), Baskar Balasubramanyam (Local Organizer)

Invited Speakers
U.K. Anandavardhanan, Olivier Brinon, Dipendra Prasad, Chandan Singh Dalawat, Sudhanshu Shekhar, Jean-Marc Fontaine, Rajat Tandon, Ramesh Sreekantan, Benoit Stroh, Ravi Raghunathan, Jacques Tilouine, Sanoli Gun, M. Manickam, R. Thangadurai, C.S. Rajan, Eknath Ghate, Olivier Taibi, Baskar Balasub-ramanyam, Chandrasheel Bhagawat, Laurent Clozel, A. Raghuram, Steven Spallone, Arvind Nair, Jorg Wildeshaus

The symposium discussed the following themes in modern number theory: classical and harmonic aspects of modular forms and automorphic forms, Galois representations, Langlands program, L-function, deformation theory of modular forms and Galois representations, Shimura varieties, p-adic L-functions, p-adic Galois representations and overconvergerent modular forms.

Homepage https://sites.google.com/site/cefipramath2012/
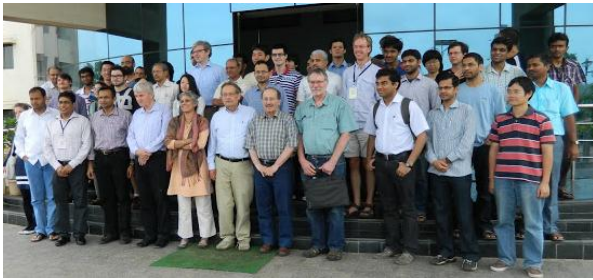
Pan Asian Number Theory Conference
July 23-27, 2012

Organizers
J. Coates, Soumen Maity, A. Raghuram, Anupam Saikia and R. Sujatha

Invited Speakers
A. Raghuram (OSU/IISER Pune), T. Abe (Tokyo), B. Hung (Zurich),
C. Mok (McMaster), C. Rajan (TIFR), D.T. Cuong (Hanoi), C. Khare (UCLA), R. Munshi (TIFR), A. Shiho (Tokyo), M. Furusawa (Osaka), Min Lee (Brown), J. Park (POSTECH), C-F. Yu (Taipei), M-L Hsieh (National Taiwan U.), W-W. Li (Chinese Acad. Sciences), X. Zhu (Harvard)

The Pan Asian Number Theory Conferences are held annually in Asia, with the aim of encouraging collaboration in research amongst Asian number theorists. Previous PANT Conferences have been held in Pohang, Korea (2009), Kyoto, Japan (2010), and Beijing, China (2011). The PANT Conference aims to cover current developments in all major areas of research in Number Theory. Virtually all speakers are of asian origin, with an emphasis on young researchers.

Homepage www.icts.res.in/additional-page/453/

Workshop on Bloch-Kato Conjectures
July 17-21, 2012

Organizers
J. Coates, Soumen Maity, A. Raghuram, Anupam Saikia and R. Sujatha

Invited Speakers
D. Blasius (UCLA), R. Sujatha (UBC), A. Raghuram (OSU/IISER), J. Coates (Cambridge), G. Kings (Regensburg), A. Saikia (IITG), R. Greenberg (Washington), S. Lichtenbaum (Brown)

The aim of the Workshop was to present a detailed proof of the highly important case of Bloch-Kato Conjectures for the values of the Riemann zeta function at the odd positive integers. The special values of the Riemann zeta function have been important in Number Theory since the work of Euler in the eighteenth century. In the 1970's, A. Borel proved that the values at the odd positive integers were linked to K-theory via regulator maps. As an important special case of general conjectures, Bloch and Kato refined Borel's work to give an exact arithmetic formula for these values. This Bloch-Kato conjecture has subsequently been proven with major contributions by Bloch, Kato, Huber, Kings, Soul and Wildeshaus. No self-contained account of this important body of work exists at present in the literature, and we hope to fill this gap. A detailed and comprehensible account of the full proof was presented at the workshop, including as much relevant background material as possible. This workshop was a great opportunity for young researchers and students to acquaint themselves with the current state of the subject.

Homepage http://www.icts.res.in/program/details/289/

National Conference on Nonlinear Systems and Dynamics (NCNSD 2012)
July 12-15, 2012

Organizers
G. Ambika, A. D. Gangal, M. S. Santhanam, Pranay Goel, Prasad Subramanian

The seventh National Conference on Nonlinear Systems and Dynamics (NCNSD2012) was held at IISER Pune.

Homepage http://www.ncnsd.org/next.php

International Conference on Mathematical and Theoretical Biology (ICMTB 2012)
January 23 -27, 2012

Local Organizers
Pranay Goel and L.S. Shashidhara

Invited Speakers
Over 100 speakers attended the meeting

ICMTB 2012 was co-organized by IISER Pune and the Society for Mathematical Biology and supported by several institutes across the country including IISc Bangalore. The meeting was one of the largest gathering of mathematical biologists in the country and international visitors at the time.

National Initiative in Mathematics Education (west zone)
December 26-28, 2011

Organizers
Anupam Singh (Convener), Baskar Balasubramanyam, Soumen Maity, V.M. Sholapurkar, V. V. Acharya, Aditi Phadke

Invited Speakers
Please see the link at webpage

Mathematics -Popularly known as the Queen of All Sciences is a core part of the school curriculum across the world. It is also in the core curriculum for a wide range of basic and professional courses. Many teachers, educators and mathematicians have responded to the challenge of teaching mathematics effectively in diverse ways: some have developed powerful pedagogical approaches or learning materials, some have introduced innovations in their teaching, some have worked with teachers, some with students, and some have taken up research to understand more deeply the teaching and learning of mathematics. To discuss the current status and trends in mathematics education research and in the practice of mathematics teaching at all levels, the International Commission on Mathematical Instruction (ICMI), a constituent of the International Mathematical Union (IMU) has been organizing the International Congress on Mathematics Education (ICME), every four years. The Congress will gather a broad spectrum of participants such as researchers in mathematics education, teacher educators, practicing teachers, mathematicians and others interested in mathematics education. The workshop was part of several such to give feedback to the national presentation from India in ICME.

Homepage https://sites.google.com/site/nimewest/

Annual Foundation School I
December 4-31, 2011

Organizers
Rama Mishra and S.A. Katre

Invited Speakers
Prof. Ravi Kulkarni for Unity of Mathematics Lecture

This is a foundation level course targeted at First year Ph.D. students. Lectures on Algebra, Analysis and Topology were given. Many problem solving sessions were conducted.

IISc-IISER Pune Workshop and Symposium on Mathematical Physiology
January 15 -23, 2011

Local organizers
Pranay Goel and L.S. Shashidhara

Indo-German Workshop on Computational Commutative Algebra
(as a part of AIS School funded by NBHM and IISER Pune)
December 13 – 31, 2010

Organizers Ravi A. Rao (TIFR Mumbai), Rabeya Basu (IISER Pune), Vinay Vagh (IIT Guwahati)

Invited Speakers
(a) Jugal Kishore Verma (IIT Mumbai)
(b) Clare D'Cruz (CMI Chennai)
(c) S.R. Ghorpade (IIT Mumbai)
(d) R.A. Rao (TIFR Mumbai)
(e) Santiago Laplagne (Germany)
(f) Abdenacer Makhlouf (France)
(g) Amitava Bhattacharya (TIFR Mumbai)
(h) Andreas Steenpass (Germany)
(i) Rabeya Basu (IISER Pune)

This workshop is aimed at young scholars working in the field of commutative algebra, algebraic geometry and invariant theory, and young students wishing to learn computational algebra. The main theme of the workshop was Groebner bases and its applications. We have covered basic topics from commutative algebra preparatory to the study of topics like computational commutative algebra, coding theory, convex polytopes, and invariant theory. We will also study the basic applications of the theory of Groebner basis, like solving polynomial equations, integer programming, and coding theory.

Homepage https://sites.google.com/site/rabeyabasu/home/workshop-on-computational-commutative-algebra

One-day Symposium on Algebra
October 2, 2010

Organizer Rabeya Basu

Invited Speakers
(a) Jugal Kishore Verma (IIT, Mumbai)
(b) Clare D'Cruz (CMI, Chennai)
(c) Amitava Bhattacharya (TIFR, Mumbai)
(d) Selby Jose (Ismail Yusuf College, Mumbai)
(e) Anuradha Garge (Mumbai University)
(f) Sarang Sane (IIT Madras)
(g) Mousumi Mondal (IISc Bangalore)

This was a meeting of experts working in commutative algebra with a combinatorial viewpoint. The aim of this event was to give an opportunity for our academic members, research scholars and students of the Institute and the visitors to interact with each other and to learn more about the subjects.

Homepage https://sites.google.com/site/rabeyabasu/home/algebra-symposium

Summer Workshop in Mathematics
July 26-31, 2010

Organizers
Anupam Singh, R. Parthasarathi, Ayan Mahalanobis

Invited Speakers
V. Balaji, T.E. Venkata Balaji, Basudeb Datta, J.K. Verma, B. V. Limaye, Shobha Madan, Jaikumar Radhakrishnan, R. Ramanujam, T. Kavitha, N.M. Singhi, Somesh Bagchi, D.S. Nagaraj

The aim of this workshop was to motivate students (especially undergraduates) to take up Mathematics for research. We invited eminent mathematicians of the country to speak in this workshop.

Homepage http://www.iiserpune.ac.in/~anupam/sw10.html

CCMB -IISER Pune -NCL National Symposium on Theoretical and Mathematical Biology
October 10 -11, 2009

Local Organizers
Pranay Goel and L.S. Shashidhara

Summer Workshop in Mathematics
July 27 - August 1, 2009

Organizers
Anupam Singh, Rama Mishra

Invited Speakers
Ramanan, R. Sujatha, C. S. Dalawat, Raja Sridharan, R. Sridharan, Siddhartha Bhattacharya, Dinesh Thakur, S. A. Katre, Siddhartha Gadgil, P.N.Srikanth, H. Bhate, N. Raja, D. Dhar

The aim of this workshop was to motivate students to take up Mathematics for research. We invited eminent mathematicians of the country to speak in this workshop.

Homepage http://www.iiserpune.ac.in/~anupam/sw.html

Classification of Algebraic Groups
March 9-12, 2009

Organizers Anupam Singh

Invited Speakers
Dipendra Prasad, Shripad Garge, Maneesh Thakur, M. S. Raghunathan

The aim of this meeting was to understand two seminal papers written by the masters of subject one by Borel Sibenthal and other by Borel Tits. These two papers are core to understanding Classification of Algebraic Groups over arbitrary field.

Homepage http://www.iiserpune.ac.in/~anupam/groups.html

Mathematics Day

The pi day (March 14 = 3.14 = approximation to pi) is celebrated in many math departments round the world. Each year IISER Pune celebrates its Mathematics Day in the month of March. We organize lectures, poster presentations, and other fun events centered on mathematics.

The purpose is to get students, teachers and citizens to visit IISER Pune and get exposed to some interesting mathematical activities (both academic as well as fun). In the 2013 version, we had an invited lecture by Prof. Chandrashekhar Khare, the premiere of the movie on Srinivasa Ramanujan by Nandan Kudhyadi and Prof. Raghuram, a talk by Dr. Vivek Mallick and a math quiz competition for college students. There was also a skit 'Life of Pi -4D' directed by Dr. Steven Spallone and his team.

Homepage https://sites.google.com/site/iiserpunepiday/
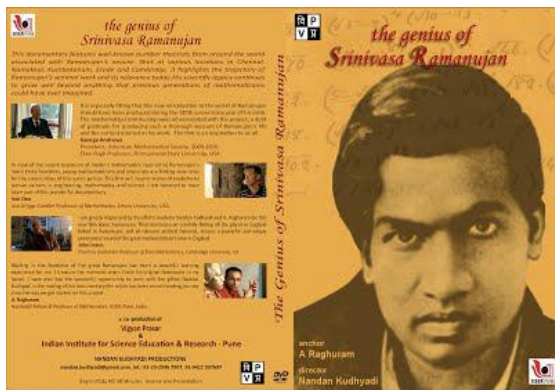
This movie on the life and work of Srinivasa Ramanujan is directed by Nandan Kudhyadi and co-produced by Vigyan Prasar and IISER Pune, and features Prof. Ken Ono, Emory University, USA; Prof. A Raghuram, IISER Pune; Prof. K Srinivasa Rao, IMSc, Chennai; and Dr. T. V. Venkateswaran, Vigyan Prasar, Delhi. The movie is shot in Chennai, Erode, Kumbakonam, Nammakal, Cambridge and other such locales where Ramanujan lived and worked.

Colloquia & Seminars (2013-2014)

Colloquia

- Prof. Alladi Sitaram (ISI, Bangalore) February 13, 2014
  Harish-Chandra; a mathematician's mathematician
- Prof. Siddhartha Gadgil (IISc, Bangalore) December 18, 2013
  Metric measure spaces and random matrices
- Prof. Isha Dewan (ISI, Delhi) November 29, 2013
  Competing risks model
- Prof. Probal Chaudhuri (ISI, Kolkata) October 25, 2013
  Deep inside data and distributions in dimensions one, two, three, ..., infinity
- Prof. Neeraj Misra (IIT, Kanpur) October 9, 2013
  Some monotonicity results for gamma distribution
- Prof. Mythily Ramaswamy (TIFR-CAM, Bangalore) September 27, 2013
  Optimal control problems
- Prof. C. S. Seshadri (CMI, Chennai) September 20, 2013
  Grassmann varieties
- Prof. Rajeeva Karandikar (CMI, Chennai) September 18, 2013
  Opinion polls in the context of Indian parliamentary democracy
- Prof. Kapil Paranjape (IISER, Mohali) September 16, 2013
  Real and complex multiplication lattices
- Prof. Gadadhar Misra (IISc, Bangalore) September 13, 2013
  The Bergman kernel
- Prof. Adimurthi (TIFR-CAM, Bangalore) August 30, 2013
  Structure of entropy solutions for conservation laws
- Prof. Satyagopal Mandal (University of Kansas, Lawrence, USA) August 2, 2013
  Inverting arrows and derived categories
- Prof. Nikolai Vavilov (St. Petersburg State University) July 12, 2013
  Decomposition of unipotents : Recent advances (alias Paghi Uno, Prendi Tre)
- Prof. Dinesh Thakur (Arizona State University, USA) July 5, 2013
  Special values of Gamma, Zeta functions and algebraic structures
- Prof. Balasubramanian (IMSc, Chennai) March 15, 2013
  Additive combinatorics

Special Talks

- Dr. Anupam Singh (IISER, Pune) December 25, 2013
  Classical groups and algebras with involution
- Prof. Ivan A. Panin (Petersburg Department of Steklov Institute of Mathematics) December 19, 2013
  On a Grothendieck and Serre conjecture on principal G-bundles over regular local rings containing an infinite field
- Prof. M. S. Raghunathan (IIT, Mumbai) December 18, 2013
  Kneser-Tits Problem
- Prof. M. S. Raghunathan (IIT, Mumbai) December 17, 2013
  Kneser-Tits Problem
- Prof. Dipendra Prasad (TIFR, Mumbai) December 16, 2013
  Maximal subgroups of classical groups
- Prof. G. Lusztig (MIT, USA) December 16, 2013
  Bruhat decomposition and conjugacy classes in classical groups
- Prof. K. N. Raghavan (IMSc, Chennai) December 13, 2013

B-N pairs and Bruhat decomposition

- Dr. Maneesh Thakur (ISI, Delhi) December 12, 2013
  On mod-2 invariants of G_2 and F_4
- Dr. Debargha Banerjee (IISER, Pune) November 22, 2013
  Modular Forms-A link road between numbers and geometry

Algebra-Geometry Seminars

- Prof. A. J. Parameswaran (TIFR, Mumbai) November 6, 2013
  Construction of Grassmanian, Flag manifolds and Schubert subvarieties
- Prof. S. M. Bhatwadekar (Bhaskaracharya Pratishthana, Pune) October 8, 2013
  Projective modules and zero cycles
- Dr. Nagaraj D. S. (IMSc, Chennai) September 17, 2013
  Complex projective varieties

Analysis Seminars

- Prof. P. N. Srikanth (TIFR-CAM, Bangalore) March 4, 2014
  Lecture 1: Regularity of Weak Solution; Lecture 2: Solutions concentrating on S^1 orbits
- Prof. M. C. Joshi (IIT, GN) February 25, 2014
  Mathematical Perspective of Control Theory – A Glimpse
- Prof. Alladi Sitaram (ISI, Bangalore) February 11, 2014
  Some generalizations of the Wiener-Tauberian theorem
- Prof. R. Sakthivel (SRIT Coimbatore) January 10, 2014
  Robust control for a class of uncertain dynamical systems
- Dr. Sheetal Dharmatti (IISER, Thiruvananthapuram) December 26, 2013
  H infinity feedback boundary stabilization of two dimensional Navier Stokes' equation
- Dr. Sandeep (TIFR-CAM, Bangalore) November 28, 2013
  Moser-Trudinger type inequalities
- Dr. Diganta Borah (IISER, Pune) November 21, 2013
  Hartogs's extension phenomenon and domains of holomorphy
- Ms. Yasmeen Akhtar (IISER, Pune) November 7, 2013
  The Riemann mapping theorem
- Prof. Venky Krishnan (TIFR-CAM, Bangalore) October 31, 2013
  Microlocal analysis of transforms in synthetic aperture radar imaging
- Dr. Chandrasheel Bhagwat (IISER, Pune) October 24, 2013
  On Fourier transforms and Paley-Wiener theorems on real semisimple Lie groups
- Prof. Ravi Aithal (University of Mumbai, Mumbai) October 17, 2013
  Synge's Theorem
- Dr. Anindya Goswami (IISER, Pune) October 3, 2013
  Ito Integration and its martingale property
- Dr. Anindya Goswami (IISER, Pune) September 26, 2013
  Brownian motion and its differential generator
- Dr. Anisa Chorwadwala (IISER, Pune) September 19, 2013
  The maximum principles in differential equations-Lecture 3
- Dr. Anisa Chorwadwala (IISER Pune) September 12, 2013
  The Maximum principles in differential equations-Lecture 2
- Dr. Anisa Chorwadwala (IISER Pune) September 5, 2013
  The maximum principles in differential equations

Geometry Seminars

- Prof. S. Senthamaraikannan (CMI, Chennai) April 12, 2013

Ring of invaraints under a finite group

- Prof. S. Senthamaraikannan (CMI, Chennai) April 11, 2013
  Geometric invariant theory
- Prof. S. Senthamaraikannan (CMI, Chennai) April 10, 2013
  Schubert varieties
- Prof. Indranil Biswas (TIFR, Mumbai) September 10, 2013
  A construction of a universal connection
- Dr. Swagata Sarkar (ISI, Kolkata) March 22, 2013
  Finite group actions on Kan complexes

Minor Thesis Seminars

- Mr. Sushil Bhunia (IISER, Pune) March 3, 2014
  Whitehead graphs on handlebodies
- Mr. Rohit Joshi (IISER, Pune) February 20, 2014
  A theorem on analytic continuation of functions of several complex variables
- Ms. Neha Prabhu (IISER, Pune) February 17, 2014
  Ramanujan graphs
- Mr. Jatin Majithia (IISER, Pune) February 10, 2014
  Theory of rational option pricing
- Ms. Yasmeen Akhtar (IISER, Pune) January 17, 2014
  Characterisation of the unit ball in C^n by its automorphism group

Number Theory Seminars

- Dr. Chandrasheel Bhagwat (IISER, Pune) February 26, 2014
  Siegel modular forms
- Mr. Punya Plaban Satpathy (IISER, Pune) February 19, 2014
  Automorphic forms
- Mr. Mihir Sheth (IISER, Pune) February 12, 2014
  Proof of the theorem of Iwasawa on the mu invariants.
- Mr. Mihir Sheth (IISER, Pune) February 5, 2014
  A theorem of Iwasawa
- Dr. Baskar Balasubramanyam (IISER, Pune) January 28, 2014
  A theorem of Matsushima and Shimura (without proof) that relates this space of cusp forms to cohomology of certain arithmetic groups
- Dr. Baskar Balasubramanyam (IISER, Pune) January 22, 2014
  Cusp forms w.r.t quaternion algebras over a totally real number field
  Dr. Debargha Banerjee (IISER, Pune) January 15, 2014
  Cusps and Fourier expansions of Hilbert modular forms
- Dr. Debargha Banerjee (IISER, Pune) January 8, 2014
  Introduction to Hilbert Modular forms
- Prof. A. Raghuram (IISER, Pune) March 22, 2013
  Number theory and cohomology
- Dr. Kaneenika Sinha (IISER, Pune)
  Introduction to modular forms - 3 lectures
- Dr. Vivek Mallick (IISER, Pune)
  Complex tori and elliptic curves - 2 lectures
- Dr. Ronnie Sebastian (IISER, Pune)
  Riemann surface structure on quotients of the upper half plane and their genus - 2 lectures
- Dr. Baskar Balasubramanyam (IISER, Pune)
  Hecke operators on modular forms - 1 lecture
- Dr. Kaneenika Sinha (IISER, Pune)
  L-functions associated to modular forms - 1 lecture

Visitors' Seminars

- Dr. Stefan Friedl (University of Regensburg, Germany) March 5, 2014
  The geometrization theorem for 3-manifolds
- Dr. Shane D'Mello (TIFR, Mumbai) February 24, 2014
  Chord diagrams and real rational planar quartics
- Dr. Jayanta Pal (IIT, Patna) February 10, 2014
  Penalization based approach in the spiking problem for the estimation of shape restricted functions
- Dr. Arnab Mitra (Ben Gurion University, Israel) February 7, 2014
  On ladder representations
- Dr. Saswata Shannigrahi (IIT, Guwahati) February 3, 2014
  Two coloring uniform hypergraphs: bounds and algorithms
- Prof. Krishna B. Athreya (Iowa State University, USA) January 27-30, 2014
  Introduction to Markov chains and Brownian motion
- Dr. Sumanta Sarkar (ISI, Kolkata) October 25, 2013
  Constructions of cryptographically significant Boolean functions
- Dr. Priyanka Shukla (IISER, Kolkata) September 30, 2013
  Stability and pattern formation in rapid granular flows
- Dr. Shodhan Rao (Groningen University, The Netherlands) September 25, 2013
  A graph-theoretical approach to the analysis and model reduction of chemical reaction networks
- Prof. C. S. Seshadri (CMI, Chennai) September 19, 2013
  Jacobian varieties
- Mr. Sugata Mondal (IMT, Toulouse, France) September 10, 2013
  Hyperbolic surfaces with small eigenvalues
- Dr. Dipramit Majumdar (ISI, Bangalore) September 6, 2013
  Geometry of Eigencurve at critical Eisenstein series of weight 2
- Dr. Sanjay Singh (TIFR, Mumbai) September 3, 2013
  Holonomy group group scheme
- Dr. Mousomi Bhakta (University of New England, Australia) August 21, 2013
  Semi linear elliptic equations and the generalized boundary trace
- Dr. Anup Biswas (University of Texas, Austin, USA) August 20, 2013
  Law of large numbers for queues under earliest deadline first scheduling
- Dr. Tejas Kalelkar (Washington University, St. Louis, USA) August 2, 2013
  Taut foliations of punctured surface bundles
- Dr. Sarang Sane (University of Kansas, USA) July 29, 2013
  Projective module and various avatars of the Euler characteristic
- Mr. Rohit Dilip Holkar July 18, 2013
  Action groupoids and a remark on generalizing Gelfand Naimark theorem
- Ms. Asha Sebastian (NIT, Calicut) July 12, 2013
  Introductory knot theory
- Prof. Dinesh Thakur (Arizona State University, USA) June 28, 2013
  What should `e' and `pi' be, if `integers' are replaced by `polynomials'?
- Dr. Atul A. Dixit (Tulane University) May 30, 2013
  Ramanujan-Hardy-Littlewood-Riesz phenomena and monotonicity results for Dirichlet L-functions
- Dr. Ronnie Sebastian (ISI, Bangalore) March 26, 2013
  Smash nilpotent cycles on varieties dominated by products of curves
- Dr. Debraj Chakrabarti (TIFR-CAM, Bangalore) March 21, 2013
  Holomorphic maps
- Dr. Arnab Saha (Australian National University, Australia) March 15, 2013
  Arithmetic jet spaces and Witt vectors
- Dr. Amit Hogadi (TIFR, Mumbai) March 8, 2013
  Fundamental groups of algebraic varieties
- Dr. Supriya Pisolkar (TIFR, Mumbai) March 7, 2013
  Commensurability and representation equivalent arithmetic lattices
- Dr. Sachin Talathi (University of Florida, Gainesville, FL, USA), February 22, 2013
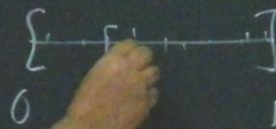 STDP induced synchrony in inhibitory neural networks: Theory and experiments

Notes

Notes

$$\lim_{N \to \infty} P_{d,N} = \left(\log_{10}(d+1) - \log_{10}(d) \right)$$

$$P_{d,N} = \frac{\#\{ d \text{ is the leading digit of } n^k \text{ for } k=1, \dots N\}}{N}$$

$$P_{1,N} >$$

0   1

Weyl

then

$[a,b]$ c

$$\lim_{N \to \infty}$$

GTM 102
GTM 106
GTM 110
GTM 121
GTM 126
GTM 129 RIM
GTM 139
GTM 150
GTM 153
GTM 186
GTM 190

Silverman — The Arithmetic of Elliptic Curves

Lang — Algebraic Number Theory Second Edition

Lang — Cyclotomic Fields I and II

Borel — Linear Algebraic Groups Second Enlarged Edition

Fulton Harris — Representation Theory

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