



Chennai Mathematical Institute

Annual Report

2013–2014

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1 Preface

It gives me great pleasure to present the Annual Report of the Chennai Mathematical Institute for the year 2013-14. This year is the 25th year since the founding of CMI. In this span we have made a significant impact on both research and teaching in the mathematical sciences in India.

An overwhelming proportion of the graduates from CMI in the past decade have gone on to pursue further studies at the best academic institutions in India and abroad. The institutions where our students have gone include UC Berkeley, Caltech, Univ. of Chicago, Harvard Univ., MIT, The Courant Institute (NYU), Princeton Univ, Univ. of Pennsylvania and Yale Univ. in the USA, ENS Paris, ENS Cachan, Univ. Paris-Sud and Univ. Bordeaux in France, the Max Planck Institutes and Humboldt University in Germany and the Harish-Chandra Research Institute, IITs, IMSc, ISI and TIFR in India.

Over a dozen CMI graduates have returned to India after completing their Ph.D.s to take up academic positions at institutions like CMI, IMSc, IIT Bombay, IIT Kanpur, TIFR, IISER Kolkata, IISER Mohali, IISER Pune as well as in research labs such as Microsoft Research, ABB Research and IBM India Research Lab. Students with CMI Ph.D.s have taken up academic positions at IISc Bangalore, IIT Bombay, IIT Guwahati and IIM Indore. Another dozen of our students have faculty or postdoctoral research positions at institutions abroad.

CMI graduates have also taken up areas such as financial mathematics, management and economics, both in India and abroad. The places where they have found placements include IBM, TCS R&D, Veritas, Barclays, Goldman Sachs, HSBC, ICICI, Mu Sigma and some startups.

CMI has exchange programmes with leading French institutions such as the Ecole Normale Supérieure in Paris and Cachan as well as the Ecole Polytechnique. CMI is one of three non-European partners in the Erasmus Mundus Master Programme ALGANT (Algebra Geometry And Number Theory), funded by the European Union. The ALGANT programme allows students to pursue Masters and Doctorate degrees across the institutions participating in the programme.

In Computer Science, CMI, along with IMSc and IISc, is part of an International Associated Laboratory set up by the French National Centre for Scientific Research (CNRS). In Mathematics, CMI along with IMSc, ISI and IISc has a partnership with ICERM at Brown University and Statistical and Mathematical Sciences Institute (SAMSI), North Carolina. This is supported by the National Science Foundation, USA and Department of Science and Technology (DST), India.

Apart from organising and participating in National and International conferences and workshops, CMI also had organised a month long program on the history of mathematics. This was coordinated by Professor Kim Plofker (Brown, USA) and Professor Clemency Montelle (U Canterbury, NZ).

Under the CMI Arts Initiative, we had several weekend programmes during the semester on arts, music, literature, history. We have started a writer's residency programme in collaboration with Sangam House, Bangalore. Jeremy Tiang (Singapore), a writer and translator, and Karen Jennings (South Africa), a writer, spent a month each at CMI under this program.

Over last few years, several young faculty members and visiting fellows have joined CMI making it a vibrant place. CMI has already established itself in the areas of research and teaching in the mathematics. Our vision is for CMI to make its mark in the area of applications of mathematics and strengthen its interaction with the industry.

As always, CMI hosted a number of distinguished academic visitors this year and there were a number lectures delivered by these visitors..

I am happy to note that Prof. Seshadri was made a Fellow of the American Mathematical Society. He was also awarded a Doctorate (Honoris Causa) by Univ. of Paris 6 (Pierre et Marie Curie), France.

Over the years, CMI received a major share of its funding from the Department of Atomic energy via the National Board of Higher Mathematics (NBHM). The UGC has funded the construction of a multi-storied building. Recently, DST has also come forward to support CMI and DAE and DST have signed an agreement to support CMI. The DST support for CMI will come via the Science and Engineering Research Board (SERB) while the support from DAE will continue to come via NBHM. The details of this arrangement are being worked out. In the meanwhile, DAE and NBHM are supporting us fully.

In addition to the generous support from the DAE, DST and UGC, CMI also receives support from private sources. We have established a Faculty Development Fund for supporting research activities at the institute and we have received generous donations from well wishers. This includes donations from Mr. Lakshmi Narayanan (Cognizant Tech.), Mr R Kannan, Mr A Duggal, Mr T Jayaraman all from the Shriram group, Shriram Trade Finance Company Ltd, Shriram Capital Ltd, TNQ Books and Journals Pvt. Ltd and Dr. Usha Rubugunday.

Thanks to the support from the government agencies as well as private donors, we have established CMI as a much desired destination for researchers in the mathematical sciences as well as for students of Mathematics, Computer Science and Physics. I am confident that CMI will continue to grow as a centre of excellence in the years to come.

Rajeeva L Karandikar
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Computer Science

1. K.V. Subrahmanyam (CMI), Chair
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Samir Datta

K. Narayan Kumar

Pramathanath Sastry

S. Senthamarai Kannan

Shiva Shankar

V.V. Sreedhar

K.V. Subrahmanyam

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Sourav Chakraborty

Clare D'Cruz

Govind S. Krishnaswami

Upendra Kulkarni

K. Narayan

Purusottam Rath

Sasanka Roy

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7 Faculty Profiles

Rajeeva L. Karandikar

Rajeeva L. Karandikar received his B.Sc. from Indore University, Indore (1976), M.Stat. from Indian Statistical Institute, Kolkata (1978) and Ph.D. from Indian Statistical Institute, Kolkata (1981).

He has been an Associate Professor at the Indian Statistical Institute, Delhi (1984-89), a Professor at the Indian Statistical Institute, Delhi (1989-2006), a Professor-in-Charge at the Indian Statistical Institute, Delhi (2000-2002), Head, Delhi Center at the Indian Statistical Institute, Delhi (2000) and (2004-2006) and an Executive Vice-President at Cranes Software International Limited.

He received the Shanti Swarup Bhatnagar Award in 1999. He has been awarded the P C Mahalanobis Gold medal by the Prime Minister at the Indian National Science Congress in February 2014. He is a fellow of the Indian Academy of Sciences and the Indian National Science Academy.

His research interests are: Probability theory and Stochastic Processes, Applications of Statistics and Cryptography.

C.S. Seshadri

C.S. Seshadri received his B.A. Hons. (Mathematics) degree from Madras University (1953) and his Ph.D. from TIFR/Bombay University (1958).

He was at the School of Mathematics, Tata Institute of Fundamental Research, Bombay from 1953 to 1984 starting as a Research Scholar and rising to a Senior Professor. He was then a Senior Professor at the Institute of Mathematical Sciences, Madras (1984-89).

He has been a Visiting Professor at the University of Paris, France; Harvard University, Cambridge, U.S.A.; Institute for Advanced Study, Princeton, U.S.A.; University of California at Los Angeles, Los Angeles, U.S.A.; Brandeis University, U.S.A.; University of Bonn, Bonn, Germany; Kyoto University, Kyoto, Japan.

He has given invited talks at many international conferences including the International Congress of Mathematicians, Nice, France, 1970.

He has received the Shanti Swarup Bhatnagar Award (1972) and the Srinivasa Ramanujan Medal of Indian National Science Academy (INSA). He was awarded the D.Sc. Degree (Honoris Causa) of Banaras Hindu University, Varanasi (1985). He has been awarded the Shanti Swarup Bhatnagar Medal (1995) of INSA and Srinivasa Ramanujan Birth Centenary Award (1995-96) of Indian Science Congress Association (ISCA). He has received G.M. Modi Science Award (1995), The Trieste Science Prize of the Academy of Sciences for the Developing World in (2006) and H.K. Firodia Award for Excellence in Science & Technology, Pune (2008).

He has also been awarded Padma Bhushan by the President of India (2009).

He is a Fellow of the Indian Academy of Sciences, Indian National Science Academy and a Fellow of the Royal Society. He has been appointed National Research Professor of the Ministry of Human Resource Development Government of India in 2006.

His research interests are: Algebraic Geometry and Algebraic Groups.

Madhavan Mukund

Madhavan Mukund received his B.Tech. (Computer Science and Engineering) from the Indian Institute of Technology, Bombay (1986) and his Ph.D. (Computer Science) from Aarhus University, Aarhus, Denmark (1992).

He is a member of the Executive Council and President of the Indian Association for Research in Computing Science (IARCS), as well as a member of the ACM India Council.

His research interests include models for concurrent and distributed systems, formal verification and distributed algorithms.

T.R. Ramadas

T.R. Ramadas received his M.Sc. in Physics from the Indian Institute of Technology, Kanpur (1977) and Ph.D. in Mathematics from TIFR/University of Bombay (1982).

He has been a Professor at the School of Mathematics, TIFR till June 2002, a Professor at the University of Montpellier, France (2000-03), a Research Scientist at ICTP (2003-10) and Head, Mathematics Group, ICTP (2010-13).

He has received the Shanti Swarup Bhatnagar Award for Mathematical Sciences (1998). He is a Fellow of the Indian Academy of Sciences.

His research interests are: Differential and Algebraic Geometry.

V. Balaji

V. Balaji received his B.A. Hons. (Mathematics) from University of Delhi (1982), his M.A. (Mathematics) from University of Delhi (1984), his Ph.D. from University of Madras (1991).

He has been an NBHM Post-doctoral Fellow at the Chennai Mathematical Institute (1989–92).

He received the Shanti Swarup Bhatnagar Award in 2006 and is a Fellow of the Indian Academy of Sciences.

His research interest is Algebraic Geometry.

Samir Datta

Samir Datta received his B.Tech. (Computer Science and Engineering) from the Indian Institute of Technology, Kanpur (1995), M.S. from Rutgers University (1997) and Ph.D. from Rutgers University (2004).

He has been a Network Architect at Tellium Inc. (2000-03) and a Post Doctoral Fellow at WINLAB, Rutgers University (2004-05).

His research interests are Complexity Theory, Wireless and High Speed Networking.

K. Narayan Kumar

K. Narayan Kumar received his M.Sc. (Tech.) in Computer Science from Birla Institute of Technology and Science, Pilani (1990). He received his Ph.D. from the TIFR/University of Bombay (1997).

His research interests include Logic, Automata theory and Concurrency.

Pramathanath Sastry

Pramathanath Sastry received his B.Sc. (Hons) in Mathematics from University of Delhi, New Delhi (1982), M.Stat. from the Indian Statistical Institute, New Delhi (1984) and Ph.D. (Mathematics) from Purdue University, U.S.A. (1990).

He has been a Teaching Assistant, a Research Assistant at Purdue University, U.S.A. (1984-1990), a Visiting Assistant Professor at University of Missouri, U.S.A. (1990-1991), a Visiting Fellow at the Tata Institute of Fundamental Research, Mumbai (1991-1992), a Fellow at SPIC Science Foundation (1992-1995), a Reader at SPIC Science Foundation (1995-1996), a Reader at Harish-Chandra Research Institute, Allahabad (1996-1999), a Reader F at Harish-Chandra Research Institute, Allahabad (1999-2001), a Visiting Assistant Professor at Purdue University, U.S.A. (1999-2001), an Asst. Assoc. Professor (Term) at the University of Toronto, Canada (2001-2006), CLA at McMaster University, Canada (2006) and an Assistant Professor at East Carolina University, U.S.A. (2007-2009).

His research interest is Algebraic Geometry.

S. Senthamarai Kannan

S. Senthamarai Kannan received his B.Sc. from HKRH College, Uthama Palayam (1985–88), M.Sc. from the Madurai Kamaraj University (1988–90) and Ph.D. from the Chennai Mathematical Institute, (1992–98). He has been a Post-doctoral Fellow at the International Centre for Theoretical Physics (1999–2000).

His research interests are Representation Theory and Algebraic Geometry.

Shiva Shankar

Shiva Shankar received his B.Tech. (Electrical Engineering) from the Indian Institute of Technology, Delhi (1978) and his Ph.D. from SUNY, Stony Brook (1983).

He has been an Assistant Professor, at the Department of Applied Mathematics, SUNY, Stony Brook (1983–84), a Visiting Fellow at the School of Mathematics, Tata Institute of Fundamental Research, Bangalore (1984–88), an Associate Professor at the Department of Electrical Engineering, Indian Institute of Technology, Bombay (1988–2000).

Visiting Positions include Institute of Mathematical Sciences, Chennai, and at Mathematics Institute, University of Groningen.

His research interests are Partial Differential Equations, Mechanics and Control Theory.

V.V. Sreedhar

V.V. Sreedhar received his B.Sc. from Andhra University, Visakhapatnam, M.Sc. (Physics) from the Indian Institute of Technology, Madras and received his Ph.D. (Physics) from Saha Institute of Nuclear Physics, Jadavpur University, Calcutta.

He has been an Assistant Professor in the Department of Physics at the Indian Institute of Technology, Kanpur, a Post-doctoral researcher at the School of Theoretical Physics, Dublin Institute of Advanced Studies, Dublin, Ireland and a Post-doctoral researcher at the Institute for Theoretical Physics, Uppsala University, Uppsala, Sweden.

His visiting positions include stints at the S. N. Bose National Centre for Basic Sciences, Kolkata, Raman Research Institute, Bangalore, Universities of Rochester, New York and Cincinnati, Ohio, U.S.A. and the High Energy Research Organization (KEK), Tsukuba, Japan.

His research interests are Quantum Entanglement, Classical and Quantum Field Theory and Fluid Dynamics.

K.V. Subrahmanyam

K.V. Subrahmanyam received his B.Tech. (Computer Science and Engineering) degree from the Indian Institute of Technology, Bombay (1986) and M.S. from Vanderbilt University, U.S.A. in 1987. He received his Ph.D. from the TIFR/University of Bombay in December, 1995.

His research interests are Circuit Complexity, Algebraic methods in Complexity theory.

Sourav Chakraborty

Sourav Chakraborty received his B.Sc. from Chennai Mathematical Institute (2003), M.S. from University of Chicago (2005) and Ph.D. from University of Chicago (2008).

He has been a Post-doctoral researcher at Technion, Israel (2008-2009) and a Post-doctoral researcher at CWI, Amsterdam (2009-10).

His research interests are Complexity and Algorithms

Clare D' Cruz

Clare D' Cruz received her M.Sc. (Mathematics) from the Indian Institute of Technology, Bombay (1991) and her Ph.D. (Mathematics) from the Indian Institute of Technology, Bombay (1996).

She has been a Post-Doctoral Fellow at the Tata Institute of Fundamental Research, Mumbai (1996–98) and a Visiting Scholar at the Northeastern University, Boston, U.S.A. (1997–98).

Her research interest is Commutative algebra.

Govind S. Krishnaswami

Govind S. Krishnaswami received his B.Sc. (Physics), B.A. (Mathematics) from University of Rochester, U.S.A. (1999), M.A. (Physics), from University of Rochester, U.S.A. (2001) and Ph.D. (Physics) from University of Rochester, U.S.A. (2004).

He has been a Marie Curie Fellow, Spinoza Institute & Institute for Theoretical Physics, Utrecht University, The Netherlands.

His research interests are Quantum Field Theory, Hydrodynamics and Mathematical Physics

Upendra Kulkarni

Upendra Kulkarni received his B.Tech. (Computer Science and Engineering) from the Indian Institute of Technology Bombay, Mumbai (1992) and Ph.D. (Mathematics) from Brandeis University, U.S.A. (1998).

He has been a Visiting Assistant Professor at the University of Massachusetts Amherst (1998-2000), an Assistant Professor at the Truman State University (2000-05), An Associate Professor at the Truman State University (2005), a Visiting Scientist at the Indian Statistical Institute, Bangalore (2005-06) and a Visiting Fellow at the Tata Institute of Fundamental Research, Bangalore (2006-07).

His research interests are Representations of algebraic groups over the integers and in characteristic p , Algebraic aspects of Lie representation theory including Lie algebras, quantum groups and related combinatorics and in solving elementary challenging problems.

K. Narayan

K. Narayan received his B.Tech. (Engineering Physics) from the Indian Institute of Technology Bombay, Mumbai (1997), M.S. (Physics) from the Cornell University, U.S.A. (1999) and Ph.D. (Physics) from the Cornell University, U.S.A. (2002).

He has been a Research Assistant at the Cornell University, U.S.A. (1998-2001), a Research Assistant at the Cornell University, U.S.A. (2001-02), a Postdoctoral Research Fellow at the Duke University, U.S.A. (2002-04) and a Postdoctoral Research (Visiting) Fellow at the Tata Institute of Fundamental Research, Mumbai (2004-07).

His research interests are String theory and cosmology, Stringy geometry and D-brane gauge theories.

Purusottam Rath

Purusottam Rath received his Ph.D. (Mathematics) from Harish Chandra Research Institute, Allahabad (2006).

He has been a Visiting Fellow at the Institute of Mathematical Sciences, Chennai (2006–2007) and a Coleman Research Fellow at Queen’s University, Canada (2007–2008).

His research interests are Combinatorial Number Theory, Diophantine Approximation and Transcendental nature of special values of L -functions.

Sasanka Roy

Sasanka Roy received his B.Sc. (Mathematics) from A.B.N. College, West Bengal, M.C.A. from North Bengal University, West Bengal (2001) and Ph.D. from Indian Statistical Institute, Kolkata (2007).

He has been a Scientist at the Tata Research Development and Design Centre, Pune (2006-09) and a Centenary Postdoctoral Fellow at the Indian Institute of Science, Bangalore (2009-10).

His research interests are Computational Geometry and Algorithms.

R. Srinivasan

R. Srinivasan received his Ph.D. degree in Mathematics from the Indian Statistical Institute and the Institute of Mathematical Sciences (1998).

He has been a Visiting Fellow at the Harish-Chandra Research Institute, Allahabad (1998-2000), a Post Doctoral Fellow at the Indian Statistical Institute (2000-01), a Post Doctoral Fellow at Universite d’Orleans, France (2001-02), a Visiting Scientist at the Indian Statistical Institute (2002-03), a Visiting Fellow at ICTP, Trieste, Italy (2003) and a JSPS Post Doctoral Fellow at University of Tokyo, Japan (2003-2005).

His research interests are Operator Algebras and Operator Theory.

M. Sundari

M. Sundari received her M.Sc. (Mathematics) from the University of Hyderabad, Hyderabad (1988), M.Phil. (Mathematics) from the University of Hyderabad, Hyderabad (1990) and Ph.D. (Mathematics) from the Indian Statistical Institute, Bangalore (1996).

She has been a Visiting Mathematician at the International Center for Theoretical Physics, Trieste, Italy (1996), a Research Associate at the University of New South Wales, Sydney, Australia (1996-97), an Assistant Professor in the Effat College, Jeddah, Saudi Arabia (2000-01), a Faculty member at the ICFAI Institute of Science and Technology, Hyderabad (2003-04) and an Assistant Professor at the Indian Institute of Technology Roorkee, Roorkee (2004-06).

Her research interests are Representation theory of Lie groups, Uncertainty Principles in Harmonic Analysis, Wiener-Tauberian theorems.

S.P. Suresh

S.P. Suresh received his M.C.A. from R.E.C. Trichy (1996), his M.Sc. (by Research) from Anna University (1999), and his Ph.D. from the Institute of Mathematical Sciences (2003).

His research interests are Logic in Computer Science, Reasoning about Security protocols and Classical Indian Epistemology.

M.K. Vemuri

M.K. Vemuri received his M.S. (Mathematics) from Syracuse University, U.S.A. (1989) and Ph.D. from the University of Chicago, U.S.A. (1997).

He has been a Visiting Assistant Professor at Colgate University, U.S.A. (1997–99), an Instructor at Polytechnic University, U.S.A. (1999–2000) and a Teaching Research Associate at Syracuse University, U.S.A. (2000–2002).

His research interest is Analysis.

K.G. Arun

K.G. Arun received his B.Sc. (Physics) from Calicut University, Calicut (1998), M.Sc. (Physics) from Cochin University of Science and Technology (2001) and Ph.D. (Physics) from Raman Research Institute, Bangalore.

He has been a Postdoctoral Research Associate, Washington University in St Louis and VESF Fellow, LAL Orsay & IAP, Paris (2009-2010).

His research interests are Gravitational Wave Astrophysics, Modelling compact binaries, High energy Astrophysics and Cosmology, Tests of General Relativity and Alternative theories of gravity.

Krishna Hanumanthu

Krishna Hanumanthu received his B.Sc. (Mathematics) from the Chennai Mathematical Institute (2001), M.Sc. (Mathematics) from the Chennai Mathematical Institute (2003) and Ph.D. (Mathematics) from the University of Missouri (2008).

His research interests are Algebraic Geometry and Commutative Algebra.

Manoj Kummini

Manoj Kummini has received his B.Tech. (Electronics and Communication Engineering) from the University of Calicut (1999), M.E. (Telecommunication Engineering) from the Indian Institute of Science, Bangalore (2002), M.A. (Mathematics) from the University of Kansas, Lawrence (2005) and Ph.D. from University of Kansas, Lawrence (2008).

He has been a Software Engineer at Sasken Communication Technologies, Bangalore (1999-2000), a Senior Design Engineer (2003) & Design Engineer (2002-2003) at Texas Instruments India, Bangalore, Graduate Teaching Assistant, University of Kansas, Lawrence, KS, U.S.A. (2003-2008), Research Assistant Professor, Purdue University, West Lafayette, IN, U.S.A. (2008-2011) and a Post-doctoral Fellow at Mathematical Sciences Research Institute, Berkeley, CA, U.S.A. (2012).

His research interest is commutative algebra.

Sukhendu Mehrotra

Sukhendu Mehrotra received his B.Sc. (Hons) in Mathematics from Delhi University (1998), M.S. in Mathematics from the University of Delaware (2000) and Ph.D. in Mathematics from the University of Pennsylvania (2005).

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Shrihari Sridharan received his B.Sc. (Mathematics) from Barathidasan University, Trichy (1998), M.Sc. (Mathematics) from Anna University, Chennai (2000) and Ph.D. (Mathematics) from the University of Manchester, Manchester (2004).

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His research interests are Complex Dynamics and Ergodic Theory.

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S. Sundar received his B.Sc. (Mathematics) from Manonmanian Sundaranar University (2005), M.Sc. (Mathematics) from the Homi Bhabha National Institute (2007) and Ph.D. (Mathematics) from the Homi Bhabha National Institute (2010).

He has been a Post-doctoral researcher at the University of Caen, France (2010–2011) and Visiting Scientist at the Indian Statistical Institute, Delhi (2011–2012).

His research interest is operator algebras—in particular, noncommutative geometry, K -theory, inverse semigroups and their C^* -algebras.

8 Awards

- Ramprasad Saptharishi won the ACM India Doctoral Dissertation Award for 2013.
- Shiladitya Banerjee, a former student of CMI, won the APS Award for Outstanding PhD Thesis in Biological Physics for 2013.
- C.S. Seshadri was awarded Doctorate Honoris Causa by Univ Paris et Marie Curie, Paris, France in 2013.
- Rajeeva L. Karandikar was awarded P C Mahalanobis Gold medal by the Prime Minister at the Indian National Science Congress in February 2014.

9 Research Activities

Mathematics

Research was carried out in the following areas: algebraic geometry, commutative algebra, representation theory, dynamical systems, functional analysis and operator algebras number theory, combinatorics, harmonic analysis symplectic topology, application of statistics and financial mathematics.

In the field of algebraic and geometry, using the computations on the cohomology of line bundles, and using the computations of the semi-stable points of the flag variety G/B for the action of a maximal torus, it was proved that if G is simple adjoint group which is simply laced, then all higher cohomologies vanish for the restriction of the tangent bundle of the flag variety to every Schubert variety in G/B . Also, it was proved that the connected component of automorphism group of a smooth Schubert variety $X(w)$ is a parabolic subgroup of G if and only if the semistable points for the T -linearised line bundle on $X(w^{-1})$ corresponding to the highest root is non-empty.

Further, it was established that a Bott-Samelson-Demazure-Hansen variety has unobstructed deformations. In addition, it was also established that this variety has no deformations when ever G is simply laced. Furthermore, it was shown that the connected component of the automorphism group of a Bott-Samelson-Demazure-Hansen variety corresponding to a reduced expression of w is a parabolic subgroup of G if and only if the semistable points for the T -linearised line bundle on $X(w^{-1})$ corresponding to the highest root is non-empty. The parabolic subgroup here depends on the choice of a reduced expression for w and so the Bott-Samelson-Demazure-Hansen variety depends very well on the choice of a reduced expression.

For a G equivariant vector bundle E on X , the wonderful compactification of a symmetric space G/H of minimal rank and for any fixed B stable closed subvariety Y in X , where B is a Borel subgroup of G , it was proved that E is nef (respectively, ample or trivial) if and only if its restriction to Y is nef (respectively, ample or trivial). Further, let X be the wonderful compactification of a symmetric space G/H . Take a $\tilde{G}$ -equivariant principal R -bundle E on X (R -complex reductive group). If the action of the isotropy group $\tilde{H}$ on the fiber of E at the identity coset is irreducible, then we prove that E is polystable with respect to any polarization on X . Further, for the wonderful compactification of the quotient of $\mathrm{PSL}(n, \mathbb{C})$ (respectively, $\mathrm{PSL}(2n, \mathbb{C})$) by the projective orthogonal group (respectively, projective symplectic group) it was established that the tangent bundle is stable with respect to any polarization. Let M be the wonderful compactification of a symmetric space G/H . Take a $\tilde{G}$ -equivariant principal R -bundle E on X (R -complex reductive group). If the action of the isotropy group $\tilde{H}$ on the fiber of E at the identity coset is irreducible, then it was shown that E is polystable with respect to any polarization on M . Furthermore, for wonderful compactification of the quotient of $\mathrm{PSL}(n, \mathbb{C})$ (respectively, $\mathrm{PSL}(2n, \mathbb{C})$) by the projective orthogonal group (respectively, projective symplectic group) we prove that the

tangent bundle is stable with respect to any polarization.

Let X be flat scheme over $\mathbb{Z}$ such that its base change, X_p , to $\overline{\mathbb{F}}_p$ is Frobenius split for all primes p . Let G be a reductive group scheme over $\mathbb{Z}$ acting on X . A result on the N_p property for line bundles on GIT quotients of $X_{\mathbb{C}}$ for the action of $G_{\mathbb{C}}$ was obtained. It was then applied to (1) an action of a finite group on the projective space and (2) the action of a maximal torus on the flag variety of type A_n .

In the field of commutative algebra the work was focused on syzygies of GIT quotients and Schubert varieties. A general result on the N_p property of quotients of projective varieties by reductive groups was achieved. Applying this theorem, some results in the case of finite group action on projective space and for the action of maximal torus on a flag variety were deduced. A study of syzygies of line bundles in Schubert varieties is on going.

Other work which also related to algebraic geometry is about K3 surfaces of Picard rank 2. An on going work is trying to understand their ample cone and syzygies. Some work was done on improving bounding Hilbert coefficients of Cohen Macaulay local rings which is an attempt to improve on the bounds already obtained earlier.

On the other hand, construction of certain free resolutions using the Kempf-Lascoux-Weyman geometric technique and study of multiplicative structures on some such free resolutions was carried out. A study of sufficient conditions for vanishing of cohomology of ample invertible sheaves on normalized blow-ups of surface and three-dimensional singularities was also taken up.

In the field of representation theory, work on equi-oriented A_n quiver was done. More precisely, a way of calculating the minimal free resolutions and deducting case-by-case that the quiver loci satisfy certain nice properties was achieved. As a natural next step in addressing this problem the case of equi-oriented A_n quivers was considered. Again in the case of quiver loci admitting a 1-step desingularization, it was shown that the complex F gives a minimal free resolution of the coordinate ring of the quiver locus, and that in this case the quiver locus is normal with rational singularities.

A study of cohomology algebra of toric complements was taken up. This work involves, in general, looking at the topology of the complement of a divisor in a complex manifold. The particular emphasis is on the complex torus where divisor is a union of codimension-1 subtori. A class for which the cohomology algebra is generated in degree 1 and it is formal in the sense of Sullivan was identified. The on going work involves a combinatorial characterization of the product structure.

Matrices of binary forms were studied Orbit closures in the space of $2 \times n$ matrices of bilinear forms was considered and their geometric properties were described by computing the minimal free resolution of their coordinate ring. Earlier it was shown that there are finitely many orbits for the above action and gave a classification of orbits. Using this work, a general formula for the dimension of each orbit closure was found. Work is going on to construct a desingularization for each orbit closure and calculate the resolutions using the Kempf-Lacoux-Weyman technique. For a large class of the orbit closures under study, we

have found a way of calculating the resolutions using a computer program and qualitative results are awaited. It was conjectured that these orbit closures are normal and have rational singularities.

Symmetric quiver varieties: The goal of this project is to generalize the notion of quiver varieties so as to extend it to the case of symmetric quivers and to find formulas, analogues of those of Buch and Fulton which will describe their fundamental classes in CH^* and K^0 .

Work on polynomial functors and their quantum version was carried out. A study is going on to understand newer areas in representation theory: categorification of quantum groups, Hecke algebras and related geometry.

Work on Quantum groups and their representations, categorification and specifically trying to categorify the representation q-Fock space of the universal enveloping algebra of the affine Lie algebra of type A by defining a category so called “Category of Quantum polynomial functor” is on going.

In the field of complex dynamical systems, the Sinai-Ruelle-Bowen measure associated to a real-valued Hölder continuous function defined on the Julia set of a hyperbolic quadratic polynomial was recovered, as a noncommutative measure by constructing an appropriate spectral triple. A focus on hyperbolic rational maps restricted on their Julia sets was given and study about the recurrence rate of typical orbits in arbitrarily small neighbourhoods around them and their relationship to the Hausdorff dimension of such small neighbourhoods was carried out.

Investigation on whether analogues of Brolins theorem hold true when iterating a holomorphic correspondence on $\mathbb{P}^1$ was carried out. A work in on going to demonstrate the following: If F is a holomorphic correspondence on $\mathbb{P}^1$, then (under certain conditions) F admits a measure μ_F such that, for any point z drawn from a large open subset of $\mathbb{P}^1$, μ_F is the weak-limit of the normalised sums of point masses carried by the pre-images of z under the iterates of F . Let $\dagger F$ denote the transpose of F . Under the condition $d_{top}(F) > d_{top}(\dagger F)$, where d_{top} denotes the topological degree, it was established that the support of μ_F is disjoint from the normality set of F . It was shown that when F admits a repeller, the analogue of equidistribution holds true.

In the area of operator algebras, there is an on going study on the endomorphism semigroups (called as E_0 -semigroups) on von Neumann algebras. A von Neumann algebra with trivial center is called as a factor and factors are subdivided into three types namely, type I, II and III with a special emphasis on E_0 -semigroups on type I factors, and recently E_0 -semigroups on type II and type III factors are also studied. A very good process has been made in a study of all these objects.

E_0 -semigroups on type I factors are divided into three types namely type I, II and III. (This has no connection with the division of factors apriori). A special class of E_0 -semigroups were introduced in an earlier work, which includes a large class of exotic type III E_0 -semigroups on type I factors. Recently a more general class of E_0 -semigroups called as Toeplitz CCR flows, which includes the generalized CCR flows as a proper subclass was studied. This

Toeplitz CCR flows is of two kinds, and we get a type I criterion for both these kinds.

Regarding E_0 -semigroups on non-type-I, as a continuation in this project studied E_0 -semigroups on type II_∞ factors and type III factors was initiated . Several families (both countable and uncountable) on these factors were produced , and a systematic theory to study them was developed. This is a completely new important development in non-commutative dynamics and it is hoped that it will lead to a flurry of activities in the next ten years.

In the field of number theory, investigation of nature of special values of L-functions to the p -adic set up was expanded. The p -adic world has its own intrinsic complexity and considerable care needs to be taken even in setting up the right definitions. Investigation is also on going about the possibility of applying explicit formulas in analytic number theory to address questions in transcendence. Conjecturally, for instance, every zero of the Riemann zeta function in $Re(s) > 0$ is supposed to be simple and transcendental. In a different direction, interest in the applications of the Schmidt-Schlickewei-Evertse Subspace theorem to integrality questions of algebraic numbers was investigated.

In the field of combinatorics and combinatorial topology, enumerative combinatorics of surface subdivision were studied. More precisely, consider a compact surface and a collection of finitely many geodesics such that their intersections give regular stratification of the surface. The number of various-dimensional strata are called face numbers. These triples satisfy the Euler relation. However not all triples of natural numbers satisfying Euler relation can be realized as face numbers. . For example, it was shown that for the genus 1 case the affine hull of these face numbers is a cone in $\mathbb{R}^2$ and any integer point in this cone represents an arrangement. Work is going on a higher-dimensional case with an assumption that all the faces are simplices.

Study of coxeter transformation groups and Artin groups is on going. The aim is to study transformation groups that have Coxeter presentation in order to understand generalized Artin groups.

Oriented matroids and MH-complexes was studied. The aim of this project is to prove that oriented matroids can be represented by certain combinatorially defined cell complexes called the metrical hemisphere complexes. These complexes are, in this respect, a generalization of zonotopes. Some progress was made last year.

In the field of harmonic analysis, the following theorem on R^n was proved. Suppose $f \in L^1(R^n)$. Assume $m x \in R^n | f(x) \neq 0 < \infty$ and $m y \in R^n | \hat{f}(y) \neq 0 < \infty$ where ' m ' denotes the Lebesgue measure on R^n and $\hat{f}$ is the Fourier transform on R^n . Then $f = 0$ a.e.

There is a possibility of a similar result for Heisenberg group. The work is going on in this direction.

In the field of contact and symplectic topology. Main focus is on establishing h -principle type results in contact and symplectic category. Recently an h -principle for overtwisted contact foliation was achieved and it was proved that an almost symplectic manifold admits a Poincare dual whose complement is Stein and hence symplectic which is potentially an important step towards establishing a weak version of h -principle for closed symplectic

manifolds.

Eugene Fama (1960s) in his PhD thesis proposed developed the concept of “Efficient Market Hypothesis (EMH)”. According to EMH, financial market is “information-efficient”. This results the price of stock to behave like random-walk. In consequence of this, one cannot consistently achieve return in excess of average market return on risk-adjusted basis. However, by late 1990 and early 2000s many empirical studies shown that EMH is not necessarily true. If EMH is true then all the assets in market are always fairly priced; otherwise assets are either under or overpriced. This turns out to be a testing of hypothesis problem, where null hypothesis is EMH is true or assets are fairly priced versus alternative hypothesis as EMH is false or assets are either over/under-priced. As there are thousands of assets, this problem turns out to be a multiple testing problem.

A method for Bayesian multiple testing with diffused prior for CAPM for 500 stocks that are considered in S and P 500 index was developed. The back-testing (aka out-of-sample performance) of the method for the period from 2008 to 2013 was considered.

In another direction, work is going on to develop Particle Filter (or Sequential Monte Carlo type Algorithm) for Very Big Data While there is an on going project of building Cortisol Estimation Method using Voice Sample. The objective of the project is to measure and predict the stress level using voice samples.

Computer Science

Conflict free replicated datatypes (CRDTs) are distributed data structures whose inherent mathematical structure guarantees eventual consistency. A fundamental CRDT called Observed-Remove Set (OR-Set) has been investigated that robustly implements sets with distributed add and delete operations. A concurrent specification for OR-Sets without ordering constraints has been formalized. A generalized implementation of OR-sets without tombstones has been provided that provably satisfies strong eventual consistency.

A formalism called session systems has been proposed to model online business systems with arbitrary numbers of concurrent agents and sessions. Under reasonable restrictions, session systems turn out to be well-structured transition systems. This provides effective algorithms for the verification of simple coverability properties. This result can be used to verify more elaborate business rules such as avoidance of conflicts of interest and the Chinese Wall Property.

A model called distributed Markov chains has been proposed to model large probabilistic systems with concurrency. In this model, synchronizations determine the probability distribution for the next moves of participating agents. Restricting the synchronizations to be deterministic results in a succinct and distributed presentation of a large global Markov chain. Verification can often be carried out efficiently in this model by exploiting the partial order nature of the interleaved semantics. A statistical model checking (SMC) procedure has been developed and used to verify two large distributed probabilistic networks.

In the area of verifying multi-threaded programs, the notion of split-width has been extended to behaviours of communicating multi-threaded programs and new uniform proofs of decidability for a variety of model-checking and other algorithmic problems have been provided using a bound on the split-width. The idea of controlling the behaviours of systems to stay within the verified (using, for instance, split-width based techniques) fragment has also been investigated.

The decidability of multi-pushdowns communicating using shared memory has also been studied. It has been established that any decidability requires restrictions on the access pattern on shared memory. Such a notion called bounded stage restriction has been proposed, and a precise classification of the decision problems under this restriction has been obtained.

The study of energy games has been extended to the infinite state setting. Energy games are a well-studied class of 2-player turn-based games on a finite graph where transitions are labeled with integer vectors which represent changes in a multidimensional resource (the energy). One player tries to keep the cumulative changes non-negative in every component while the other tries to frustrate this. Generalized energy games played on infinite game graphs induced by pushdown automata (modelling recursion) or their subclass of one-counter automata have been considered, and it has been proved that energy games are decidable in the case where the game graph is induced by a one-counter automaton and the energy is one-dimensional. On the other hand, every further generalization is undecidable: Energy games on one-counter automata with a 2-dimensional energy are undecidable, and energy games on pushdown automata are undecidable even if the energy is one-dimensional. These results are established by showing an equivalence with simulation games.

Regular model checking manipulates infinite (typically “regular”) sets of configurations of a system by representing them symbolically. It relies on the effective closure properties of regular sets. For lossy channel systems and related models, the embedding relation on words plays a key role as it models the lossiness of the channels. In this setting it is important to identify optimal algorithms for computing regular sets of subwords and superwords. These questions had not been raised before in the context of regular model checking. The state complexity of relevant operations involving the embedding relation, such as closing a given regular set under this relation, were studied.

The Simon’s piecewise testability congruence is a tool for assessing the complexity of some problems involving subwords. The congruence relates two words if they have the same subsequences of length upto n . After the concept was introduced in 1983, the question of measuring its index was raised. In an automata-theoretic or verification setting it is relevant to consider this question with a fixed alphabet and arbitrary word lengths, particularly whether the index is singly exponential or doubly exponential in the word length. This problem has solved.

Research on primal infon logic, a logic for access control and delegation, was continued. A cubic time algorithm for the derivability problem for this logic was derived.

The foundations of a logical theory of zero knowledge and partial secrecy as employed

in security protocols has also been carried out. In particular, an extension of the Dolev-Yao model (the standard formal model used in security) has been proposed, where agents communicate assertions about terms in addition to terms. Some of the complexity of this system has been worked out.

Counter systems and their relation to models such as data words and models with other infinite storage mechanisms (such as stacks) have also been studied.

Digital systems control most of the devices that surround us. Timing constraints are often crucial for cyber-physical systems that are designed to interact with the physical world. Correctness of cyber-physical systems that work under time-constraints is an ongoing challenge. One method to certify systems involves modeling it as a mathematical object and have a computer aided method to verify all possible behaviours in this mathematical model. A prominent model for cyber-physical systems that has been studied for the last 25 years is “timed automata”. Better algorithms for verifying behaviours in this timed automaton model have been developed.

Following on previous work “Quantum deformations of irreducible representations of $GL(mn)$ toward the Kronecker problem” (Bharat Adsul, Milind Sohoni and K V Subrahmanyam. *Contemporary Mathematics, Vol. 602, 2013*), further progress on this problem has been made, in an effort towards a good understanding of the crystal basis for this commuting action.

Introduced by Immerman and Patnaik in the mid-’90s, Dynamic Complexity involves finding descriptive complexity bounds on updates for various problems. A central open problem in the area is whether Directed Reachability is in DynFO. Partial progress towards resolution of this conjecture has been made by showing slightly weaker bounds for reachability in the dynamic setting and a DynFO bound for embedded planar restrictions.

Computing an arbitrary bit of the output of an arithmetic circuit (BitSLP) is a fundamental problem studied by Allender et al. who had shown that BitSLP lies in the Counting Hierarchy (CH). The precise depth upper bound on BitSLP has been improved by placing it in $\text{PH}^{\text{PP}^{\text{PPP}}}$. Related natural restrictions such as powering of matrices have also been studied and sum-of-square-roots lower bounds for the same under PH^{PP} reductions have also been shown.

The bounded space complexity of the determinant of the (weighted) adjacency matrix of a graph of bounded tree width has also been studied by a non-trivial use of the Logspace version of Courcelle’s theorem from Elberfeld et al. The technique has been extended to other linear algebraic invariants like the characteristic polynomial, rank and feasibility of a system of linear equations – all for the case of bounded treewidth matrices.

The property testing versions of some classical problems in computational geometry were studied. This opens up a new area of research on which work is being continued. This area is both mathematically challenging as well as important from the point of view of applications.

Work was also carried out on the problem of testing properties of linear and quadratic

functions. This work has partially answered some important question in this field and the techniques have been used by other people in more recent works.

The problem of counting matching in graphs using the markov chain sampling method was also tackled. While the problem is well known to be very challenging, some new techniques for attacking the problems were devised and they have been used successfully for some special kind of matching problems.

It has been shown that the exciting current known depth four circuit size lower bounds [KSS, STOC 2014] [FLMS, STOC 2014] can be unified in a simple way using a combinatorial technique. Interestingly, the technique involves nothing beyond binomial estimates and property of derivatives. Another contribution of this work is a quadratic determinantal complexity lower bound for a seemingly easy polynomial which is the iterated matrix multiplication polynomial. The iterated matrix multiplication polynomial is the $(1, 1)$ th entry of the product of n generic $n \times n$ matrices.

Looking at the current exciting results at depth four, one might wonder if it is sufficient to prove circuit size lower bounds at depth three. A recent result justifies that it is true over $\mathbf{Q}$ [GKKS, FOCS 2013]. Strong enough lower bounds here can prove Valiant's conjecture. However, this is not true over fixed-size finite fields. A strong exponential circuit size lower bound is already known for the determinant polynomial [GK, STOC1998]. Work has been carried out improving the situation by proving depth three circuit size lower bounds for two seemingly different polynomials (one which is built from the combinatorial design of Nisan and Wigderson [NW, FOCS 1998] and the other is the iterated matrix multiplication polynomial) over fixed-size finite fields. This strengthens the already known lower bounds over fixed-size finite fields.

Work has also been carried out on matching algorithms with preferences, data structures for finding mode (when elements have no total ordering) and nearest largest neighbour. Continued work on DNA computing is also being done.

Physics

Research in theoretical physics has been carried out in a variety of areas including mathematical physics, fluid dynamics, classical gravity, gravitational waves, astrophysics, plasma and condensed matter physics, quantum field theory, particle physics, string theory and loop quantum gravity.

Mathematical Physics

An exact expression for a flat connection on the complement of a torus knot was derived. A general method was subsequently developed for deriving exact expressions for vector potentials produced by arbitrarily knotted solenoids.

Fluid dynamics

A new conservative regularization of the equations of ideal Eulerian hydrodynamics and compressible gas dynamics is being investigated.

Classical Gravity, Gravitational Waves and Astrophysics

- An improved gravitational waveform model in frequency domain for compact binary systems with spins incorporating the 2PN correction in the amplitude and 3.5PN correction in the phase was derived.
- Parameter estimation problem of neutron star- black hole systems using gravitational wave observations was studied in detail in the context of a world wide network of gravitational wave detectors.
- The importance of measuring inclination angle of a compact binary using gravitational wave observations for better understanding of short Gamma Ray Bursts was pointed out.
- A mass space metric for template placement of inspiral-merger-ringdown gravitational waveforms was constructed and is being implemented in the LIGO Algorithms Library, a data analysis library used in gravitational wave data analysis.
- The effect of Kaluza scalar on the geodesic deviation is being studied.

Plasma and condensed matter physics

Recent theories of spin half quantum plasmas and claims of spin gradient driven light amplification in metals were critically examined. These theories were found to contradict well-established principles of quantum and statistical physics.

Quantum Field Theory & Particle Physics

- A new correspondence between the Higgs mechanism in particle physics and the Added Mass effect in fluid mechanics was identified.
- A reinterpretation of the anomalous events seen in the Kolar experiments of 1960s, 1970s and 1980s as decays of light dark matter particles is given.
- An update of the earlier RG analysis of neutrino masses and mixings in the framework of high-scale-unification of leptonic mixing with quark mixing is undertaken. This is necessary in view of the recent determination of the reactor angle by the Daya Bay and RENO experiments. An important result of this work is that the atmospheric angle lies in the second octant.

- The renormalization group evolution of mixings and masses of Dirac neutrinos is done under the hypothesis of unification of the leptonic and quark mixings. This evolution is unique and does not suffer from the ambiguities that plague the similar evolution of Majorana neutrinos arising from the Majorana phases.

String Theory

- Non-conformal brane plane wave backgrounds, dual to strongly coupled gauge theories with constant energy flux, and holographic entanglement entropy for spacelike strip subsystems in them were studied in detail. These are generalizations of previous work (2012) where AdS plane waves, gauge/string realizations of "hyperscaling violation", dual to certain anisotropic CFT excited states, were found and subsequently entanglement entropy was studied systematically for strips, exhibiting novel scaling.
- Mutual information (i.e. with two disjoint strip subsystems) in the above backgrounds is currently being studied.
- Certain asymptotically de Sitter spacetimes (complex "bluewalls") were studied assuming the existence of gauge/gravity duality (dS/CFT) for de Sitter space. It was argued that these are gravity duals to the analogs of states in this Euclidean CFT with constant spatially uniform energy-momentum density, technically equivalent to an analytic continuation of the Euclidean AdS black brane.

Loop Quantum Gravity

- . Quantization of the Hamiltonian constraint was investigated in the context of Euclidean loop quantum gravity. An attempt was made to define diffeomorphism invariant dynamical equations of LQG when the space-time metric is Euclidean rather than Lorentzian.
- A new extension of the BMS group (named after Bondi, Matzner and Sachs) was proposed. A definition for the canonical generators associated to the smooth diffeomorphisms was proposed and it was shown that the resulting Ward identities are equivalent to the subleading soft graviton theorem of Cachazo and Strominger.
- Quantization of cosmological perturbations in the loop quantum gravity framework is currently being studied.

10 Publications

Journal Articles

Mathematics

- J1 Roger Casals, Dishant M. Pancholi, Francisco Presas: Contact Blow-Up, *Expositiones Mathematicae*, In Press.
(<http://www.sciencedirect.com/science/article/pii/S0723086914000048>).
- J2 Kavita Sutar: Orbit closures of source-sink Dynkin quivers, *Int Math Res Notices*, March 2014, doi:10.1093/imrn/rnu037.
- J3 Priyavrat Deshpande: On a generalization of Zaslavsky's theorem for hyperplane arrangements, *Annals of Combinatorics*, March 2014, Volume 18, Issue 1, pp 35-55.
- J4 Purusottam Rath, S. Gun and M. Ram Murty: A note on special values of L-functions, to appear in the *Proceedings of American Math. Society*.
- J5 Indranil Biswas and S. Senthamarai Kannan: Stability of the tangent bundle of the wonderful compactification of an adjoint group, *Doc. Math.* 18 (2013), 1465-1472.
- J6 S. Senthamarai Kannan, B. Narasimha Chary and S.K. Pattanayak: Torus invariants of the homogeneous coordinate ring of G/B -connection with Coxeter elements, *Comm. Algebra* 42 (2014), no. 5, 1880-1895.
- J7 S. Senthamarai Kannan: GIT related problems of the flag variety for the action of a maximal torus, *Springer Proceedings in Mathematics and Statistics*, New Delhi, Heidelberg, New York, 2014, 189-203.
- J8 Shiva Shankar: The Hautus Test and Genericity Results for Controllable and Uncontrollable Behaviors, *SIAM Journal of Control and Optimization*, 52:32-51, 2014.
- J9 Shrihari Sridharan: Spectral triples and Sinai-Ruelle-Bowen measures, to appear in *Complex Analysis and Operator Theory*.
- J10 R. Srinivasan, Panchugopal Bikram, Masaki Izumi and V.S. Sunder: On extendability of endomorphisms and of E_0 -semigroups on factors, *Kyushu J. Math* 68 (2014), 165-179.
- J11 R. Srinivasan and Oliver Margetts: Invariants for E_0 -semigroups on II_1 factors, *Communications in Mathematical Physics*, November 2013, Vol 323, issue 3, pp 1155-1184.

Computer Science

- J12 S. Akshay, Benedikt Bollig, Paul Gastin, Madhavan Mukund and K. Narayan Kumar: Distributed Timed Automata with Independently Evolving Clocks, *Fundam. Inform.* 130(4): 377-407 (2014).
- J13 John Augustine, Qi Han, Philip Loden, Sachin Lodha and Sasanka Roy: Tight Analysis of Shortest Path Convergecast in Wireless Sensor Networks, *Int. J. Found. Comput. Sci.* 24(1): 31-50 (2013) (Invited in the special issue of CATS 2011).
- J14 Partha Mukhopadhyay, Shachar Lovett and Amir Shpilka: Pseudorandom Generators for $CC0[p]$ and the Fourier Spectrum of Low-Degree Polynomials over Finite Fields, *Computational Complexity*, 2013.
- J15 Partha Mukhopadhyay, Zohar Karnin, Amir Shpilka and Ilya Volkovich: Deterministic identity testing of depth-4 multilinear circuits with bounded top fan-in, *SIAM J. of Computing*, 2013.
- J16 Prajakta Nimbhorkar, Bireswar Das and Samir Datta: Log-space algorithms for paths and matchings in k-trees, *Theory of Computing Systems*, Volume 53, Issue 4, pp 669-689 (2013).
- J17 Prateek Karandikar and Philippe Schnoebelen: On the index of Simon's congruence for piecewise testability, to appear in *Information Processing Letters*. (<http://arxiv.org/abs/1310.1278>).
- J18 Prateek Karandikar and Philippe Schnoebelen: Generalized Post Embedding Problems, to appear in *Theory of Computing Systems*. (journal version of CSR 2012 paper) (<http://arxiv.org/abs/1109.1691>).
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Physics

- J21 Govind S. Krishnaswami, Rajaram Nityananda, Abhijit Sen and Anantanarayanan Thyagaraja: Comment on "Spin-gradient-driven light amplification in a quantum plasma", *Phys. Rev. Lett.* 112, 129501 (2014), arXiv:1403.0228 [physics.plasm-ph]
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- J24 K. Narayan: Nonconformal brane plane waves and entanglement entropy, *Phys.Lett.B* 726, pp.370 (2013), arXiv:1304.6697 [hep-th].
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- J26 Gauhar Abbas, Saurabh Gupta, G. Rajasekaran, and Rahul Srivastava: Predictions from high scale mixing unification hypothesis, *Physical Review D* 89, 093009, 2014. arXiv: 1401.3399 [hep-ph].
- J27 Gauhar Abbas, Saurabh Gupta, G. Rajasekaran, and Rahul Srivastava: High scale mixing unification for Dirac neutrinos, *Physical Review Letters*, 2013 (Submitted). arXiv: 1312.7384 [hep-ph].
- J28 MVN. Murthy and G. Rajasekaran: Anomalous Kolar events revisited: Dark matter? *Pramana*, 82(3):L 609, 2014.
- J29 G. Rajasekaran: Fermi and the theory of weak interactions, *Resonance*, 19(1):18, 2014.
- J30 V.V. Sreedhar: An Exact Expression for a Flat Connection on the Complement of a Torus Knot, *Journal of Knot Theory and Its Ramifications*, Vol. 22, No. 10 (2013).
- J31 V.V. Sreedhar: A General Method for Deriving Vector Potentials Produced by Knotted Solenoids, to Appear in *Modern Physics Letters*, 2014.

Conference Papers

Computer Science

- C1 M. F. Atig, K. Narayan Kumar and P. Saivasan: Adjacent Ordered Multipushdown Systems, *Proc. DLT’13*, Springer LNCS 7907 (2013).
- C2 Nikhil Balaji and Samir Datta: Collapsing Exact Arithmetic Hierarchies, 8th International Workshop on Algorithms and Computation, WALCOM 2014, Springer-Verlag LNCS 8344 pp.273–285
- C3 Samir Datta and Raghav Kulkarni: Space Complexity of Optimization Problems in Planar Graphs, To Appear in TAMC 2014.
- C4 Partha Mukhopadhyay and Suryajith Chillara: On the Limits of Depth Reduction at Depth 3 Over Small Finite Fields, To Appear in MFCS 2014.

- C5 Partha Mukhopadhyay and Suryajith Chillara: Depth-4 Lower Bounds, Determinantal Complexity: A Unified Approach, In Proceedings of STACS 2014, LIPIcs Vol 25, Schloss Dagstuhl (2014).
- C6 M. Praveen, Jeryme Leroux and Gregoire Sutre: Hyper-Ackermannian Bounds for Push-down Vector Addition Systems, To Appear in the proceedings of the joint meeting of the 23rd CSL and the 29th ACM/IEEE Symposium on LICS, 2014.
- C7 Sourav Chakraborty, Rameshwar Pratap, Sasanka Roy and Shubhangi Saraf: Helly-Type Theorems in Property Testing, Theoretical Informatics - 11th Latin American Symposium (LATIN 2014), Springer LNCS 8392. pp 306–317, 2014.
- C8 Sourav Chakraborty, Rupam Acharyya and Nitesh Jha: Counting Popular Matchings in House Allocation Problems, Computer Science - Theory and Applications - 9th International Computer Science Symposium in Russia, (CSR 2014).
- C9 Sourav Chakraborty, Abhishek Bhrushundi and Raghav Kulkarni: Property Testing Bounds for Linear and Quadratic Functions via Parity Decision Trees, To Appear in Proc. of CSR 2014.
- C10 F. Herbreteau, B. Srivathsan and I. Walukiewicz: Lazy abstractions for timed automata, CAV 2013, Springer LNCS 8044, pp 990–1005, 2013.
- C11 Prateek Karandikar and Philippe Schnoebelen: On the state complexity of closures and interiors of regular languages with subwords, To Appear in Proc. of DCFS 2014 (<http://arxiv.org/abs/1406.0690>).
- C12 A Baskar, Prasad Naldurg, K.R. Raghavendra and S.P. Suresh: Primal infon logic: derivability in polynomial time, Proceedings of FSTTCS 2013, pp 162–174, LIPIcs Vol 24, Schloss Dagstuhl (2014).
- C13 Madhavan Mukund, Gautham Shenoy R. and S.P. Suresh: Optimized OR-Sets Without Ordering Constraints, Proc. ICDCN 2014 Springer LNCS 8314 (2014) 227-241.
- C14 S. Akshay, L. Helouet and Madhavan Mukund: Sessions with an unbounded number of agents, Proc. ACSD 2014, IEEE (2014) to appear.

Physics

- C15 C.K. Mishra, K.G. Arun and B.R. Iyer: 2.5PN kick from black-hole binaries in circular orbit: Nonspinning case, Proceedings of “Relativity and Gravitation - 100 Years after Einstein in Prague” Ed. J. Bicak (2013).

Preprints

Mathematics

- P1 Dishant M. Pancholi: On complement of almost symplectic classes.
- P2 Kavita Sutar and Priyavrat Deshpande: Deletion-restriction in toric arrangements.
- P3 Kavita Sutar: Resolutions of quiver loci of equioriented A_n .
- P4 Krishna Hanumanthu and S. Senthamarai Kannan: Syzygies of some GIT quotients.
- P5 Priyavrat Deshpande: Face enumeration for line arrangements in a 2-torus.
- P6 Purusottam Rath, T. Chatterjee and S. Gun: Number field extension of a question of Milnor.
- P7 S. Senthamarai Kannan: On the automorphism group of a smooth Schubert variety.
- P8 B. Narasimha Chary, S. Senthamarai Kannan and A. J. Parameswaran: Automorphism group of a Bott-Samelson-Demazure-Hansen Variety.
- P9 Indranil Biswas, S.Senthamarai Kannan and D.S. Nagaraj: Equivariant vector bundles on Complete Symmetric Varieties of minimal rank.
- P10 Indranil Biswas, S. Senthamarai Kannan and D.S. Nagaraj: On Equivariant principal bundles over wonderful compactifications.
- P11 Shrihari Sridharan: The Recurrence Rate and Hausdorff Dimension of a Neighbourhood of some Typical Point in the Julia Set of a Rational Map.
- P12 Shrihari Sridharan and Gautam Bharali: The Dynamics of Holomorphic Correspondences of $\mathbf{P}^1$: Invariant Measures and the Normality set.
- P13 R. Srinivasan and Oliver Margetts: Non-cocycle-conjugate E_0 -semigroups on factors.

Computer Science

- P14 Nikhil Balaji and Samir Datta: Tree-width and Logspace: Determinants and Counting Euler Tours. CoRR abs/1312.7468 (2013).
- P15 Eric Allender, Nikhil Balaji and Samir Datta: Low-depth Uniform Threshold Circuits and the Bit-Complexity of Straight Line Programs, Electronic Colloquium on Computational Complexity (ECCC) 20: 177 (2013).
- P16 A. Cyriac, P. Gastin and K. Narayan Kumar: Verifying Communicating Multi-Pushdown Systems, <http://hal.archives-ouvertes.fr/hal-00943690>

- P17 Prajakta Nimbhorkar, Pratik Ghosal and Meghana Nasre: Rank-Maximal matchings: structure and algorithms.
- P18 Petr Janar, Prateek Karandikar and Philippe Schnoebelen: Unidirectional Channel Systems Can Be Tested, (journal version of IFIP TCS 2012 paper) (<http://arxiv.org/abs/1406.5067>).
- P19 Rani Siromoney: Hexagonal Array Grammars and Tiling.
- P20 Vaishnavi Sundararajan, R. Ramanujam and S.P. Suresh: Extending Dolev-Yao with assertions.
- P21 A Baskar, R Ramanujam and S.P. Suresh: Dolev-Yao theories with distributive encryption.
- P22 Sumit Kumar Jha, Madhavan Mukund, Ratul Saha and P S Thiagarajan: Distributed Markov Chains, arXiv:1408.0979.

Physics

- P23 Alok Laddha and Miguel Campiglia: On asymptotic symmetries and subleading soft graviton theorem, arXiv:1408.2228.
- P24 Alok Laddha: Hamiltonian constraint in Euclidean LQG revisited: First hints of off-shell Closure, arXiv:1401.0931.
- P25 Alok Laddha and M. Varadarajan: LQG dynamics: Chapter for a volume in the World Scientific series titled “100 Years of General Relativity” ed. by A. Ashtekar and J. Pullin.
- P26 Govind S. Krishnaswami, Rajaram Nityananda, Abhijit Sen and Anantanarayanan Thyagaraja: A critique of recent theories of spin half quantum plasmas, arXiv:1306.1774 [physics.plasm-ph].
- P27 R. Parthasarathy: Influence of Kaluza scalar on the Raychaudhuri Equation. arXiv: 1311.0103 (hep-th).
- P28 K.G. Arun, H. Tagoshi, A. Pai and C.K. Mishra: Synergy of short gamma ray burst and gravitational wave observations: Constraining the inclination angle of the binary and possible implications for off-axis GRBs, (arXiv:1403.6917).
- P29 H. Tagoshi, C.K. Mishra, A. Pai and K.G. Arun: Parameter estimation of neutron star-black hole binaries using an advanced gravitational-wave detector network: Effects of the full post-Newtonian waveform, (arXiv:1403.6915).

Ph.D. Thesis

T1 Ramprasad Saptarishi: Unified Approaches to Polynomial Identity Testing and Lower Bounds (April 2013).

11 The National Undergraduate Programme

In 1998, CMI initiated an National Undergraduate Programme in the Mathematical Sciences in collaboration with Madhya Pradesh Bhoj Open University with a 3 year course in Mathematics and Computer Science, leading to a B.Sc. Honours degree. In 2001, this programme was extended to the postgraduate level with separate 2 year courses leading to M.Sc. degrees in Mathematics and Computer Science. The scope of the undergraduate programme was expanded in 2003 to incorporate a 3 year course leading to a B.Sc. Honours degree in Physics. CMI commenced a two year course leading to an M.Sc. degree in Applications of Mathematics in 2010.

From 2012, the B.Sc. Physics programme has been restructured as a B.Sc. programme in Mathematics and Physics. There is a common admission to the B.Sc. programmes in Mathematics and Computer Science and Mathematics and Physics and all students do the same courses in the first semester. Students choose their stream at the end of the first semester.

The undergraduate and postgraduate teaching programmes at CMI are both run in co-operation with the Institute of Mathematical Sciences (IMSc), Chennai. These programmes tap the teaching talent available at the elite research institutes of the country, which are normally outside the university system. Students are thus exposed to lectures by active researchers who bring a very different perspective to the teaching.

B.Sc. (Hons.) Mathematics and Computer Science

In 2013, the sixteenth batch of students was admitted to the undergraduate programme. At the end of the first semester, 18 opted for B.Sc. in Mathematics and Computer Science. The second year B.Sc. class has 17 students in Mathematics and Computer Science and the third year B.Sc. class has 21 students. Out of the 18 students of the 2010 batch who took their degrees at the convocation in August, 2013, several have been placed in very prestigious institutions.

- Arjun Arul
Facebook Inc.
- Anudhyan Boral
PhD student in Computer Science, Harvard University, USA
- Sujoy Chakraborty
MSc student in Mathematics, Chennai Mathematical Institute
- Jaitra Chattopadhyay
- Ronno Das
PhD student in Mathematics, Chennai Mathematical Institute

- Udyam Das
- Apratim De
Graduate student in Applied Mathematics, Central European University, Hungary
- Sonam Kumar
- Ayan Maiti
- Viswambhara Makam
PhD student in Mathematics, University of Michigan, USA
- Sayanta Mandal
PhD student in Mathematics, Chennai Mathematical Institute
- Jayan Mukherjee
MSc student in Mathematics, Chennai Mathematical Institute
- Gaurav Digambar Patil
PhD student in Mathematics, University of Toronto, Canada
- Anwesh Ray
PhD student in Mathematics, Chennai Mathematical Institute
- Debaditya Raychaudhury
MSc student in Mathematics, Chennai Mathematical Institute
- Siddharth K
PhD student in Computer Science, New York University, USA
- Ayan Sengupta
- Siddhesh Wagh
PhD student in Mathematics, University of Oklahoma, USA

B.Sc. (Hons.) Physics

This programme was started in 2003 with the assistance of the Physics Faculty of the IMSc., Chennai, and the active participation of physicists across the country.

The third year class has 9 students. Out of the 9 students of the 2010 batch who took their degrees at the convocation in August, 2013, several have been placed in very prestigious institutions.

- Ritam Basu
- Chinmay Kalaghatgi
PhD student in Physics, Chennai Mathematical Institute
- Anirudh Krishna
PhD student in Physics, Perimeter Institute, University of Waterloo, Canada
- Srijita Kundu
- Arya Mitra
- Anil Nair
- Shibasis Roy
- Sonakshi Sachdev
PhD student in Physics, Chennai Mathematical Institute
- Himalay Senapati
PhD student in Physics, Chennai Mathematical Institute

B.Sc. (Hons.) Mathematics and Physics

Of the 26 students admitted to the undergraduate programme in 2013, 8 students opted for B.Sc. in Mathematics and Physics as the end of the first semester. The second year class has 5 students.

M.Sc. Mathematics

In 2013, 12 students have joined the programme. There are 8 students in the second year of the programme. Four students who joined the programme in 2011 have completed the programme successfully.

- Siddhant Agrawal
PhD student in Mathematics, University of Michigan at Ann Arbor, USA
- Shivaji Das
- Yajnaseni Dutta
PhD student in Mathematics, University of Illinois at Chicago, USA
- Tushar Kanta Naik
PhD student in Mathematics, Harish-Chandra Research Institute, Allahabad

M.Sc. Computer Science

In 2013, 8 students have joined the programme. There are 9 students in the second year of the programme. Nine students who joined the programme in 2011 have completed the programme successfully.

- Abhishek Bhrushundi
PhD student in Computer Science, Chennai Mathematical Institute
- Suryajith Chillara
PhD student in Computer Science, Chennai Mathematical Institute
- Shion Samadder Chaudhury
- Abhishek Hemantkumar Dang
- Ritwika Ghosh
PhD student in Computer Science, University of Illinois at Urbana-Champaign, USA
- Varunkumar Jayapaul
PhD student in Computer Science, Chennai Mathematical Institute
- Mithilesh Kumar
PhD student in Computer Science, Chennai Mathematical Institute
- Biman Roy
Research Assistant, IIT Kanpur
- Hrishikesh Terdalkar
Project Associate, IIT Kanpur

M.Sc. Applications of Mathematics

In 2013, 8 students have joined the programme. There are 12 students in the second year of the program. Eleven students who joined the programme in 2010 have completed the programme successfully.

- Niranka Banerjee
Project student, Institute of Mathematical Sciences, Chennai
- Pauline Ezhilarasi A
- Pratish Gandhi
Goldman Sachs, Bangalore

- Pratik Ghosal
Research Assistant, IIIT Delhi
- Shubhayan Kabir
- Lav Kumar
- Nikhil S Mande
PhD student in Computer Science, TIFR, Mumbai
- Amlan Modak
Credit Suisse, Mumbai
- Arnab Saikat Nayak
Goldman Sachs, Bangalore
- Navoneel Raichaudhuri
Dolat Capital, Mumbai
- Kaustav Sarkar
Credit Suisse, Mumbai

Convocation

The 11th Annual Convocation of CMI was held on 31 July 2013. Degrees were awarded to 55 successful candidates at various levels. Of these, 27 were B.Sc. candidates, 27 were M.Sc. candidates and 1 was a Ph.D. candidate. Shri Sunil Kumar, I.A.S., Chief Secretary, Government of Chhattisgarh, gave away the degree certificates. Prof. P.S. Thiagarajan, National University of Singapore, delivered the convocation address.

For the B.Sc. programmes, the CMI Medal of Excellence was awarded to Ronno Das in Mathematics and Computer Science and Srijita Kundu in Physics for their outstanding performance at the undergraduate level. For the M.Sc. programmes, the CMI Medal of Excellence was awarded to Siddhant Agrawal in Mathematics, Nikhil S. Mande in Applications of Mathematics and Mithilesh Kumar in Computer Science.

The S. Parthasarathy Commemorative Prize for original research work by undergraduate students was awarded to Anudhyan Boral and Siddharth Krishna.

12 Activities of the Undergraduate Students

ACM Inter-collegiate Programming Contest

CMI was one of teams that qualified to participate in the World Finals of the ACM-ICPC held at St. Petersburg, Russia in July 2013. The team consisted of Arjun Arul, Anudhyan Boral and Siddharth Krisha. Ronno Das accompanied the team as a coach. The team received an honorable mention in the contest. This is the third time that a team from CMI has qualified for the World Finals.

13 Undergraduate/Graduate Courses

Course	Instructor
Advance Particle Physics	H S Mani
Advanced Machine Learning	Madhavan Mukund
Advanced Programming	Samir Datta
Advanced Set Theory	S P Suresh
Advanced Topics in Optimization	K V Subrahmanyam
Algebra	Prem Prakash Pandey
Algebra I	Shiva Shankar
Algebra II	S Senthamarai Kannan
Algebra II	Prem Prakash Pandey
Algebra III	Clare D'Cruz
Algebra IV	Krishna Hanumanthu
Algebraic Geometry	Krishna Hanumanthu
Algebraic Groups II	S Senthamarai Kannan
Algebraic Topology	Priyavrat Deshpande
Algebraic Topology II	Priyavrat Deshpande
Analysis	Shrihari Sridharan
Applied Statistics	Sourish Das
Approximation Algorithms	Prajakta Nimbhorkar
Atomic and Molecular Physics	R Parthasarathy
Automata Theory & Verification	K Narayan Kumar
Automata for Real-Time Systems	B Srivathsan
Caculus III	Sukhendu Mehrotra
Calculus I	B V Rao
Calculus II	B V Rao
Classical Electrodynamics	K G Arun
Classical Mechanics	Govind Krishnaswami
Classical Mechanics I	H S Mani
Classical Mechanics II	Govind Krishnaswami
Coding Theory	Sourav Chakraborty
Commutative Algebra	Manoj Kummini
Commutative Algebra & Invariant of Groups	Manoj Kummini

Complex Analysis	Purusottam Rath
Complex Analysis	Shiva Shankar
Complexity Theory	Samir Datta
Computational Methods	Sourish Das
Concurrent Programming	S P Suresh
Condensed Matter Physics	Vidya Ravindran
Continuum Mechanics & Nonlinear Dynamics	K G Arun
Creative English	Usha Mahadevan
Cryptography	Santanu Sarkar
Cryptography	K V Subrahmanyam
Data Mining & Machine Learning	Madhavan Mukund
Design & Analysis of Algorithms	Sasanka Roy
Design & Analysis of Algorithms	Partha Mukhopadhyay
Differential Equations	Dishant Pancholi
Differential Equations	Shrihari Sridharan
Differential Geometry	Upendra Kulkarni
Differential & Integral Eqns	Dishant Pancholi
Discrete Mathematics	K V Subrahmanyam
Discrete Mathematics	Sourav Chakraborty/Samir Datta
Discrete Mathematics (MSc)	B Srivathsan
Econometrics I	V Swaminathan
Econometrics II	V Swaminathan
Economics	Malathi Velamuri
Electromagnetism I	K Narayan
Elliptic Functions and Transcendence	Purusottam Rath
English	Usha Mahadevan
Ergodic Theory	B V Rao
Finance I	Sreejata Banerjee
Finance II	Sreejata Banerjee
Functional Analysis	R Srinivasan
Game Theory	T Parthasarathy
General Relativity	Alok Laddha
Harmonic Analysis	Murali Vemuri
Intro to Programming (Haskell)	K Narayan Kumar

Intro to Programming (Python)	Samir Datta
Introduction to Logic	S P Suresh
Introduction to String Theory	K Narayan
Laboratory	K G M Nair
Laboratory 1	K G M Nair
Linear Algebra	Kavita Sutar
Mathematical Physics	G Rajasekaran
Mathematical Writing	Kavita Sutar
Measure Theoretic Probability	Rajeeva L Karandikar
Measure Theory	S Sundar
Model Checking and Systems Verification	M Srivas
Nuclear & Particle Physics	G Rajasekaran
Operator Algebras	R Srinivasan
Optimization	K V Subrahmanyam
Optimization	T Parthasarathy
Perse Sheaves	Upendra Kulkarni
Principles of Digital Systems Design and Modeling	M Srivas
Probabilistic Graphical Models	Madhavan Mukund
Probability Theory	Nandini Kannan
Probability and Statistics	Ananya Lahiri
Program Analysis	Madhavan Mukund
Programming Language Concepts	S P Suresh
Quantum Field Theory	R Parthasarathy
Quantum Field Theory	T R Govindarajan
Quantum Mechanics	Alok Laddha
Quantum Mechanics I	T R Govindarajan
Quantum Mechanics I	V V Sreedhar
Quantum Mechanics I	V V Sreedhar
Real Analysis	M Sundari
Real Analysis	Sundar Sobers
Recursion Theory	S P Suresh
Representation Th. of Symmetric Groups	Kavita Sutar
Risk Management	Ananya Lahiri
Simulation Methods	Samar Singh
Statistical Mechanics	Prabuddha Chakraborty

Statistical Mechanics I	R Jagannathan/T R Govindarajan
Statistical Mechanics II	S. Lakshminarasimhan
Statistical Mechanics III	S. Lakshminarasimhan
Stochastic Processes I	Rajeeva L Karandikar
Theorem Proving	Madhavan Mukund/S P Suresh/M Srivas
Theory of Computation	B Srivathsan
Topology	V Balaji
Topology	V Balaji
Toric Varieties	Sukhendu Mehrotra

14 Special Lectures

- R. Sridharan: History of elliptic functions and a few footnotes (April 2013).
- K V Subrahmanyam: Deformations of $U_q(gl_{mn})$ modules - an approach to the Kronecker problem (April 2013).
- Ramprasad Saptarishi: Unified Approaches to Polynomial Identity Testing and Lower Bounds (April 2013).
- Priyavrat Deshpande: Cohomology algebra of the complement of a toric arrangement (August 2013).
- Govind S. Krishnaswami: Modular forms and Hecke operators: a physical interpretation, Mathematics research seminar (September 2013).
- Lakshya Bhardwaj: Classification of 4d N=2 gauge theories (October 2013).
- N.D. Hari Dass: Varieties of Quantum Measurements. (October 2013).
- N.D. Hari Dass: The Superposition Principle in Quantum Mechanics - did the rock enter the foundation surreptitiously? (March 2014).
- B. Narasimha Chary: Automorphism group of a Bott-Samelson variety (March 2014).
- Rajeeva Karandikar: Power and Limitations of Opinion Polls (March 2014).

15 Workshops/Schools/Conferences

***h*-principle and its applications to contact and symplectic geometry, July 2013**

This workshop was organized by V. Balaji, Dishant M. Pancholi and Shiva Shankar to cover the preliminaries necessary to follow Prof. Yakov Eliashberg's lectures at CMI.

- M. Dutta and D.M.Pancholi
Introduction to h-principle
- S. Shankar
Basic symplectic geometry and Arnold conjecture
- Gautam Bharali
An introduction to plurisubharmonic functions and Stein manifolds
- S. Venugopalan
Introduction to contact geometry

Workshop and XIII Discussion Meeting On Harmonic Analysis (DMHA), December 2013

The workshop was held at the Chennai Mathematical Institute, Chennai and the Conference was held at the Institute of Mathematical Sciences, Chennai. The organizers were : V S Sunder (IMSc.), Sundari Maddala (CMI), Shrihari Sridharan (CMI) and Murali Vemuri (CMI).

The following topics were covered in the lectures that took place during the workshop.

- S. Sundar, CMI
Basic Measure Theory, Product Spaces, Fubini's Theorem, Infinite Product Spaces, Hilbert Spaces, Radon - Nikodym Theorem, Spectral Theorem for Self-adjoint Operators, Banach - Alaoglu Theorem
- R. L. Karandikar, CMI
Conditional Expectations, Martingale Convergence Theorem, Borel - Cantelli Lemma.
- Amritanshu Prasad, IMSc
The Fourier Transform on T and R , Generalisation to LCA Groups, Plancherel Theorem, Hausdorff - Young Inequality, Pontryagin Duality.

- M. K. Vemuri, CMI
Locally Compact Groups, Representations in Hilbert Space, Irreducible Representations, The Dual Object, Fourier Transforms, A Statement of Plancherel for Type I Groups.
- B. V. Rao, CMI
Partitions, Kolmogorov and Sinai Entropy, Basic Ergodic Theory, Theorems of Birkhoff and von Neumann, Poincare's Recurrence Theorem, Transitivity.

Lectures to honour Prof. K.R. Nagarajan on his 80th Birthday, December 2013

- Krishna Hanumanthu, CMI
Hilbert coefficients of local rings
- Rohith Varma
Higgs bundles on Elliptic surfaces

Reading Manuscripts on Mathematical Sciences in Sanskrit, December 2013

This reading was arranged under the auspices of the Working Group for History of Astronomical and Mathematical Sciences in India (HAMSI). The participants read together and discussed the various Sanskrit manuscripts that each of them was currently working on. "Field Trips" were also organised to see Sanskrit scientific manuscripts in the area, at the K. V. Sarma Library and/or the Manuscripts Library at University of Madras. The participants were

- Prof. Christopher Minkowski, Boden Professor of Sanskrit, Oriental Institute, University of Oxford, UK.
- Dr Clemency Montelle, Senior Lecturer, Department of Mathematics and Statistics, University of Canterbury, New Zealand.
- Prof. Kim Plofker, Department of Mathematics, Union College, New York, U.S.A.
- Prof. K. Ramasubramanian, Department of Humanities and Social Sciences, IIT Bombay, India.
- Prof. Kenneth Zysk, Department of Cross-Cultural and Religious Studies, University of Copenhagen, Denmark.

CMI Arts Initiative

The objective of the CMI Arts Initiative is to provide a space for students, professionals and anybody else keenly interested in the humanities and arts to interact and learn from experts in these areas.

To achieve this, CMI invites distinguished professionals and academicians from these fields to give a series of lectures and performances of about 15-20 hours, spread over two or three weekends, on a topic of their choice.

The following programmes were held in 2013–2014.

- *Film Appreciation* by Parvathi Nayar, August-September, 2013
- *South Indian Temple Architecture* by Chithra Madhavan, November, 2013.

Writers in residence

CMI has a new writers' residency programme in cooperation with Sangam House, Bangalore. CMI supports two international writers each year for a residency of four weeks. Under this program the following writers were in residence during 2013-14.

- Jeremy Tiang, a writer and translator from Singapore. (January 2014)
- Karen Jennings, writer from South Africa. (February 2014)

Endowment Lectures at CMI

- Persi Diaconis, Mary V. Sunseri Professor of Statistics and Mathematics at Stanford University, U.S.A. delivered the Annual K. Madhava Sarma Memorial Distinguished Lecture on “Adding Numbers and Shuffling Cards” (December 2013).
- Jaikumar Radhakrishnan, TIFR, Mumbai. delivered the R.K. Rubugunday Distinguished Lecture on “The girth of graphs and the limits of two bit probes” (February 2014).
- Pascal Weil LaBRI, CNRS and University of Bordeaux, France delivered the K. Lakshmanan Memorial Distinguished Lecture on “About the lattice of finitely generated subgroups of a free group” (March 2014).

16 Conferences, Visits and External Lectures

Rajeeva L. Karandikar

- Gave invited talks on Opinion Polls in the context of Indian Parliamentary Democracy at IISER, Pune in September 2013.
- Visited Indian Statistical Institute, Delhi, in December 2013.
- Gave an invited talk at National Meet of Research Students in Mathematical Sciences, University of Pune on “Introduction to Monte Carlo Simulation” in February 2014.
- Gave invited talks on Opinion Polls in the context of Indian Parliamentary Democracy at University of Pune as part of Science day celebrations (2014).
- Gave invited talks on Opinion Polls in the context of Indian Parliamentary Democracy at IIT, Kanpur, in March 2014.
- Gave invited talk at a discussion meeting on “Nonlinear Filtering and Data Assimilation”, at ICTS, Bangalore on “Introduction to Nonlinear Filtering”.
- Gave an invited talk at the Indo French Technology summit, New Delhi, on “Economic Benefits of Mathematical Science Research.

Madhavan Mukund

- Gave series of video lectures on Algorithms, Microsoft Research Massively Empowered Classrooms online course, during January-May 2013.
- Gave an invited talk on “Concurrent programming: old problems, new challenges” at TACTiCs 2013, 9th Global TCS Technical Architects’ Conference, at Tata Consultancy Services, Chennai, in April 2013.
- Visited LSV, ENS de Cachan, France and LIAFA, Univ Paris 7, France in May 2013.
 - Presented a talk entitled “Deterministically Communicating MDPs” at LSV, ENS de Cachan, France.
 - Presented a talk entitled “Optimized OR-Sets Without Ordering Constraints” at LIAFA, Univ Paris 7, France in May 2013.
- Gave an invited talk on “Concurrent programming: old problems, new challenges” at Global Analytics, Chennai, in June 2013.
- Attended 12th Update Meeting on Advanced Formal Methods at New Delhi, in July 2013.

- Presented a talk at the Round Table on “IT Systems in the industry: how to ensure software reliability?” at India-France Technology Summit, New Delhi, in October 2013.
- Visited IRISA, Rennes, France in September-October 2013 and presented a talk entitled “Deterministically Communicating MDPs” at IRISA, Rennes, France in October 2013.
- Gave an invited talk on “Correctness in a connected world”, IDRBT Doctoral Colloquium at Institute for Development and Research in Banking Technology, Hyderabad, in December 2013.
- Participated in ACM India Annual Event at IIT Delhi, in February 2014.
- Gave an invited talk on “Who’s Afraid of Algorithms”, at MSR MEC Workshop, Chennai, in February 2014.
- Gave lectures on Data Mining and Machine Learning in the Business Analytics Training Programme at ISI Chennai, in March 2014.
- Gave lectures on NP-Completeness at SSN College of Engineering, Chennai, in March 2014.

Samir Datta

- Visited Leibnitz University of Hannover as Guest Professor (W3) during April - July 2013 and gave a course on Logspace Computation.

K. Narayan Kumar

- Attended CEFIPRA Workshop on “Challenges in overcoming complexity, from big data to cyber-physical systems”, in April 2013.
- Visited Uppsala University, Sweden, in May 2013.
- Visited LSV, ENS de Cachan in June 2013 and as part of the CNRS LIA “Informel”.
- Gave a talk on “Split-width and the Verification of Concurrent Recursive Programs”, at TIFR, Mumbai, in July 2013.
- Gave a talk on “Split-width and the Verification of Concurrent Recursive Programs”, at IISc, Bangalore, in October 2013.

S. Senthamarai Kannan

- Attended Vector Bundles conference at KSOM during March 2014.

K.V. Subrahmanyam

- Attended Workshop on Representations of Algebraic Groups, by Peter Feibeg, in October 2013, at IMSc.
- Attended Workshop on Generators and Relations for Soergel Bimodules by Prof. Ben Elias, held in February 2014 at IMSc.
- Visited Prof Bharat Adsul in IIT Mumbai, in February 2014.

Sourav Chakraborty:

- Attended Property Testing Workshop at Haifa.
- Attended CTW 2013.
- Attended Mysore Park Workshop 2013.
- Visited Harry Buhrman at CWI, Amsterdam, in May 2013.
- Visited Sophie Laplante in Laboratoire d'Informatique Algorithmique: Fondements et Applications (LIAFA), in May 2013.
- Visited Eldar Fischer at Technion, Israel, in June 2013.
- Attended LATIN 2014.
- Was a visiting Associate professor at University of California, San Diego from January to March 2014.
- Gave a series of 30 lectures on Algorithms for UGC program.

Govind S. Krishnaswami

- Along with Profs G. Rajasekaran and H. S. Mani, co-organised a national Refresher Course on quantum mechanics (May 2013) at SB College Changanacherry, Kerala for college and university faculty. This course is conducted by the three Indian science academies under the chairmanship of Prof. N. Mukunda. Taught a lecture course (13 lectures) on relativistic quantum mechanics and gave some supplementary lectures on non-relativistic quantum mechanics.
- Visited Thiruvananthapuram for physics discussions with Prof. S.G. Rajeev during June 2013.
- Gave a talk on "Higgs mechanism and fluid mechanics" at the Second Ramanujan Fellows Conclave at IISER Pune, during December 2013.

- Along with Professors G. Rajasekaran, H. S. Mani and K. S. Mallesh, co-organised a national Refresher Course on quantum mechanics (December 2013) at JSS Mahaviyapeetha, Suttur, Karnataka for college and university faculty. Taught a lecture course (13 lectures) on Quantum Mechanics: Formalism, Harmonic oscillator, Angular momentum, Identical particles, Atoms.

Upendra Kulkarni

- Gave lectures on representations of Chevalley groups in the ATM school on Chevalley Groups, in May 2013 at IISER Pune.
- Attended Workshop on Cohomological Finite Generation by Wilberd van der Kallen during June - July 2013 at IMSc., Chennai.
- Attended Workshop on Sheaves on affine flag manifolds, combinatorics of Bruhat graphs and modular representations of algebraic groups by Professor Peter Fiebig in October 2013 at IMSc., Chennai.
- Gave lectures on Clifford algebras in AIS on Classical Groups and Introduction to K-theory, in December 2013 at IISER, Pune.
- Attended Workshop on Soergel bimodules and Kazhdan-Lusztig theory by Ben Elias during January - February 2014 at IMSc., Chennai

K. Narayan

- Visited String theory group, Institute for Advanced Study (IAS), Princeton, U.S.A., in May 2013 and gave a talk on “D-brane plane waves, hyperscaling violation and entanglement entropy”.
- Attended Great Lakes Strings Conference, in May 2013, at U. Kentucky, U.S.A. and gave a talk on “D-brane plane waves, hyperscaling violation and entanglement entropy”.
- Visited Center for Particle Physics, MIT, USA, in May 2013.
- Attended “The Information Paradox, Black Holes and Entanglement” workshop, at ICTS Bangalore, in September 2013.

Sasanka Roy

- Visiting professor at Simon Fraser University, BC, Canada, August–December 2013.
- Attended WALCOM preschool and workshop at IIT Madras, in February 2014.

- Gave an invited talk on “Data Structures for Optimizing Localized Geometric Query” at National Workshop and Conference on Discrete Mathematics and its Applications (NWCDMA), Jadavpur University, in March 2014.

R. Srinivasan

- Attended and gave a talk titled “CCR flows on type III factors” in the conference in honor of 70th birth day of Prof Kalyan B. Sinha at KSOM.
- Visited University of Kyoto, Japan, during June-July 2013.
- Gave a talk at RIMS, Kyoto, Japan titled “Non-cocycle-conjugate E_0 -semigroups on non-type-I factors” in July 2013.
- Gave a talk at IMSc titled “Many CCR flows” in March 2014.

M. Sundari

- Gave an invited talk on “An analogue of Benedicks theorem for the Heisenberg group” at the Mathematics Department of IIT Madras in April 2013.
- An Instructional Workshop on Harmonic Analysis and 13th Discussion Meeting on Harmonic Analysis was organised in December 2013 with co-organisers V.S. Sunder, Murali K. Vemuri and Shrihari Sridharan. The conference is supported by NBHM, IMU-CDC, IMSc and CMI.

S.P. Suresh

- Attended Foundations of Software Technology and Theoretical Computer Science (FSTTCS) 2013, during December 2013 at IIT Guwahati and presented a paper on primal infon logic.
- Attended Indian School on Logic and its Applications (ISLA) 2014, in January 2014 at Tezpur University and gave a course of lectures on modal logic.

K.G. Arun

- Visited ICTS, Bangalore, during June-July and December 2013.
- Gave an invited talk at Field Theory and Gravitation (FTAG) held at IIT Gandhinagar in September 2013.
- Attended Gravitational Wave Physics and Astronomy Workshop at IUCAA, Pune, in December 2013.

Sourish Das

- Taught “Linear Models” at ISI Chennai in Fall 2013 semester (September - December 2013).
- Gave a talk on “Some Perspective on Efficient Market Hypothesis and Multiple Testing Problem” at ISI-Chennai, in January 2014.
- Gave a talk on “Bayesian Solution to Some Ill-Posed Problems”, at CMI.

Manoj Kummini

- Visited IMSc, Chennai, in July 2013.
- Gave an invited talk at Hanoi, Vietnam, in December 2013.
- Attended KSOM at Kozhikode, in February 2014.

Shrihari Sridharan

- Visited Indian Institute of Science Education and Research - Thiruvananthapuram, Thiruvananthapuram during April - May 2013.
- Gave an invited lecture in the Symposium on Complex Analysis, Annual Meeting of the Ramanujan Mathematical Society at Reva Institute of Science and Technology, Bangalore, during June 2013.
- Visited Indian Institute of Science, Bangalore during June - July 2013.
- Attended International Conference on Teichmüller Theory and Interfaces with Ergodic Theory and Group Actions at Jawahar Lal Nehru University, Delhi, during October 2013.
- Visited Ramanujan Institute for Advanced Study in Mathematics, Chennai during November 2013 and lectured on Ergodic Theory in the Lecturers Refresher Course.
- Visited Center for Excellence in Mathematical Sciences, Almora during December 2013 and lectured on Measure and Dimension Theory in the Instructional School for Lecturers.
- Visited Kalyani University, West Bengal during March 2014 and gave an invited lecture in the National Seminar on Mathematics and its Applications.
- Visited Indian Institute of Science Education and Research - Bhopal, Bhopal during March 2014 and lectured in the Conference on Harmonic Analysis and Operator Theory.

Prajakta Nimbhorkar

- Visited Institute of Mathematics, Prague, Czech Republic, during February - March 2014.

S. Sundar

- Visited Prof. Renault at University of Orleans for a month during September October 2013 to collaborate. The collaboration ended in a research article titled “Groupoids associated to Ore semigroup actions” which is accepted by J. Operator theory.
- Attended the workshop held in Kerala School of Mathematics in February 2014 on the occasion of 70th birthday of Prof. Kalyan B. Sinha.

B. Srivathsan

- Attended Formal Methods Update Meeting, in July 2013 at IIT Delhi.
- Visited IIT Bombay in September 2013 and delivered two guest lectures to Masters students.

Alok Laddha

- Delivered three seminars at the Horac Hearne Institute for Gravitational physics, Louisiana State university, U.S.A. in March 2014.

Priyavrat Deshpande

- Attended Annual meeting of the Ramanujan mathematical society, in June 2013.
- Gave a lecture on “Enumerative aspects of medu wadai cutting” at the Central University of Hyderabad, in February 2014.
- Attended National conference on advances in mathematics, in March 2014.
- Gave a lecture on “Topological generalization of Artin groups” at Hansraj College, Delhi University, in March 2014.

Kavita Sutar

- Attended Annual meeting of the Ramanujan mathematical society, in June 2013.

- Gave an invited talk at the Annual RMS Conference, Bangalore on “Geometry of orbit closures of quiver representations” in June 2013.
- Gave an invited talk at University of Hyderabad on “Similarity classes of matrices and some geometry” in February 2014.

T.R. Govindarajan

- Attended Bayrischzell Workshop in May 2013 and gave a talk on “Quantization, topological models and generalized geometries”
- Visited Arnold Sommerfeld Center, Ludwig Maxmilians University, Munich, in May 2013.
- Visited University of Zaragoza, Spain, in June 2013.
- Gave a talk on “Field Theoretic Aspects of Gravity” (FTAG IX), at IIT, Gandhi Nagar, Gujarat, during September 2013.
- Attended International Workshop on Mathematical Structure in Quantum Physics and Applications, CHEP, IISc, Bangalore during February 2014.
- Attended International Program on Quantum Information at Inst of Physics, Bhubaneswar, in February 2014.

R. Parthasarathy

- Gave a talk on “Changing Scenes in Particle Physics” at SRM University, in March 2014.

B.V. Rao

- Visited and lectured at Department of Electrical Engineering, Indian Institute of technology, Bombay, in April 2013
- Visited and taught at Department of Probability and Statistics, Michigan State University East Lansing, during May - June 2013
- Visited and gave lecture at Astrostatistics School Kavalur, Indian Institute of Astrophysics, in (July 2013).
- Visited and gave lecture at the School in Topology, Center for Excellence in Mathematics, Kumaun University, Almorah, during September - October 2013.

- Attended and gave lecture at UGC Refresher course at Ramanujan Institute, Madras University, Chennai, during November 2013.
- Attended and gave lecture at Advanced training programme in statistics, Pondichery (by Indian Statistical Institute, Chennai) in November 2013.
- Attended lectures in probability and stochastic processes at ISI, Bangalore, during December 2013.
- Attended the Conference Statistics 2013 held at C.R. Rao Advanced Institute of Math, Stat, Comp. at Hyderabad, in December 2013.
- Attended and gave lecture at Workshop in Probability at ISI, Kolkata, in December 2013.
- Attended and gave lecture at School in Probability at Tejpur University, in January 2014.
- Visited Indian Statistical Institute, Tejpur, in January 2014.
- Attended and gave lecture at Stochastic modelling in system engineering at Department of Mathematics, Coimbatore Institute of Technology, Coimbatore, in March 2014.
- Gave Departmental symposium at the Department of mathematics and Statistics IISER, Kolkata, in March 2014.
- Gave S Panchapakesan Endowment lecture at the Department of Statistics, Madras University, in March 2014.

G. Rajasekaran

- Participated in Workshop on Neutrinos and INO Project held at Kalasalingam University, Krishnan Koil during April 2013 and gave a talk on “The elusive neutrinos and their importance”.
- Visited IISER, Mohali, in April 2013 and gave a Colloquium talk on “The elusive Neutrinos and the INO”.
- Visited IIT, Ropar, Punjab, in April 2013 and gave a Colloquium talk on “Standard Model, Higgs Boson and What Next?”.
- Participated in Workshop on NDBD, Neutrinos and Dark Matter held at IIT, Ropar and Punjab University, Chandigarh during April 2013 and gave a talk on “NDBD and Dark Matter”.
- Gave two lectures at St Berchman’s College, Chenganacherry, in May 2013 on “Standard Model of HEP and Higgs” and “Neutrinos and INO”.

- Gave 12 lectures in the Science Academies' Refresher Course in Quantum Mechanics at St Berchman's College, Chenganacherry, in May 2013.
- Visited University of California, Riverside during May - June 2013 and pursued collaborative research with Physics Department of UCR.
- Visited IIT, Madras, in August 2013 and gave a talk on HEP at the function held to inaugurate the HEP laboratory.
- Participated in Asian Quantum Information Conference held at IMSc during August 2013.
- Participated in INO Collaboration Meeting held at Madurai Kamaraj University during September 2013 and also gave a lecture to students on "Standard Model, Higgs Boson and What Next?".
- Participated in Science Academies Workshop on HEP held at JM College, Periakulam in September 2013 and talked on "SM and Higgs discovery".
- Participated in Workshop on Higgs discovery held at IIT, Madras, in November 2013. Talked on "Standard Model and Higgs".
- Participated in SERC School on Experimental HEP held at IIT, Madras during December 2013 and gave the inaugural talk, Colloquium and two more talks on the Standard Model of HEP.
- Gave twelve lectures in the Science Academies' Refresher Course in Quantum mechanics at JSS Institution, Suttur, in December 2013.
- Gave a Course of about 24 lectures on High Energy Physics at Madurai Kamaraj University during December 2013 - January 2014.
- Participated in National Seminar on Higgs and Neutrinos held at Sri Krishna College of Technology, Coimbatore in January 2014 and gave two talks on "SM and Higgs" and "Neutrinos".
- Visited Bharathiar University, Coimbatore in January 2014 and gave a Colloquium talk on "Standard Model, Higgs Boson and What Next?".
- Participated in Science Academies Workshop on HEP held at St Joseph's College, Irinjalakuda, Kerala in January 2014 and gave two lectures on "Standard model and Neutrinos".
- Visited Saintgits College of Engineering, Kottayam in January 2014 and gave a talk on "Neutrinos and INO".
- Visited Alagappa University, Karaikudi in March 2014 and Gave two lectures on "Standard Model and Higgs" and "Neutrinos and INO".

- Participated in Science Academies Lecture Workshop in Theoretical Physics held at Presidency College, Chennai during March 2014 and gave two lectures on “Basic Principles of Quantum Mechanics”.
- Lectured at Department of Nuclear Physics, University of Madras on Quantum Mechanics on Sundays through the whole year.

Shraddha Srivastava

- Attended Workshop on Chevalley groups at IISER, Pune, during May 2013.
- Attended Workshop on Cohomological finite generation by Prof. Vander kallen at IMSc during June - August 2013.
- Attended Workshop on Sheaves on affine flag manifolds, combinatorics of Bruhat graphs and modular representation of algebraic groups by Prof. Peter Fiebig during October at IMSc., Chennai.
- Attended Workshop on Soergel bimodules and Kazhdan-Lusztig theory by Dr. Benjamin Elias during January - February 2014 at IMSc., Chennai.

Prateek Karandikar

- Attended GImInAL 2013, in Chennai.
- Attended ETAPS 2014, in Grenoble, France.
- Attended GT-Verif 2014, in Paris, France.

Kuldeep Saha

- Attended CIRM Summer school on Geometric and Quantum topology in dimension 3 held at CIRM Luminy, Marseille, France.
- Visited the Fourier Institute of University of Joseph Fourier, Grenoble to work under Prof. Christine Lescop for one month and gave talks on “Every orientable closed 3-manifold can be obtained from S^3 via surgery”, and “Unoriented cobordism groups in dimension 1 to 7” in the Geometry and Topology seminar.

Gautham Shenoy R

- Visited Tata Research Development and Design Center (TRDDC) and delivered a Talk on “Eventual Consistency & Conflict-Free Replicated Data Types (CRDTs)” in December 2013.

- Attended 15th International Conference on Distributed Computing & Networking (ICDCN) and presented a selected paper titled “Optimized OR-Sets Without Ordering Constraints” in January 2014.

Mitra Koley

- Attended workshop on classical group in December 2013 at IISER, Pune.
- Attended lecture series by Peter Fiebig at IMSc., Chennai during January - February 2014.
- Attended lecture series by Ben Elias at IMSc., Chennai January - February 2014.

Nikhil Balaji

- Visited Dr. Nutan Limaye at the Computer Science Department at IIT Bombay during April - May 2013.
- Attended the 33rd IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science at IIT Guwahati, in December 2013.
- Attended the 8th International Workshop on Algorithms and Computation, WAL-COM, in February 2014, at IITM, Chennai.

Vaishnavi Sundararajan

- Attended Formal Methods Update Meeting, in July 2013 at IIT Delhi.

Sachin Phatak

- Delivered a talk on “Higgs mechanism and the added mass effect in fluids” at the Symposium in honor of Nobel Laureate Walter Kohn held at Sathyabama University, Chennai, in December 2013.

Chinmay Kalaghatgi

- Attended Gravitational Wave Physics and Astrophysics Workshop at IUCAA, Pune.
- Attended Winter School in Experimental Gravitational Wave Physics at RRCAT, Indore in December 2013.

Sonakshi Sachdev

- Visited Raman Research Institute in summer 2014 under Joseph Samuel working on diffusion in curved space.
- Visited School of Astronomy and Astrophysics at IIST in December 2013.

17 Other Professional Activities

Rajeeva L. Karandikar

- Member of Governing council of INSA (Indian National Science Academy) and ISI (Indian Statistical Institute).

C.S. Seshadri

- Fellow of the American Mathematical Society, U.S.A., 2013.

Madhavan Mukund

- Member, Editorial Board, LIPIcs Leibniz International Proceedings in Informatics.
- Member, Editorial Board, Transactions on Petri Nets and Other Models of Concurrency (ToPNoC).
- Member, Programme Committee, 28th International Symposium on Logic in Computer Science (LICS 2013), New Orleans, USA, July 2013.
- Member, Programme Committee, 38nd International Symposium on Mathematical Foundations of Computer Science (MFCS 2013), Vienna, Austria, August 2013.
- Member, Programme Committee, 11th International Symposium on Automated Technology for Verification and Analysis (ATVA 2013), Hanoi, Vietnam, October 2013.
- President, Indian Association for Research in Computing Science (IARCS).
- Member ACM India Council, Association of Computing Machinery (ACM).
- Executive Director, International Olympiad in Informatics.
- National Coordinator, Indian Computing Olympiad.
- Member, Scientific Board, Mysore Park Workshop Series.
- Convenor, Academic Council and Member, Board of Studies in Computer Science, Chennai Mathematical Institute
- Member, Board of Studies in Mathematical Sciences, Homi Bhabha National Institute
- Member, Board of Studies in Computer Science, PSG College of Technology, Coimbatore

Samir Datta

- PC member for STACS 2014.

K. Narayan Kumar

- Member, Programme Committee, 7th International Workshop on Reachability Problems 2013 (RP'13), Uppsala, Sweden, September 2013.
- Member, Programme Committee, 33rd International Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS'13), Guwahati, India, December 2013.
- Coach, Indian Computing Olympiad.
- Leader of the Indian team, International Olympiad in Informatics, Brisbane, Australia, 2013.

Shiva Shankar

- Editorial Board, Multidimensional Systems and Signal Processing (Springer).

Govind S. Krishnaswami

- Supervised the undergraduate thesis of Himalaya Senapati on the Ising model in one and two dimensions: exact, approximate and numerical results (May 2013).
- Supervised the undergraduate thesis of Sonakshi Sachdev on geometric and group theoretic aspects and stability of rigid body dynamics and motion on the hyperbolic plane. Thesis title: Rigid body dynamics on configuration space (May 2013).
- Supervised the M.Sc. thesis of Sachin Phatak on fluid mechanics, eventually focussing on a correspondence between the Higgs mechanism and the added mass effect (June 2013 - March 2014).
- Refereed paper for Modern Physics letters A.

Upendra Kulkarni

- Co-organizer of lecture series by Profs. van der Kallen (June 2013), Peter Fiebig and Ben Elias (January - February 2014).
- Coordination of BSc entrance exam paper and interviews.

K. Narayan

- Served as external Ph.D. Thesis and Defence (Viva) Examiner for (i) Karthik Inbasekar, student at IMSc., Chennai and (ii) Souvik Banerjee, student at IOP Bhubaneswar.

Sasanka Roy

- Organizing committee Member WALCOM, Program Committee Member of National Workshop and Conference on Discrete Mathematics and its Applications (NWCDMA), Jadavpur University, March 2014.

K.G. Arun

- Active member of LIGO Scientific Collaboration through IndIGO consortium.
- Organized a school and workshop on numerical relativity at ICTS Bangalore with P. Ajith (ICTS, Bangalore) and B.R. Iyer (RRI, Bangalore).

Sourish Das

- Worked with “Stress Mobile” on the project of building Cortisol Estimation Method using Voice Sample.
- Consulted HCL on the POC project of warranty analysis.

Manoj Kummini

- Referee for Journal of Pure and Applied Algebra and Rocky Mountain Mathematics Journal.
- Reviewer for AMS MathReviews and Zentralblatt Math.

Prajakta Nimbhorkar

- Subreviewer for FSTTCS 2014.

Shrihari Sridharan

- Organised Instructional Workshop on Ergodic Theory and Harmonic Analysis in Chennai Mathematical Institute during December 2013 (alongwith Profs. M. Sundari and Murali Vemuri).

- Organised XIII Discussion Meeting on Harmonic Analysis in Institute of Mathematical Sciences during December 2013 (alongwith Profs. M. Sundari and Murali Vemuri).

B. Srivathsan

- Part of a Indo-French project “Algorithmic Verification of Real-time Systems” funded by DST-INRIA-CNRS. Other partners include IIT Bombay, University of Bordeaux (France) and INRIA-Rennes (France).
- Sub reviewer for TACAS 2013, FSTTCS 2013, ICALP 2014 and IEICE journal.

Alok Laddha

- Guided Two project students in the summer of 2014. Akshay Khadse from IISER, pune did a project titled “Structure of Asymptotic Infinity in General Relativity” Pranay Gorantala from IIT, Chennai did a project titled “Hamiltonian analysis of Gravitational field and quantization of 2+1 D Gravity”.
- Member of the Scientific Organizing committee for IAGRG-2015.
- Co-ordinator of Students seminar in the physics department in Spring 2014.

Priyavrat Deshpande

- Supervised Aneesh Karthik’s (a graduate student) project on some problems in enumerative combinatorics. The joint work has been submitted for publication. Currently working on one more problem. On the basis of this project he has been selected to work with the eminent combinatorialist Prof. Richard Ehrenborg as his Ph.D. student at the University of Kentucky.
- Supervising masters’ thesis of Ronno Das. The thesis topic involves studying various aspects of Artin groups. This is work in progress.

Kavita Sutar

- Reviewing for Zentralblatt, MATH.

G Rajasekaran

- Member of Academic Council of CMI Chairman of Board of Studies in Physics, CMI Convener of Indian National Science Academy (Chennai Chapter)
- Popular Science article at Madurai, in April 2013. Tamil article titled “Vignanamum atharku appalum” was published in Mulumai Ariviyal Udayam Vol 6, No 4.
- Popular Science Lecture at Rajarajan Institute of Science, Madurai, in April 2013. Gave the Second Rajarajan Memorial Lecture on “Science and Beyond Science” in Tamil.
- Popular science talk at Vivekananda College, Chennai, in September 2013. Gave a lecture on “Fundamental Physics in the last hundred years” in Tamil.
- Popular Science Lecture at Rajarajan Institute of Science, Madurai, in September 2013. Gave a lecture on “Neutrinos and INO”.
- Popular Science article at Madurai in October 2013. Tamil article titled “Alamana unmaiha” was published in Mulumai Ariviyal Udayam, Vol 6, No 10.
- Popular Science article at Bangalore, in January 2014. Published the article “Fermi and the Theory of Weak Interactions” in Resonance Vol 19, No 1.

Nikhil Balaji

- Reviewer for STACS 2014.

Chinmay Kalaghatgi

- Presented a poster of the work on calculation of IMRPhenomB waveform metric at GWPAW in December 2013.

18 Visitors

- M. LI Jhih-Huang, Ecole Normale Supérieure, France. Gave a talk on “Introduction to Percolation and Geometry of Groups” (April 2013).
- Weiken He, Ecole Normale Supérieure, France. Gave a talk on “Selberg’s $3/16$ theorem, spectral gap and expander graphs” (April 2013).
- Sourish Das, SAS Institute, Pune. Gave a talk on “On Bayesian Inference of Covariance Matrix” (April 2013).
- Roy Joshua, Ohio State University, U.S.A. Gave a talk on “Notions of Purity and the Cohomology of Quiver moduli” (June 2013).
- Marco Antei, Ben Gurion University of the Negev, Be’er Sheva, Israel. Gave a talk on “On the extension of torsors” (July 2013).
- David Farris, IISc, Bengaluru. Gave a talk on “Introduction to pseudoholomorphic curve and contact homologies” (July 2013).
- Arindam Banerjee, University of Virginia, USA. Gave a talk on “Bounds on Castelnuovo-Mumford regularity of edge ideals of simple graphs” (July 2013).
- C.R. Ramakrishnan, Stonybrook University NY, U.S.A. Gave a talk on “Probabilistic Tabled Logic Programming with Application to Model Checking” (July 2013).
- Nitin Nitsure, TIFR, Mumbai. Gave a talk on “Descent and Cohomological Descent” (August 2013).
- Samrat Bhowmick, IOP, Bhubaneswar. Gave a talk on “Anisotropic Branes” (August 2013).
- Wilberd van der Kallen, Utrecht University. Gave a talk on “An integrality theorem of Grosshans over arbitrary base ring” (August 2013).
- Rajesh Kulkarni, Michigan State University. Gave a talk on “Relative Brauer groups of curves” (August 2013).
- Sriram Sankaranarayanan, University of Colorado Boulder, USA. Gave a talk on “Invariance and Almost-Sure Termination Analysis for Probabilistic Programs” (August 2013).
- R. Parimala, Emory University, USA. Gave a talk on “Invariants of quadratic forms” (August 2013).
- Seshadri Chintapalli, Institute of Mathematical Sciences, Chennai. Gave a talk on “Embedding theorems on hyperelliptic varieties” (August 2013).

- Sriram Rajamani, Microsoft Research India. Gave a talk on “Probabilistic Programming: A Program Analysis Perspective” (August 2013).
- Sinnou David, Universite de Paris VI (Pierre et Marie Curie). Gave a talk on “Points of small height on abelian varieties over function fields” (August 2013).
- Utsav Choudhury, Institut fur Mathematik, Universitat Zurich. Gave a talk on “Motivic Galois groups and applications” (August 2013).
- M Praveen, LaBRI, University of Bordeaux, France. Gave a talk on “Reasoning about Data Repetitions with Counter Systems” (August 2013).
- Seshadri C, Sandia National Labs, San Francisco. Gave a talk on “Monotonicity testing and directed isoperimetries of the hypercube” (September 2013).
- Neena Gupta, ISI, Kolkata. Gave a talk on On Zariski’s Cancellation Problem (September 2013).
- Peter Fiebig, Erlangen University. Gave a talk on “Modular representations of algebraic groups” (October 2013).
- Yashonidhi Pandey, IISER Mohali. Gave a talk on “A properness result for degenerate Quadratic and Symplectic Bundles on a smooth projective curve” (October 2013).
- Vijaysekhar Chellaboina, Risk and Finance Research Group, Innovations Lab, TCS, Hyderabad. Gave a talk on “Stochastic Control for Finance: A Tutorial” (October 2013).
- Yakov Eliashberg, Stanford University. Gave a talk on “From the ”last geometric theorem” of Poincare to Arnold’s conjectures and Gromov’s holomorphic curves” (November 2013).
- Yakov Eliashberg, Stanford University: Symplectic Geometry of Stein manifolds (Lecture Series) (November 2013).
- Amitabh Virmani, IOP, Bhubhaneswar. Gave a talk on “Black holes in string theory” (November 2013).
- Sayan Bhattacharya, MPI, Saarbruecken. Gave a talk on “Price of Anarchy, Auctions, and Approximations” (November 2013).
- Clemency Montelle, University of Canterbury, New Zealand. Gave a talk on “The early history of the ‘Pascal’ triangle” (November 2013).
- Kim Plofker, Union College, Schenectady, NY, USA. Gave a talk on “The evolution of the sine” (November 2013).

- Srikanth Tupurani, Institute of Mathematical Sciences, Chennai. Gave a talk on “An interesting result about finite dimensional complex semi-simple algebras” (December 2013).
- Barbara Fantechi, SISSA, Trieste, Italy: An introduction to Intersection Theory (Lecture Series) (January 2014).
- Shreyas Patankar, UC Berkeley. Gave a talk on “Spin physics of new materials” (January 2014).
- Srikanth Tupurani, A former Ph.D student from Institute of Mathematical Sciences, Chennai. Gave a talk on “Skein theory for finite depth sub-factor planar algebra” (January 2014).
- Aaditya Ramdas, Carnegie Mellon University. Gave a talk on Theoretical Connections between Convex Optimization and Active Learning (January 2014).
- Rajsekar Manokaran, Theoretical Computer Science Group at KTH, Sweden. Gave a talk on “On the Approximability of the Maximum Acyclic Subgraph problem” (January 2014).
- Siddhartha Mandal, Department of Genes and Environment, Norwegian Institute of Public Health, Oslo, Norway. Gave a talk on “Are we analyzing microbiome data correctly? CoMicZ: A novel statistical framework to characterize microbial composition” (January 2014).
- Ram Gopal Vishwakarma, Zacatecas University, Mexico. Gave a talk on Introduction of T_{ik} : Einsteins Real Biggest Blunder? (January 2014).
- Hema Srinivasan, University of Missouri. Gave a talk on “Subadditivity of Maximal shifts in Free Resolutions” (January 2014).
- Harikrishnan Ramani, SUNY Stony Brook. Gave a talk on “Transverse-momentum Resummation” (January 2014).
- M. Subbiah, Department of Mathematics, L N Government College Ponneri. Gave a talk on “Honing priors - Bayesians’ outlook on scientific judgements” (January 2014).
- Barbara Fantechi, SISSA, Trieste, Italy. Gave a talk on “An introduction to Donaldson-Thomas invariants” (January 2014).
- Kuntal Banerjee, HRI, Allahabad. Gave a talk on “On the boundaries of the Arnold tongues” (January 2014).
- Ben Elias, MIT. Gave a talk on “Perverse sheaves for dummies” and “Quantum algebraic geometric Satake without tears” (January 2014).

- Constantin Enea, LIAFA, Univ. Paris Diderot - Paris 7. Gave a talk on “Verifying Eventual Consistency of Optimistic Replication Systems” (February 2014).
- Deepak Kapur, University of New Mexico, USA. Gave a talk on “When is a formula invariant?” (February 2014).
- Pradeesha Ashok, The Department of Computer Science and Automation, IISc. Gave a talk on “First Selection Lemma for Various Geometric Objects” (February 2014).
- Amartya Kumar Dutta, ISI, Calcutta. Gave a talk on “History of Galois Theory” (February 2014).
- Amartya Kumar Dutta, ISI, Calcutta. Gave a talk on “Some Applications of G_a -actions on Affine Varieties” (February 2014).
- C.S. Rajan, TIFR, Mumbai. Gave a talk on “Torelli-Tate type theorem for elliptic surfaces” (February 2014).
- Philippe Schnoebelen, CNRS and ENS Cachan, France. Gave a talk on “The Power of Well-Structured Systems” (February 2014).
- Philippe Schnoebelen, CNRS and ENS Cachan, France. Gave a talk on “The Power of Priority Channel Systems” (February 2014).
- Dr. Sambuddha Roy, IBM Research, New Delhi. Gave a talk on “On Graph Density” (February 2014).
- Dr. Sambuddha Roy, IBM Research, New Delhi. Gave a talk on “Some topics in Submodular Optimization - a survey” (February 2014).
- Pascal Weil, CNRS and Universite de Bordeaux, France. Gave a Series of Lectures on “Algebraic theory of languages: Quantifier Alternation Hierarchy within FO(2) over Words” (March 2014).
- Sudarshan Ananth, IISER Pune. Gave a talk on “Scattering amplitude structures in higher spin theories” (March 2014).
- Pablo Solis, University of California, Berkeley. Gave a talk on “Partial compactifications of Loop groups and moduli of G -bundles on curves” (March 2014).
- V.S. Sunder, Institute of Mathematical Sciences, Chennai. Gave a talk on “A pedagogical re-take on the spectral theorem” (March 2014).
- John Meakin, University of Nebraska-Lincoln, USA. Gave a talk on “Inverse monoids and immersions of CW-complexes” (March 2014).
- Troels Bak Andersen, University of Aarhus, Denmark. Gave a talk on “Introduction to quantum groups” (March 2014).

- Troels Bak Andersen, University of Aarhus, Denmark. Gave a talk on “Fusion rings for quantum groups” (March 2014).
- Dennis Hasselstrom Pedersen, University of Aarhus, Denmark. Gave a talk on “Fernando-Mathieu classification of simple weight modules for quantum groups” (March 2014).
- Henning Haahr Andersen, University of Aarhus, Denmark. Gave a talk on “Quantum analogues of cohomology of line bundles on flag manifolds”, (March 2014).
- Henning Haahr Andersen, University of Aarhus, Denmark. Gave a talk on “Tilting modules for algebraic groups and quantum groups” (March 2014).
- Henning Haahr Andersen, University of Aarhus, Denmark. Gave a talk on “The category $\mathcal{O}$ for quantum groups” (March 2014).
- Sourav Das, Postdoc Fellow, National University of Singapore. Gave a talk on “A frequency domain approach for the estimation of parameters of spatio-temporal stationary random processes” (March 2014).
- Ashoke Sen, Harish-Chandra Research Institute, Allahabad. Gave a talk on “Search for a unified theory” (Part of the CMI-Fiesta student festival activities) (March 2014).
- Yogeshwaran, Technion - Israel Institute of Technology, Israel. Gave a talk on “Central limit theorems for some random simplicial complexes” (March 2014).
- Prabha Mandayam, Institute of Mathematical Sciences, Chennai. Gave a talk on “Incompatibility and complementarity in quantum information theory” (March 2014).
- L. Sriramkumar, IIT Madras. Gave a talk on “On the detection of the imprints of primordial gravitational waves on the CMB by BICEP2” (March 2014).
- Vijay Ravikumar, TIFR, Mumbai. Gave a talk on “Equivariant Pieri rules for Isotropic Grassmannians” (March 2014).
- Sriram Nambiar. Gave a talk on “The origins of the axiomatic method: the conceptual framework of Aristotle’s logic” (March 2014).