



**Chennai Mathematical Institute**

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**Annual Report  
2011 - 2012**

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Padur Post, Siruseri,  
Tamilnadu 603 103. India.

## **Chennai Mathematical Institute**

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## Contents

01. Preface .....	5
02. Board of Trustees .....	8
03. Governing Council .....	9
04. Research Advisory Committee.....	10
05. Academic Council.....	11
06. Boards of Studies.....	12
07. Institute Members .....	13
08. Faculty Profiles .....	16
09. Awards .....	26
10. Research Activities .....	27
11. Publications .....	34
12. The National Undergraduate Programme.....	41
13. Activities of the Undergraduate Students.....	45
14. Undergraduate /Graduate Courses .....	47
15. Courses, Special Lectures .....	50
16. Workshops/ Schools .....	51
17. Conferences, Visits and External Lectures .....	55
18. Other Professional Activities .....	65
19. Visitors .....	69
20. Audited Statement of Accounts 2011-2012.....	74





## Preface

I am happy to present the Annual report of the Chennai Mathematical Institute for the year 2011-12.

The Institute has firmly established itself as premier place for teaching and research in mathematical sciences in India. CMI graduates have gone on to pursue further studies at the best academic institutions in India and abroad. These include Caltech, Chicago, MIT, Princeton, U Penn and Yale in USA, ENS Paris, 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.

Overall, the majority of CMI graduates have either completed or are currently enrolled in PhD programmes throughout the world. About a dozen CMI graduates have returned to India after completing their PhDs to take up academic positions at institutions like IITs, TIFR, IMSc, CMI and IISERs as well as in research labs such as Microsoft Research and IBM India Research Lab. Another dozen have faculty or postdoctoral research positions at academic and research institutions across the world.

CMI graduates have also moved into areas such as financial mathematics, management and economics, both in India and abroad. Recognizing the need for mathematically trained manpower in these areas, CMI has recently started a Masters programme in Applications of Mathematics.

Chennai Mathematical Institute 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.

At a research level, CMI has recently entered into two important international collaborations. 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 recently initiated a partnership with ICERM at Brown University and Statistical and Mathematical Sciences Institute (SAMSI), North Carolina to form a Virtual Institute in Mathematical and Statistical Sciences (VI-MSS). This is part of the Science Across Virtual Institutes (SAVI) programme of the National Science Foundation, USA and is supported by the Department of Science and Technology (DST), India.

Over last few years, several young faculty members and visiting fellows have joined making it a vibrant place.

CMI has established itself in areas of research and teaching. Our vision is for CMI to make its mark in the area of applications of mathematics and interaction between academia and industry. As the information technology wave gives way to biotechnology, the IT industry is moving towards services with significant analytical component. This is an area where demand is increasing and Indian institutions are not yet geared sufficiently to cater to this demand. CMI has made a promising start and the Institute would like this activity to take root. We hope to strengthen this, via our MSc Applications of Mathematics program as well as with CMI faculty engaging in consultancy.

CMI gets its major funding from the Department of Atomic energy via the National Board for Higher Mathematics. The UGC has given us funds for the construction of an additional building, parts of which are ready. In addition to the generous support from the DAE, CMI also receives support from private sources. I take this opportunity to thank the Shriram Group Companies and Tata Consultancy Services for their support.

Dr. L. Swaminathan made a generous endowment in the memory of his uncle Mr. K. Lakshmanan and Mrs. Usha Rubugunday made a similar endowment in memory of her husband. This has led to annual Lakshmanan and Rubugunday memorial lectures at CMI. This year, Professor N. Mohan Kumar, Washington University, St Louis, U.S.A. gave the Lakshmanan memorial lecture and Professor V.S. Sunder from the Institute of Mathematical Sciences, Chennai delivered the Rubugunday memorial lecture.

The family of Shri K. Madhav Sarma, who was the Secretary of the CMI trust, has made a donation for an annual lecture in his memory. We will be having the first lecture sometime soon.

Thanks to the support from the government as well as private donors, we have established CMI as a much desired destination for students to study Mathematics, Computer Science and Physics and for faculty to teach and carry out their research. I am confident that CMI will continue to receive generous support from Government of India, the Industry and individuals.

**Rajeeva L Karandikar**

*Director*



## Board of Trustees

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Uthagamandalam 643 002
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7. **Prof. C.S. Seshadri, F.R.S.** - Member  
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8. **Prof. P.S. Thiagarajan** - Member  
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New York University, New York, U.S.A.
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Director, Harish Chandra Research Institute, Allahabad



## Research Advisory Committee

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1. **Prof. R. Balasubramanian**  
Director, Institute of Mathematical Sciences, Chennai.
2. **Prof. David Mumford**  
Brown University, Providence, R.I., U.S.A.
3. **Prof. M.S. Narasimhan, F.R.S.**  
TIFR Bangalore Centre, Bangalore
4. **Prof. M.S. Raghunathan, F.R.S.**  
Professor of Eminence  
Tata Institute of Fundamental Research, Mumbai
5. **Prof. S.R.S. Varadhan, F.R.S.**  
Courant Institute of Mathematical Sciences  
New York University, New York, U.S.A.
6. **Prof. M. Vidyasagar**  
University of Texas at Dallas, U.S.A.

## Academic Council

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1. **R.L. Karandikar** (Chairman),  
Director, Chennai Mathematical Institute,  
Chennai
2. **Madhavan Mukund** (Convenor),  
Dean of Studies, Chennai Mathematical  
Institute, Chennai
3. **Manindra Agrawal**,  
Professor, Indian Institute of Technology  
Kanpur, Kanpur
4. **M.S. Ananth**,  
Director, Indian Institute of Technology  
Madras, Chennai
5. **V. Balaji**,  
Professor, Chennai Mathematical  
Institute, Chennai
6. **R. Balasubramanian**,  
Director, Institute of Mathematical  
Sciences, Chennai
7. **S.G. Dani**,  
Professor, Tata Institute of Fundamental  
Research, Mumbai,  
Chairman, National Board for Higher  
Mathematics
8. **H.P. Dikshit** (UGC nominee),  
Director General, School of Good  
Governance and Policy Analysis, Bhopal
9. **S. Kesavan**,  
Institute of Mathematical Sciences,  
Chennai
10. **N. Mukunda**,  
Professor, Indian Institute of Science,  
Bangalore
11. **Rajaram Nityananda**,  
Professor, National Centre for Radio  
Astrophysics, Pune
12. **Jaikumar Radhakrishnan**  
Professor, Tata Institute of Fundamental  
Research, Mumbai
13. **G. Rajasekaran**,  
Professor, Chennai Mathematical  
Institute, Chennai
14. **C.S. Seshadri**, f.r.s.  
Director-Emeritus, Chennai Mathematical  
Institute, Chennai
15. **Shiva Shankar**,  
Professor, Chennai Mathematical  
Institute, Chennai
16. **Jugal Verma**  
Professor, Indian Institute of Technology  
Bombay, Mumbai



## Boards of Studies

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### Mathematics

1. **V. Balaji** (CMI), Chair
2. **S.A. Choudum** (IIT, Madras)
3. **R. Karandikar** (CMI)
4. **S. Kesavan** (IMSc)
5. **Pramathanath Sastry** (CMI)
6. **Shiva Shankar** (CMI)
7. **V. Suresh** (University of Hyderabad)
8. **K.V. Subrahmanyam** (CMI, Chair, Board of Studies in Computer Science)

### Computer Science

1. **K.V. Subrahmanyam** (CMI) Chair
2. **Manindra Agrawal** (IIT, Kanpur)
3. **V. Arvind** (IMSc)
4. **Madhavan Mukund** (CMI)
5. **K. Narayan Kumar** (CMI)
6. **V. Vinay** (LimberLink, Bangalore)
7. **V. Balaji** (CMI, Chair, Board of Studies in Mathematics)

### Physics

1. **G. Rajasekaran** (IMSc/CMI), Chair
2. **R. Jagannathan** (CMI)
3. **H.S. Mani** (CMI)
4. **R. Parthasarathy** (CMI)
5. **J. Samuel** (RRI)
6. **V.V. Sreedhar** (CMI)
7. **C.S. Sundar** (IGCAR, Kalpakkam)



## Institute Members

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Director	<b>Rajeeva L. Karandikar</b>
Director-Emeritus	<b>C.S. Seshadri</b>
Professors	<b>Shiva Shankar V. Balaji Madhavan Mukund K. Narayan Kumar Pramathanath Sastry Samir Datta V.V. Sreedhar S. Senthamarai Kannan K.V. Subrahmanyam</b>
Associate Professors	<b>Clare D'Cruz Govind S. Krishnaswami K. Narayan Purusottam Rath R. Srinivasan M. Sundari S.P. Suresh Suresh Nayak Upendra Kulkarni M.K. Vemuri</b>
Assistant Professors	<b>K.G. Arun Dishant M. Pancholi Krishna Hanumanthu Manoj Kummini Partha Mukhopadhyay Prajakta Nimbhorkar</b>

Adjunct Professors

**Sasanka Roy  
Shrihari Sridharan  
Sourav Chakraborty**

**Alladi Sitaram  
S. Dale Cutkosky**

**P.P. Divakaran  
G. Rangarajan  
N.D. Hari Dass  
R. Jagannathan  
Kavita Ramanan  
S. Kesavan  
V. Kumar Murty  
V. Lakshmibai  
H.S. Mani  
Manindra Agrawal  
M.G. Nadkarni  
K.R. Nagarajan  
R. Parimala  
R. Parthasarathy  
T. Parthasarathy  
B.P. Purnaprajna  
G. Rajasekaran  
S. Ramanan  
N. Ramanathan  
Ramesh Hariharan  
M. Ram Murty  
R.V. Ramamoorthi  
Rani Siromoney  
B.V. Rao  
H.K. Sahu  
Shreekumar Varma  
R. Sridharan  
Sudarshan Ananth  
A. Thyagaraja  
V. Vinay**

Visiting Scientist	<b>P. Vanchinathan</b> - Until June 2011
Visiting Fellows	<b>Micah Leamer</b> <b>Archana Subhash Morye</b> <b>Sarbeswar Pal</b> <b>K. Srilata</b> <b>Yashonidhi Pandey</b> <b>Preena Samuel</b>
Research Scholars	<b>Abhishek Bhrushundi</b> <b>Aneesh Chandrasekhar</b> <b>Debangshu Mukherjee</b> <b>Prakash Saivasan</b> <b>Mitra Koley</b> <b>Nagarajan Krishnamurthy</b> <b>Nitesh Jha</b> <b>Prateek Karandikar</b> <b>Rohith Varma</b> <b>Rameshwar Pratap Yadav</b> <b>Shraddha Srivastava</b> <b>Subramani Muthukrishnan</b> <b>Varunkumar Jayagopal</b>
	<b>Abhishek Hemantkumar Dang</b> <b>Apurv Nakade</b> <b>Gopakumar</b> <b>Parul Jain</b> <b>Nana Siddharth</b> <b>Nikhil Balaji</b> <b>Pranabendu Misra</b> <b>Rahul Singh</b> <b>Ramprasad Saptharishi</b> <b>Sayan Chakraborty</b> <b>T.R. Shyam Sundar</b> <b>Suryajith Chillara</b> <b>Vinay Kumaraswamy</b>
NBHM Research Scholars	<b>Santosha Kumar Pattanayak</b> <b>Pabitra Barik</b>
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## Faculty Profiles

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### Rajeeva Karandikar

Rajeeva 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.

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 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.

## **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. Balaji**

V. Balaji received his B.A. Hons. (Mathematics) from University of Delhi (1982), his M.A. (Mathematics) degree 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).

His research interest is: Algebraic Geometry.

## **Madhavan Mukund**

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

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

His research interests are: Partial order based models for concurrent systems and Logics for specifying and verifying concurrent systems.

## **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. degree from the 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), Master of Statistics 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.

## **Samir Datta**

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

## **V.V. Sreedhar**

V.V. Sreedhar received his BSc degree from Andhra University, Visakhapatnam, MSc degree in Physics from the Indian Institute of Technology, Madras and received his PhD degree in 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-doc 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.

## **S. Senthamarai Kannan**

S. Senthamarai Kannan received his B.Sc. degree from HKRH College, Uthama Palayam (1985-88), M.Sc. degree 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.

## **K.V. Subrahmanyam**

K.V. Subrahmanyam received his B.Tech. (Computer Science) 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. degree from the University of Bombay in December, 1995.

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

## **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.

## **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.

## **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 Eat 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. degree from R.E.C. Trichy (1996), received his M.Sc. (by Research) from Anna University (1999) and received his Ph.D. degree from the Institute of Mathematical Sciences (2003).

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

## **Suresh Nayak**

Suresh Nayak received his B.Tech. (Computer Science) degree from the Indian Institute of Technology, Bombay (1991), M.S. and Ph.D. (Mathematics) degree from the Purdue University, (1997,98).

He has been a Visiting Fellow at the Harish-Chandra Research Institute, Allahabad (1999-2001).

His research interests are: Algebraic Geometry and Commutative Algebra.

## **Upendra Kulkarni**

Upendra Kulkarni received his B.Tech (Computer Science) 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.

## **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.

### **Dishant M. Pancholi**

Dishant M. Pancholi received his B.Sc. from M.S. University of Baroda, Vadodara (1996), M.Sc. from M.S. University of Baroda, Vadodara (1998) and Ph.D. from Tata Institute of Fundamental Research, Mumbai (2006).

He has been a Visiting Fellow at TIFR Centre, Bangalore (2006-07) and a Post doctoral Fellow at the International Centre for Theoretical Physics, Trieste, Italy (2008-10).

His research interests are: Contact and symplectic topology.

### **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.

## **Partha Mukhopadhyay**

Partha Mukhopadhyay received his B.E. Electronics & Telecommunication Engineering from Jadavpur University, Kolkata (2000), M.Tech. (Computer Science) from the Indian Statistical Institute, Kolkata (2002) and Ph.D. from the Institute of Mathematical Sciences, Chennai (2009).

He has been a Software Engineer at Motorola India Electronics Ltd., Bangalore (2002-2003), a Research Associate at the Indian Statistical Institute, Kolkata (2003-2004) and a Postdoctoral Fellow at Technion, Israel (2009-2010).

His research interests are: Complexity Theory and Additive Combinatorics.

## **Prajakta Nimbhorkar**

Prajakta Nimbhorkar received her B.E. (Computer Science and Engineering) from Government College of Engineering, Aurangabad (2003), M.Tech. (Information Technology) from Indian Institute of Technology, Bombay (2005) and Ph.D. The Institute of Mathematical Sciences, Chennai (2010).

Her research interests are: Complexity and Algorithms.

## **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.

## **Shrihari Sridharan**

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).

He has been a Post-doctoral Fellow at the Institute of Mathematical Sciences, Chennai (2004-2006), a Post-doctoral Fellow at the Indian Institute of Science, Bangalore (2006-2007) and a Senior Lecturer at the Department of Mathematics, Indian Institute of Technology, Guwahati (2007-2008).

His research interests are: Complex Dynamics and Ergodic 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 Post-doctoral researcher at CWI, Amsterdam (2009-10).

His research interests are: Complexity and Algorithms.

## Awards

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- Purusottam Rath has been awarded ICTP Regular Associateship until December 2016.



## Research Activities

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### Mathematics

The main areas of research activity have been in algebraic geometry, topology and geometry, representation theory, operator theory, commutative algebra, harmonic analysis, probability theory, control theory and dynamical systems.

In the field of Topology and Geometry work was carried out which generalized Brylinski's Knot beta function to higher dimensional submanifolds of Euclidean space (the analytic continuation here is more complicated than in the case of a Knot). It was found that one of its residues is related to the Willmore functional. There is on-going research exploring this connection, as well as a generalization of the beta function to compactly supported (Schwartz) distributions in Euclidean space; the beta function of a double-layer distribution on a hypersurface is of particular interest. Work was done on an eigenvalue optimization problem for certain domains in rank-one symmetric spaces. There was also some investigation on using computers to study the curvature term in the Bochner-Weitzenböck formula.

In the field of Differential Equations there was a study about the escape velocity of the Sinai-Ruelle-Bowen (SRB) measure through holes of positive measure constructed in the Julia set of hyperbolic rational maps. An explicit formula for the escape velocity through holes of different sizes is obtained and the dependence of the escape velocity on the position of the hole is discussed. Later, the Hausdorff dimension of the survivor set is also computed. Subsequently there was new work to recover the Sinai -Ruelle -Bowen measure associated to a real-valued Holder continuous function defined on the Julia set of a hyperbolic quadratic polynomial, as a noncommutative measure by constructing an appropriate spectral triple. Work was carried out to explore the generic differentiability of the conjugacy between two hyperbolic dynamical systems, and to give a fractal description of the set of non-differentiability for the conjugacy using the Hausdorff dimension.

In Probability Theory there was a continuation of earlier work on “Portfolio selection for fat tailed distributions”, as well as the use of randomness tests for design and analysis of block ciphers.

In the field of Operator Theory there was continued work on the endomorphism semigroups (called as E0-semigroups) on  $B(H)$ , the algebra of all bounded operators on a separable Hilbert space. Two significant works have been completed this year related to the theory of E0-semigroups on II1 factors. After the initiating work of Alexis Alevras, this is a next step in the theory of E0-semigroups on II1 factors.

The first one is related to showing some fundamental families of E0-semigroups called as Clifford flows on the hyperfinite II1 factor are mutually non cocycle conjugate. This is shown by defining the dual E0-semigroup on the commutant and then by associating an invariant called as super product system. We also compute some other invariants called as ‘set of multiunits’ and ‘the group of gauge cocycles’.

The second work is related to the problem of extending an E0-semigroup on a II1 factor and its dual semigroup on the commutant, to an E0-semigroup on the algebra of bounded operators on the Hilbert space, where the II1 factor is acting. We obtain several equivalent conditions for an E0-semigroup to be extendable. Using those conditions we prove that the whole family of E0-semigroups called as Clifford flows are not extendable. Further work is in progress to try and generalize these results to slightly more complicated situations.

In the field of Harmonic Analysis some work has been carried out in an attempt to establish an analogue of Benedicks theorem for two step nilpotent groups. In the Euclidean case this is proved by M. Benedicks using Poisson summation formula

In the fields of Algebraic Geometry and Representation Theory, there has been work on understanding explicit connection between Mirkovic Vilonen Cycles and Standard Monomial Basis.

There has been work in understanding the connection between Torus Invariants being a Polynomial ring and the study of certain nice Coxeter elements. There has been ongoing research on polynomial functors and on representations of the symmetric group. There has been some work on free resolutions of the homogeneous coordinate ring of a Schubert variety in a Grassmanian.

Work has been carried out in the the theory of Grothendieck Duality, more specifically on differential operators and Grothendieck duality, on the fundamental class and Grothendieck duality.

There has been work on the construction of Hitchin pairs on reducible curves as well as a degenerating family of smooth curves with reducible limits. The moduli construction and the study of the Hitchin fibre give a generalization of the Abelianization of moduli spaces of torsion-free sheaves on singular curves by means of compactifications of Neron models of Picard varieties of certain singular curves.

## Computer Science

### Formal methods and verification

The model checking problem for linear and branching time temporal logics has been studied for varieties of multi pushdown systems. Tight elementary bounds have been obtained in the linear time case and nonelementary lower bounds have been established for branching time. The model checking problem for data languages has also been studied.

A model for describing data languages has been proposed that is expressive enough to describe distributed protocols with process creation. It has been shown that MSO with data equality is decidable for such systems, using an interpretation on the MSO theory of multiply nested words.

Kleene theorems have been established for two subclasses of labelled product systems, product T-systems and product free choice systems, inspired by well-studied subclasses of 1-bounded Petri nets.

A new formalism for modelling web services has been proposed that is session-based, but avoids using session identifiers. The model can be translated to a dialect of Petri nets that allows the verification of important properties of web services.

An alternative proof of correctness has been obtained for bounded version vectors, yielding a more space-efficient algorithm.

### Computational Complexity Theory

The space bounded complexity of the problem of computing the bits of an algebraic number has been investigated, using Newton Raphson as elementary tool for approximating algebraic numbers.

A deterministic polynomial-time algorithm has been obtained to construct a directed  $O(\log |G|)$  degree Cayley expander for a finite group  $G$  described in terms of its multiplication table. Further, a deterministic polynomial-time algorithm has

been obtained to compute an expanding generating set of size roughly quadratic in  $n$  for a group  $G$  that is a solvable permutation group of the symmetric group  $S(n)$ .

The space/parallel complexity of matching problems in graphs embedded on the plane and on surfaces of moderate genus has been improved.

Aspects of proof complexity have been studied for NC0 proof systems. Many languages ranging from regular to NP-complete have been shown to such proof systems. On the other hand, some simple languages have also been exhibited that do not have such proof systems.

In property testing, the query complexity of problems such as monotonicity, distribution testing and testing function isomorphism has been studied. Progress has been made in the area of testing function isomorphism.

## Security protocols

Questions related to the logical modeling of protocols that use homomorphic encryption have been studied. Matching lower and upper bounds have been established for some versions of the passive intruder problem (or the term derivability problem) for protocols using homomorphic encryption. Proof-size lower bounds have also been obtained.

Certain variations of intuitionistic logics with modalities have been studied with applications to authorization and access control in systems. Normalization procedures and efficient algorithms have been provided for one such logic.

## Algorithmic game theory

Significant progress has been made in the well known matroid secretary problem. The competitive ratio has been improved by a quadratic factor, thus moving one step closer to the conjecture that constant competitive ratio is achievable.

## Physics

Research in theoretical physics at CMI, during the year 2011-2012, was performed in the following broad areas: (1) Classical General Theory of Relativity, (2) String Theory, (3) Quantum Field Theory and Particle Physics, (4) Fluid Dynamics, (5) Mathematical Physics and (6) Miscellaneous.

In classical general relativity, anisotropic emission of gravitational waves (GWs) from inspiralling compact binaries was examined by studying the loss rate of linear momentum and hence gravitational recoil of the system in the far-zone of the



source (a nonspinning binary system of black holes in quasi-circular orbit) at the 2.5 post-Newtonian (PN) order. An analytical expression was obtained in harmonic coordinates for recoil velocity of the binary accumulated in the inspiral phase. The maximum recoil velocity of the binary system at the end of its inspiral phase (i.e. at the innermost stable circular orbit (ISCO)) was estimated to be of the order of 4 km/sec which is smaller than the 2PN estimate of 22 km/sec. Beyond inspiral, an estimate was obtained of the more important contribution to the recoil velocity from the plunge phase. The maximum recoil velocity at the end of the plunge, involving contributions both from inspiral and plunge phase, for a binary with symmetric mass ratio 0.2 is of the order of 182 km/sec.

Various alternative theories of gravity predict dipolar gravitational radiation in addition to quadrupolar radiation. It was shown that gravitational wave (GW) observations of inspiralling compact binaries can put interesting constraints on the strengths of the dipole modes of GW polarizations. A physically motivated gravitational waveform was put forward for dipole modes, in the Fourier domain, in terms of two parameters: one which captures the relative amplitude of the dipole mode with respect to the quadrupole mode ( $\alpha$ ) and the other a dipole term in the phase ( $\beta$ ). This two parameter representation is used to discuss typical bounds on their values using GW measurements. The expected bounds on the amplitude parameter  $\alpha$  and the phase parameter  $\beta$  for Advanced LIGO (AdvLIGO) and Einstein Telescope (ET) noise power spectral densities are obtained using Fisher information matrix. AdvLIGO and ET may at best bound  $\alpha$  to an accuracy of  $\sim 10^{-2}$  and  $\sim 10^{-3}$  and  $\beta$  to an accuracy of  $\sim 10^{-5}$  and  $\sim 10^{-6}$  respectively.

In string theory, studies were carried out on Lifshitz scaling and hyperscaling violation involving dimensional reductions of AdS null deformations. It was pointed out that solutions without any dimensional reduction can be interpreted as spatially anisotropic Lifshitz systems and that a certain nongeometric construction of Lifshitz-like solutions is possible.

Normalizable null deformations to  $AdS_5 \times S^5$ , corresponding to states in the  $N=4$  super Yang-Mills theory with uniform lightcone momentum density were also studied. These, upon DLCQ, give rise to effective bulk spacetimes that exhibit “hyperscaling violation” with a particular exponent, that leads to logarithmic violations of the area law of entanglement entropy, which is a striking result in a string/gauge theory realization.

Attempts were also made to study the de Sitter space analogues of cosmological deformations studied earlier in anti de Sitter space. These solutions correspond

to certain constrained initial data for de Sitter deformations: the dual Euclidean CFT is placed on a background Ricci-flat space, with the state being tuned to have vanishing energy-momentum tensor, which appears to be dual to Big-Crunch type singularities in the bulk.

In quantum field theory, aspects of five dimensional Kaluza theory with Kaluza scalar were studied.

The standard model of particle physics allows the possibility of a stable massive charged particle. The consequences of this possibility were pointed out. In particular, this would have interesting astrophysical consequences. By replacing one or more electrons from normal atoms by these “massive electrons” a candidate for dark matter was constructed in terms of this strongly bound neutral matter.

An attempt was made to give a theoretical explanation for the superluminality of neutrinos claimed by the OPERA experiment. Since neutrino waves travel as a superposition of three waves corresponding to the three mass and energy eigenstates, their mutual interference can affect the group velocity of the neutrino waves. The calculation indeed shows this to be the case. However the parameters are such that the superluminality claimed by the OPERA experiment cannot be explained.

In fluid dynamics, research has focussed on a serendipitous computer-aided discovery of a cousin (SIDV) of the KdV equation of one-dimensional fluid flow, which shares its solitary wave solution. SIDV is the simplest scale, translation and space-time re.lection invariant nonlinear advection-dispersion equation. It admits plane, solitary and cnoidal waves and displays recurrence (lack of equilibration) in bounded domains, but does not appear (in general) to be integrable or follow from a Lagrangian of the KdV-type. SIDV is an interesting bridge between non-linear advection and diffusion. It could serve as a model for investigations of recurrence and wave interactions.

In mathematical physics, some interesting mathematical results were derived using simple physical models. In particular, a method was developed to construct exact expressions for flat connections on the complements of torus knots.

In the miscellaneous category, studies have been carried out on an approach to renormalization of divergent (especially asymptotically free) quantum mechanical systems, based on a Krein formula for the resolvent of the hamiltonian.

Also, a decision support system has been developed for application in forensic science to analyse the profile of a bullet that caused fracture to a glass panel. In this



analysis fractal geometry is used. The system would help expedite the identification process and reduce the use of resources in terms of manpower and investigation time.

A pedagogical article on Gravitational Waves in Resonance magazine and another on pedagogical problems in constructing examples to illustrate subtle issues in physics (at postgraduate level) were produced.



## Publications

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### Journal Articles

#### Mathematics

- J1. Shiva Shankar: A question of models, *The Mathematics Student*, 80:13-20, 2011.
- J2. Shrihari Sridharan: Sinai -Ruelle -Bowen measure leaks, *Communications in Mathematical Analysis*, vol 13, 2012, pp 1 -22.
- J3. Rajeeva L. Karandikar and Rajendra Bhatia: Monotonicity of the matrix geometric mean, *Mathematische Annalen* (2011), pp. 1-15.
- J4. S.Senthamarai Kannan: Normality, projective normality and EGZ theorem, *Integers* 11(2011), A28, pp, 11B785.
- J5. S.Senthamarai Kannan: Projective normality of Weyl group quotients, *Proc. Indian Acad.Sci. Math. Sci.* 121 (2011), no. 1, 19-26.
- J6. Purusottam Rath, S. Gun and M. Ram Murty: Transcendental nature of special values of L-functions, *Canadian Journal of Mathematics*, 63 (2011) 136-152.
- J7. Purusottam Rath, S. Gun and M. Ram Murty: On a conjecture of Chowla and Milnor, *Canadian Journal of Mathematics*, 63 (2011), no. 6, 13281344.
- J8. Purusottam Rath, S. Gun and M. Ram Murty: Algebraic Independence of Values of Modular Forms, *International Journal of Number Theory*, 7 (2011), no.4, 10651074.
- J9. Purusottam Rath, S. Gun and M. Ram Murty: Transcendental values of certain Eichler integrals, *Bulletin of London Mathematical Society*, 43 (2011), no.5, 939952.

- J10. M. Sundari and Angela Pasquale: An uncertainty principle for the Schrodinger equation on Riemannian symmetric spaces of noncompact type, to appear in Annales de l'institut Fourier, Vol. 61

## Computer Science

- J11. Partha Mukhopadhyay, Shachar Lovett and Amir Shpilka: Pseudorandom Generators for  $CC_0[p]$  and the Fourier Spectrum of Low-Degree Polynomials over Finite Fields Joint work, to appear in Computational Complexity.
- J12. Partha Mukhopadhyay, Zohar Karnin, Amir Shpilka, and Ilya Volkovich: Deterministic identity testing of depth-4 multilinear circuits with bounded top fan-in, to appear in SIAM J. of Computing.
- J13. Prajakta Nimbhorkar, Telikepalli Kavitha, and Meghana Nasre: Popularity at minimum cost, to appear in Journal of Combinatorial Optimization.
- J14. Ramprasad Saptharishi: Anindya De, Chandan Saha and Piyush Kurur: Fast integer multiplication using modular arithmetic, to appear in the SIAM Journal of Computing.
- J15. Ramprasad Saptharishi: Chandan Saha and Nitin Saxena: A Case of Depth-3 Identity Testing, Sparse Factorization and Duality, to appear in the journal of Computational Complexity.
- J16. Samir Datta, Raghav Kulkarni, Raghunath Tewari, N. V. Vinodchandran: Space complexity of perfect matching in bounded genus bipartite graphs, J. Comput. Syst. Sci. 78(3): 765-779 (2012).
- J17. Samir Datta, Meena Mahajan, B. V. Raghavendra Rao, Michael Thomas, Heribert Vollmer: Counting classes and the fine structure between NC1 and L. Theor, Comput. Sci. 417: 36-49 (2012).
- J18. Sourav Chakraborty: On the Sensitivity of Cyclically-Invariant Functions, Journal of Discrete Mathematics and Theoretical Computer Science (special issue celebrating Laci Babai's 60th birthday) 13(4):51-60 (2011).
- J19. Sourav Chakraborty, Jop Briet, David Garca-Soriano and Arie Matsliah: Monotonicity Testing and Shortest-Path Routing on the cube, Combinatorica 32(1):35-53 (2012).

## Physics

- J20. K.G. Arun, C.K. Mishra and B.R. Iyer: 2.5PN linear momentum flux from inspiralling compact binaries in quasicircular orbits and associated recoil: Nonspinning case, *Physical Review D* 85, 044021 (2012).
- J21. K.G. Arun: Generic bounds on dipolar gravitational radiation from inspiralling compact binaries, *Classical and Quantum Gravity* 29, 075011 (2012).
- J22. K.G. Arun and P. Ajith: Gravitational Wave Astronomy: A new window to the Universe, *Resonance magazine*, October 2011 Issue, pp 922.
- J23. Govind S. Krishnaswami, A. Sen, D. Ahalpara and A. Thyagaraj: A KdV-like advection-dispersion equation with some remarkable properties, *Commun Non-linear Sci Numer Simulat* (2012) in press, arXiv:1109.3745 [nlin.PS].
- J24. K. Narayan: On Lifshitz scaling and hyperscaling violation in string theory, arXiv:1202.5935 [hep-th], *Phys. Rev. D* 85, 106006 (2012).
- J25. K. Narayan: Lifshitz-like systems and AdS null deformations, arXiv:1103.1279 [hep-th], *Phys. Rev. D* 84, 086001 (2011).
- J26. G. Rajasekaran, Sumit T Garg, T Shreecharan, P Das and N Deshpande: TeV scale implications of noncommutative space-time in laboratory frame with polarized beams, *Journal of High Energy Physics*, 10.1107.024,2011.
- J27. G. Rajasekaran, D Indumathi, Romesh K Kaul, and MVN Murthy: (ii) Group velocity of neutrino waves, *Physics Letters B*, 709(4-5)413, 2012.
- J28. G. Rajasekaran: Cabibbo angle and the universality of weak interactions, *Physics News*, 41(3),21, 2011.
- J29. G Rajasekaran: Pround Truths, *Current Science*, 101(6):727,2011.

## Conference Papers

### Mathematics

- C1. Purusottam Rath and S.D. Adhikari: Simplices with monochromatic vertices: reflections on some problems in Euclidean Ramsey Theory, to appear in the conference proceedings held at Chennai in honour of Prof. T.C. Vasudevan.

## Computer Science

- C2. K Narayan Kumar, Benedikt Bollig, Aiswarya Cyriac and Paul Gastin: Model Checking Languages of Data Words, Proceedings of the 15th International Conference on Foundations of Software Science and Computational Structures (FoSSaCS 2012), Springer LNCS 7213 (2012) 391-405.
- C3. Partha Mukhopadhyay, V. Arvind, Prajakta Nimbhorkar, and Yadu Vasudev: Near-Optimal Expanding Generator Sets for Solvable Permutation Groups, MFCS 2012.
- C4. Rameshwar Pratap Yadav and Samir Datta: Computing Bits of Algebraic Numbers, TAMC 2012: 189-201.
- C5. M. Mukund, P. Darondeau and L. Helouet: Assembling Sessions, Proc. ATVA 2011, Springer LNCS 6996 (2011) 259-274.
- C6. M. Mukund, K. Lodaya and R Phawade: Kleene theorems for product systems, Proc. DCFS 2011, Springer LNCS 6808 (2011) 235-247.
- C7. Partha Mukhopadhyay, Prajakta Nimbhorkar and V. Arvind: Erdos-Renyi Sequences and Deterministic construction of Expanding Cayley Graphs, Latin American Symposium on Theoretical Informatics (LATIN 2012).
- C8. Ramprasad Saptharishi, Manindra Agrawal, Chandan Saha and Nitin Saxena: Jacobian hits circuits: Hitting-sets, lower bounds for depth-D occur-k formulas & depth3 transcendence degree-k circuits, accepted in Symposium on Theory of Computing (STOC) 2012.
- C9. Pranabendu Misra, M.S. Ramanujam, Venkatesh Raman and Saket Saurabh: A polynomial kernel for Feedback Arc Set on Bipartite Tournaments, In ISAAC 2011.
- C10. Prateek Karandikar: Cutting Through Regular Post Embedding Problems, co-authored with Philippe Schnoebelen, to appear in The 7th International Computer Science Symposium in Russia (CSR 2012), <http://arxiv.org/abs/1109.1691>.
- C11. Samir Datta, Arjun Gopalan, Raghav Kulkarni, Raghunath Tewari: Improved Bounds for Bipartite Matching on Surfaces. STACS 2012: 254-265.
- C12. Olaf Beyersdorff, Samir Datta, Meena Mahajan, Gido Scharfenberger-Fabian, Karteeek Sreenivasaiah, Michael Thomas, Heribert Vollmer: Verifying Proofs in Constant Depth, MFCS 2011: 84-95.

- C13. Sourav Chakraborty and Oded Lachish: Improved Competitive Ratio for the Matroid Secretary Problem, ACM-SIAM Symposium on Discrete Algorithms (SODA 2012).
- C14. Sourav Chakraborty David Garcia-Soriano Arie Matsliah: Testing by Implicit Learning with Fewer Queries, International Colloquium on Automata, Languages and Programming (ICALP 2011).
- C15. Sourav Chakraborty, Eldar Fischer, David Garcia-Soriano and Arie Matsliah: Junta-symmetric functions, hypergraph isomorphism, and crunching, 27th Annual IEEE Conference on Computational Complexity (CCC 2012).

## Physics

- C17. K.G. Arun and Einstein Telescope Design study group members: Scientific Potential of Einstein Telescope, Proceedings of the Moriond Meeting 2011 at La Thuille, Italy.
- C18. M. Reduan, S. M. Syed-MohdDaud, M. Nazri-MatHusin, M. Yaacob, R. Kuppuswamy, S.M. Syed-Mohamed and R. Jagannathan: Development of Decision Support System for Identification of Bullet-Induced Glass Fractures, Submitted to the International Conference on Computer & Information Sciences (ICCIS2012), Kuala Lumpur, June 2012.
- C19. K. Narayan: cosmological singularities, AdS/CFT and de Sitter deformations, arXiv:1204.3506 [hep-th], to appear in the proceedings of ICGC2011 conference, Dec 2011, Goa.

## Preprints

### Mathematics

- P1. Clare D'Cruz: Homology, mixed multiplicities and fiber cones.
- P2. Clare D'Cruz and Marc Chardin: Cusps in  $P_n$  of analytic spread  $n$ .
- P3. Shrihari Sridharan: Spectral triples and Sinai-Ruelle-Bowen measures.
- P4. Shrihari Sridharan: Smoothness of conjugacies in dynamical systems.
- P5. M.K. Vemuri and E.J. Fuller: The Brylinski beta function of a surface, arXiv:1012.4096.
- P6. M.K. Vemuri: The Brylinski beta function of a double layer.

- P7. M.K. Vemuri: Two functionals connected to the Laplacian in a class of doubly connected domains in rank-one symmetric spaces of non-compact type.
- P8. Purusottam Rath, S. Gun and M. Ram Murty: Linear independence of Hurwitz zeta values and a theorem of Baker-Birch-Wirsing over number fields
- P9. Purusottam Rath: Linear independence of cotangents.

## Computer Science

- P10. Partha Mukhopadhyay, Prajakta Nimbhorkar, V. Arvind and Yadu Vasudev: Near-Optimal Expanding Generating Sets for Solvable Permutation Groups.
- P11. A Baskar, R Ramanujam, and S P Suresh: Dolev-Yao theories with distributive encryption.
- P12. A Baskar, Prasad Naldurg, K R Raghavendra, and S P Suresh. Primal modal logic: applications to cryptography and access control.
- P13. Olaf Beyersdorff, Samir Datta, Andreas Krebs, Meena Mahajan, Gido Scharfenberger-Fabian, Karteek Sreenivasaiah, Michael Thomas, Heribert Vollmer: Verifying Proofs in Constant Depth, Electronic Colloquium on Computational Complexity (ECCC) 19: 79 (2012).
- P14. Sourav Chakraborty, Raghav Kulkarni, Satyanarayana V.Lokam and Nitin Saurabh: Towards the Fourier Entropy Conjecture.
- P15. Sourav Chakraborty, Eldar Fischer, Yonatan Goldhirsh and Arie Matsliah. On the Power of Conditional Samples in Distribution Testing.
- P16. Sourav Chakraborty, Akshay Kamath and Rameshwar Pratap: Testing Uniformity of Stationary Distribution.

## Physics

- P17. R. Parthasarathy: Causality of the Brane Universe -OPERA and ICARUS. hep-ph/1203.6192.
- P18. G. Rajasekaran: A stable massive charged particle, ArXiv:1105.5213.

## Book

### Mathematics

- B1. V. Balaji, V. Lakshmibai, M.P. Murthy and M.V. Nori: Collected Papers of C.S. Seshadri, Vector Bundles and Invariant Theory, Volume I, Hindustan Book Agency (2012).



- B2. V. Balaji, V. Lakshmibai, M.P. Murthy and M.V. Nori: Collected Papers of C.S. Seshadri, Schubert Geometry and Representation Theory, Volume II, Hindustan Book Agency (2012).

## Computer Science

- B3. M. Mukund: Regular Languages: From Automata to Logic and Back, in R. Sujatha, H.N. Ramaswamy, C.S. Yogananda (eds) Math Unlimited: Essays in Mathematics, CRC Press (2011).

## Ph.d. Thesis

- P1. Nagarajan Krishnamurthy: Equilibria in Bimatrix Games and Stochastic Games: Theoretical and Computational Aspects (May 2011).
- P2. Santosha Kumar Pattanayak: Problems related to Invariant theory of Torus and finite groups (June 2011).
- P3. A. Baskar: Decidability Results For Extended Dolev-Yao Theories (December 2011).







## The National Undergraduate Programme

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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 M.Sc. degree in Applications of Mathematics in 2010.

The undergraduate and postgraduate teaching programmes at CMI are both run in cooperation 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

In 2011, the fourteenth batch of students was admitted to the undergraduate programme. 21 students have joined the programme. The second year B.Sc. class has 17 students, while the third year B.Sc. class has 13 students. Out of the 9 students of the 2009 batch who took their degrees at the convocation in August, 2011, several have been placed in very prestigious institutions.

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Ranjani Banhatti

Masters student in Scientific Computing,  
Heidelberg, Germany.

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Neeraj Bapat

Masters student, Ecole Polytechnique, France.

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Sirshendu Dam

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Yajnaseni Dutta	MSc student in Mathematics, CMI.
Ritwika Ghosh	MSc student in Computer Science, CMI
Tanmay Inamdar	MSc student in Logic ILLC, Amsterdam, the Netherlands.
Sudeshna Kolay	PhD student in Computer Science, IMS, Chennai.
Bharat Ram	MSc student in Computer Science, Weizmann Institute, Rehovot, Israel.
Rahul Singh	PhD student in Mathematics, CMI.

## **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.

In 2011, 9 students have joined the programme. The second year B.Sc. class has 9 students, while the third year B.Sc. class has 8 students.

During the course of the academic year, Physics students perform some basic experiments in class at CMI. In addition, students have an intensive laboratory programme at the Homi Bhabha Centre for Science Education (HBCSE), Mumbai, during the summer vacation after the first year. A similar arrangement has been worked out with the Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam for students at the end of the second year. Regular laboratory classes are conducted with the help of IIT Madras for students in the third year.

Out of the 5 students of the 2008 batch who took their degrees at the convocation in August, 2011, several have been placed in very prestigious institutions.

Sagnik De	Graduate student in Physics, University of Mississippi, U.S.A.
Sukanya Ghosh	Masters student in Mathematics of Cryptography and Communications, Royal Holloway College, University of London, U.K.
Pavithran Iyer	Graduate Student in Physics, University of Sherbrooke, Canada.
Debangshu Mukherjee	PhD student in Physics, CMI.
Shreyas Patankar	Graduate Student in Physics, University of California at Berkeley, U.S.A.

## M.Sc. Mathematics

5 students who joined the programme in 2009 have completed the programme successfully.

Aneesh Karthik	PhD student in Mathematics, CMI
Mizanur Rahaman	
S. Padmavathi	PhD student in Mathematics, MIT, U.S.A.
Ramen Ghosh	
Vinay Kumaraswamy	PhD student in Mathematics, CMI

In 2011, 3 students have joined the programme.

## M.Sc. Computer Science

21 students who joined the programme in 2009 have completed the programme successfully.

Arpith Siromoney.	
Gautam Prakriya	PhD student in Computer Science, University of Wisconsin at Madison, U.S.A.
Jose Mathew	Efficient Frontier Systems, Chennai.
Prateek Karandikar	PhD student in Computer Science, CMI.
Rohit Babbar	PhD student in Computer Science, Grenoble, France.
Shambwaditya Saha	PhD student in Computer Science, Institute of Mathematical Sciences, Chennai.
T R Shyam Sundar	Clay Labs, Chennai.
Vikash Agarwal	Aricent Technologies, Gurgaon.
Megha Bhandari	Tata Consultancy Services, Mumbai.
Hina Bhatia	Steria, Noida.
LI Amala Fernando	Cognizant Technology Service, Chennai.
Shwetha Kini	Cognizant Technology Service, Chennai.
Rohit Kumar	Tata Consultancy Services - SMB, Mumbai.
Stephen Lee	Tata Research Development and Design Centre, Pune.

Srikanta Maharana	Bally Technologies Pvt India Ltd, Chennai.
Alok Ranjan	Tata Consultancy Service - USAA, Chennai.
Prabhat Sahoo	Bally Technologies Pvt India Ltd, Chennai.
Monika Sharma	Ericcson, Kolkata.
V. Madhuri	Accenture, Delhi.
Swarna Srinivasan	Tata Consultancy Services, Chennai.
S Aiswarya	Cognizant Technology Service, Chennai.

In 2011, 7 students have joined the programme.

## **M.Sc. Applications of Mathematics**

In 2011, 11 students have joined the programme.

## **Convocation**

The 9th Annual Convocation of CMI was held on 3 August 2011. Degrees were awarded to 41 successful candidates at various levels. Of these, 14 were at the Undergraduate level, 25 were at the Postgraduate level and 2 were at Ph.D. level. Dr. C. Rangarajan, Chairman, Economic Advisory Council to the Prime Minister, gave away the degree certificates. Prof. Ravi Kannan, Principal Researcher, Microsoft Research Labs, Bangalore, delivered the convocation address.

The CMI Gold Medal of Excellence was awarded to Rahul Singh in B.Sc. (Hons.) in Mathematics & Computer Science and Shreyas Ganesh Patankar in B.Sc. (Hons.) in Physics. The CMI Gold Medal of Excellence was awarded to S. Padmavathi in M.Sc. in Mathematics and Prateek Rajeeva Karandikar in M.Sc. in Computer Science.



## Activities of the Undergraduate Students

### Informatics Olympiad

CMI faculty coordinate the training and selection of students to represent India at the International Olympiad in Informatics through the Indian Association for Research in Computer Science (IARCS).

### Achievements of CMI students

#### Prizes won

- AMTI National Mathematics Talent Competitions 2011: Ronno Das finished first in the Seniors Level.

- Shaastra at IIT-Madras - August 2011

Event	Participant	Place
Online Math Champ Set 1	Ronno Das	1st
Online Math Champ Set 2	Ronno Das	2nd
Online Math Champ Set 3	Ronno Das	2nd

- Shaastra Cube Open 2011 at IIT Madras -October 2011

Participant	Event	Place
Nikhil Mande	Rubik's Cube(3x3)	3rd
	3x3 Blindfolded	2nd
	3x3 Fewest Moves	1st (with National Record)

- Amrita Cube Open 2012 at Amrita Vishwa Vidyapeetham, Kollam, Kerala - February 2012

Participant	Event	Place
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Shubhayan Kabir	2x2 Cube	3rd
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■ Pragmaan Cube Open 2012 at NIT Trichy - February 2012

Participant	Event	Place
Nikhil Mande	Rubik's Cube(3x3)	3rd
	2x2 Cube	3rd
	3x3 Blindfolded	2nd

## Interaction with graduate students from Ecole Normale Superieure

Chennai Mathematical Institute has an agreement with the Ecole Normale Superieure in Paris, France, one of the leading institutions in the world for teaching and research in Mathematics. This agreement provides for regular exchange visits by academic members of CMI and ENS, Paris. This includes, in particular, exchanges of visits by undergraduate students between the two institutions.

Every year, the top three students passing out from the B.Sc. Mathematics programme spend 8 weeks at the ENS, where they work on research projects with the ENS faculty. In May–June 2011, Neeraj Bapat, Rahul Singh and Bharat Ram visited the ENS.

Valentine Roos from the ENS visited CMI during January-February, 2010.

## Interaction with graduate students from Ecole Polytechnique

Chennai Mathematical Institute has an agreement with the Ecole Polytechnique in Paris, France, one of the leading institutions in the world for teaching and research in Physics.

Every year, the top three students passing out from the B.Sc. Mathematics programme spend 8 weeks at the ENS, where they work on research projects with the ENS faculty. In May–July 2011, Shreyas Patankar, Siddharth Yenamandala and Debangshu Mukherjee visited the ENS.



## Undergraduate / Graduate Courses

Course	Instructor
■ Algebra I.....	Krishna Chaitanya
■ Calculus I.....	T Parthasarathy
■ English .....	Shreekumar Varma
■ Intro to Programming (Haskell) .....	K Narayan Kumar
■ Algebra III.....	Manoj Kummini
■ Real Analysis.....	R Srinivasan
■ Caculus III.....	Pramathanath Sastry
■ Design & Analysis of Algorithms.....	Samir Datta
■ Theory of Computation.....	K V Subrahmanyam
■ Algebra IV .....	S Senthamarai Kannan
■ Introduction to Logic .....	S P Suresh
■ Concurrent Programming.....	S P Suresh
■ Cryptography.....	K V Subrahmanyam
■ Coding Theory .....	Sourav Chakraborty
■ Topics in Pseudorandomness.....	Partha Mukhopadhyay
■ Automata Theory & Verification .....	K Narayan Kumar
■ Verification .....	Madhavan Mukund
■ Circuit Complexity .....	Samir Datta
■ Classical Mechanics I.....	V V Sreedhar
■ Electromagnetism I .....	R Parthasarathy
■ Mathematical Physics I .....	Rakesh Nigam
■ Intro to Programming (Python) .....	Madhavan Mukund

- Laboratory ..... M V Rao
- Electromagnetism II ..... G Rangarajan
- Mathematical Physics III..... R Jagannathan
- Quantum Mechanics II ..... Govind Krishnaswami
- Statistical Mechanics II ..... N D Hari Dass
- Laboratory ..... M V Rao
- Electromagnetism II ..... G Rangarajan
- Mathematical Physics III..... R Jagannathan
- Quantum Mechanics II ..... Govind Krishnaswami
- Statistical Mechanics II ..... N D Hari Dass
- Laboratory ..... M V Rao
- Atomic and Molecular Physics..... H S Mani
- Statistical Mechanics III..... S Sivakumar
- Quantum Field Theory ..... G Rajasekaran
- Probability and Statistics ..... Rajeeva L Karandikar
- Linear Algebra..... Clare D'Cruz
- Analysis ..... Preena Samuel
- Stochastic Calculus ..... B V Rao
- Algebra ..... Purusottam Rath
- Real Analysis..... Archana Morye
- Topology ..... V Balaji
- Differential & Integral Eqns ..... Shrihari Sridharan
- Complex Geometry and Moduli..... C S Seshadri
- Measure Theory ..... S Kesavan
- Algebraic Topology..... Shiva Shankar
- Classical Mechanics ..... K G Arun
- Electrodynamics..... H S Mani
- Quantum Mechanics..... K Narayan
- Mathematical Physics ..... R Jagannathan
- Intro to Contact & Symplectic Topology .. Dishant Pancholi
- Hilbert Schemes & Deformation Theory.. Pramathanath Sastry
- Economics ..... Malathi Velamuri



- Computational Complexity Theory ..... Partha Mukhopadhyay
- Quantum Mechanics-I..... R Jagannathan
- Readings in Fiction ..... K Srilata
- Automata Theory & Verification II-2..... K Narayan Kumar
- Differential Geometry ..... Dishant Pancholi
- Programming Language Concepts ..... S P Suresh
- Topology ..... Krishna Hanumanthu
- Algebraic Geometry ..... S Ramanan
- Algebraic Number Theory ..... Purusottam Rath
- Measure Theory ..... V Srinivasan
- Syzygies ..... Manoj Kummini
- Complex Analysis ..... Sarbeswar Pal
- Analytic Theory of Algebraic Numbers.... K Srinivas
- Topics in Graph Theory ..... Samir Datta
- Condensed Matter Physics ..... G Rangarajan
- Nuclear and Particle Physics ..... G Rajasekaran
- Game Theory ..... T Parthasarathy
- Functional Analysis ..... S Kesavan
- Algorithmic Number Theory..... Pushkar Shripad Joglekar
- Algebraic Number Theory ..... Purusottam Rath
- Optimization ..... K V Subrahmanyam
- Complexity Theory ..... V Arvind
- Algebraic Number Theory ..... K Srinivas
- Finance II..... Rajeeva L Karandikar
- Risk Management ..... Rituparna Sen
- Stochastic Finance ..... B V Rao
- Econometrics II..... Kausik Chaudhuri
- Data Mining and Machine Learning ..... Madhavan Mukund
- Randomized Algorithm ..... Sourav Chakraborty &  
..... K V Subrahmanyam
- Proof Theory ..... S P Suresh



## Courses, Special Lectures

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- Prof. C.S. Seshadri gave two talks on “My Mathematical Reminiscences” (June 2011).
- S. Padmavathi gave a talk on “The Jacobian of a smooth projective curve” (June 2011).
- N.D. Hari Dass gave a talk on “Revisiting the Heisenberg Microscope” (September 2011).
- Pranabendu Misra gave a talk on “A polynomial kernel for Feedback Arc Set on Bipartite Tournaments” (December 2011).
- Eleonora Dell’Aquila gave a talk on “New Methods And Ideas For Yang-Mills Scattering” (December 2011)
- Rajeeva L. Karandikar gave a talk on “Is there a science behind opinion polls?” (March 2012).

### Endowment Lectures at CMI - February 2012

- K. Lakshmanan Memorial Distinguished Lecture: Complete Intersections - N. Mohan Kumar, Washington University, St Louis, U.S.A.
- R.K. Rubugunday Distinguished Lecture: An invitation to free probability - Prof. V.S. Sunder, Institute of Mathematical Sciences, Chennai.



## Workshops/ Schools

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### **I Advanced Instructional School (sponsored by NBHM) on Lie Algebras during July 2011 at Chennai Mathematical Institute (CMI) and Institute of Mathematical Sciences (IMSc)**

This AIS aimed to develop basics of the theory as the classification of the algebras by means of root systems, the structure of an algebra in terms of a Cartan subalgebra and root spaces, complete reducibility of representations, parametrization of the irreducible representations by means of highest weights, well known character formulas for representations, Chevalley groups and their basic properties and affine Kac-Moody Lie algebras and their representations, up to the Kac-Weyl character formula and the proof of the Macdonald identities.

Conveners: Upendra Kulkarni (CMI), K. N. Raghavan (IMSc), and S. Viswanath (IMSc).

#### **Resource persons:**

- P1. Punita Batra (HRI, Allahabad)
- P2. Anuradha Garge (CEBS, Mumbai)
- P3. Shripad Garge (IIT, Bombay)
- P4. Senthamarai Kannan (CMI)
- P5. Upendra Kulkarni (CMI),
- P6. Brajesh Mishra (Allahabad University, Allahabad)
- P7. K.N. Raghavan (IMSc)
- P8. Ravindra
- P9. P. Shukla (Allahabad University, Allahabad)
- P10. Anupam Kumar Singh (IISER, Pune)
- P11. K.V. Subrahmanyam (CMI)
- P12. S. Viswanath (IMSc).

Unity of Mathematics lectures: In addition to the lectures on the syllabus proper, there were two lectures on relations to physics ("The uses of Lie groups and Lie algebras in physics") by N. Mukunda, IISC, Bangalore and a lecture on relations to computational complexity ("Positivity and plethysms in geometric complexity theory") by Ketan Mulmuley.

## **II Workshop on Pseudorandomness -August 2011**

The workshop aimed at highlighting the latest tools and techniques in the area of pseudo-randomness. This workshop was supported by the CMI-TCS Academic Alliance.

Broadly, the scope of the workshop was: Expanders and applications, Additive combinatorics and its applications to pseudorandomness, Codes, and their relation to extractors and expanders.

Organisers: K. V. Subrahmanyam (CMI), Partha Mukhopadhyay (CMI), Sourav Chakraborty (CMI) and V Balaji(CMI).

### **Lectures:**

- Introductory Talk - Jaikumar Radhakrishnan , TIFR, Mumbai.
- Lossless expanders/extractors from algebraic codes, Expander codes, Euclidean Sections -Venkatesan Guruswami, Carnegie Mellon University.
- Application of Boolean function analysis to computational randomness -Andrej Bogdanov, Chinese University of Hongkong, Hongkong.
- The Kakeya Problem and the Joints Conjecture -Neeraj Kayal, Microsoft Research, Bangalore.
- Pseudorandom generators for threshold functions using invariance principles - Prahladh Harsha, TIFR, Mumbai

## **III Advanced Instructional School on Invariant Theory (AIS) Supported by NBHM - December 2011**

Conveners: V. Balaji, CMI and A.J. Parameswaran (TIFR, Mumbai).

### **Main Lectures:**

- P1. D.S. Nagaraj, IMSc, Chennai -Initial aspects of GIT. Hilbert-Mumford etc.
- P2. Jugal Varma, IIT, Mumbai -Commutative Algebra aspects of GIT.

- P3. K.N. Raghavan, IMSc -Work of Kempf and Hesslink on instability flags.
- P4. A.J. Parameswaran, TIFR, Mumbai - Characteristic p methods, Ramanan - Ramanathan, ramifications, Luna's slice theorem
- P5. V. Balaji, CMI - Rousseau's work on instability, Bogomolov's work on instability.
- P6. Pramathanath Sastry, CMI -Mumford's conjecture, various aspects.

### Unity Lectures:

- P1. S. Ramanan, CMI -Three talks on classical Invariant theory.
- P2. C.S. Seshadri, CMI -GIT construction of moduli of abelian varieties.
- P3. Pierre Cartier, Institut des Hautes Etudes Scientifiques, France -On invariants in geometry, algebra, and mechanics (classical, relativistic and quantum): a century of developments

## IV CMI-IMSc Mathematics Colloquium 2012 - January 2012

Organisers: V. Balaji (CMI), V. Lakshmibai (Northeastern University, U.S.A.), A.J. Parameswaran (TIFR, Mumbai), K. N. Raghavan (IMSc, Chennai) and Pramathanath Sastry (CMI).

This colloquium consisted of talks in algebraic geometry and related areas of mathematics, celebrating the work of C. S. Seshadri, on the occasion of his 80th birthday. The following speakers gave lectures at the colloquium.

- Michel Brion (Grenoble, France) -The cohomology algebra of an algebraic group
- Corrado DeConcini (Roma I, Italy) -Index, infinitesimal Index of transversally elliptic operators and splines
- Jochen Heinloth (Essen, Germany) -On motivic classes of moduli spaces of Higgs bundles
- Mohan Kumar (St. Louis, U.S.A.) -Spaces of rational curves in general hypersurfaces
- Adrian Langer (Warsaw, Poland) -On a positive equicharacteristic version of the Grothendieck-Katz conjecture
- Laurent Lafforgue (IHES, France)
- Vikram Mehta (TIFR, India)

- Patrick Polo (Jussieu, France) -On torsion in integral intersection cohomology of Schubert varieties
- Tadao Oda (Tohoku, Japan) -(Semi)stability and (quasi)crystals.
- Claudio Procesi (Roma I, Italy) -Algebraic and geometric aspects of the non linear Schroedinger equation
- C.S. Rajan (TIFR, Mumbai) -Spectrum and Arithmetic
- M.S. Raghunathan (IIT-Bombay, India)
- Arun Ram (Melbourne, Australia) -Views from 20 years trekking on the LS path
- T.R. Ramadas (ICTP, Italy)
- V. Srinivas (TIFR, India) -Abelian Varieties and Theta Functions associated to certain compact Riemannian manifolds: constructions inspired by superstring theory
- Constantin Teleman (Berkeley, USA) -Geometric Langlands correspondence after Beilinson-Drinfeld and deformed opers
- Ravi Vakil (Stanford, USA) - Stabilization of discriminants in the Grothendieck ring
- Jonathan Weitsman (Northeastern, USA) -Semiclassical analysis, loop group characters, and the modular group action (joint with Victor Guillemin and Shlomo Sternberg)

## Conferences, Visits and External Lectures

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### Rajeeva L. Karandikar

- Invited speaker at India Finance Conference, IIM Bangalore.
- Visited ITAM (Instituto Tecnológico Autónomo de México) and gave talks on “Martingale problem approach to Markov processes” and “Copulas, tail dependence and Value-at-Risk” in April 2011.
- Visited National Science Foundation (NSF), U.S.A. and gave a talk about CMI and its activities.
- Visited ISI, Delhi in May 2011.
- Gave an invited talk on “On Differential equations and Diffusion Processes” at Ramanujan Mathematical Society annual conference in Allahabad, in October 2012.
- Gave an invited plenary talk on “Portfolio theory in the spirit of Markowitz in nongaussian world” -at the India Finance Conference, IIM, Bangalore.
- Gave a talk on “Randomness and its role in design and analysis of Blockciphers” at Indo-US workshop on Cryptology at Indian Statistical Institute, Kolkata.
- Gave an invited at the Institute colloquium at IIT, Bombay on “Is there a science behind opinion polls?” in March 2012.
- Attended Pre-conference tutorial on Stochastic Calculus at India Finance Conference, IIM, Bangalore.
- Gave a 6-hour tutorial on Stochastic Calculus at ICTS School in Math Finance, TIFR Mumbai.

## C.S. Seshadri

- attended the CAAG 2012 Conference held at Puducherry in March 2012.

## Shiva Shankar

- Attended CAAG, and gave a talk on ‘Arithmetic’ results in PDE.
- Lectured on ‘symplectic reduction and completely integrable systems’ in a workshop on Ergodic Theory at KSOM.

## G. Rajasekaran

- Visited Texas A and M University, College Station, Texas, USA in July 2011 and had discussions with Prof Rupak Mahapatra and his group on the possibility of initiating Dark Matter experiments in India.
- Visited University of California, Riverside during July 2011 and had discussions with the Neutrino group.
- Participated in the International Lepton-Photon symposium at TIFR, Mumbai during August 2011.
- Visited Banares Hindu University during December 2011 and gave two lectures on “Neutrinos and India-based Neutrino Observatory” and “Is there a Final Theory?”
- Visited BARC, Mumbai in January 2012 and had discussions with BARC Engineers in connection with INO.
- Participated in Workshop on High Energy Physics Phenomenology (WHEPP 12) at Mahabhaleshwar during January 2012 and talked on “Group velocity of neutrino waves”.
- Participated in NuHoRizons (Conference on Neutrinos) at HRI, Allahabad during February 2012 and talked on “Group velocity of neutrino waves”.
- Visited Banares Hindu University during February 2012 and gave two lectures on “A Journey into the microcosmos”: 1. Standard Model, 2. String Theory.
- Visited BARC, Mumbai during February 2012 and participated in the INO Collaboration Meeting.



- Participated in National Symposium on Space Sciences at Sri Venkateswara University, Tirupati during February 2012 and presented an invited interdisciplinary talk on “Neutrinos in Physics and Astronomy”.
- Visited Hyderabad University during February 2012 and gave a Colloquium “The elusive neutrino and the INO” and a seminar “Group velocity of neutrino waves”.
- Visited Bharathidasan University, Tiruchy during March 2012 and gave two lectures: 1. A journey through the microcosmos, 2. The elusive neutrino and INO”.
- Visited Jamal Mohideen College on March 2012 and talked on “The elusive neutrinos and INO”.
- Participated in the Symposium on Particles and Detectors at TIFR, during March 2012.
- Teaching Quantum Mechanics to MSc Physics students of Colleges in and around Chennai, every Sunday, throughout the year (Venue: Nuclear Physics Department, Guindy Campus of University of Madras).
- Gave a Popular Science talk on “The elusive neutinos and their importance at the Planetarium, Bangalore in September 2011. Participated in the panel discussion on ways to spread astronomy education in the colleges.
- Gave lectures at MIT, Anna University, Chennaiinn in January 2012: 1.A journey into the microcosmos, 2.Neutrinos and INO.
- Gave lectures at Vivekananda College, Chennai on Feb21, 2012: 1.The elusive neutrino, 2. INO.
- Gave a popular talk at a private Association named “Friends Group” at Coimbatore in March 2012 on “Neutrinos and INO”.

## **Madhavan Mukund**

- Attended Fourth Indo-American Frontiers of Science Symposium (IAFOS) 2011, Irvine, U.S.A., in April 2011. Member of Organizing Committee.
- Visited LSV, ENS de Cachan, France, LaBRI, Bordeaux, France and IRISA, Rennes, France in April-May 2011 and gave a talk on “Assembling Sessions” at LSV, ENS de Cachan

- Attended 10th Update Meeting on Advanced Formal Methods, at VIT University, Vellore, July 2011 and gave a talk on “The decidability frontier for Petri nets”, 10th Update Meeting on Advanced Formal Methods, VIT University, Vellore, July 12-14, 2011.
- Attended ACM Chennai Faculty Workshop on Formal Methods for Specification and Verification, CMI, July 2011 and gave a talk on “Adding time to automata”.
- Participated in ACM Education Council meeting, at Denver, Colorado, U.S.A. in September 2011.
- Visited Tata Research Development and Design Centre (TRDDC), Pune in September 2011.
- Attended ATVA 2011, at Taipei, Taiwan, October 2011 and presented a talk.
- Visited LSV, ENS de Cachan, France, LaBRI, Bordeaux, France and IRISA, Rennes, France in November 2011.
- Attended FSTTCS 2011, IIT Bombay, Mumbai, in December 2011 and chaired a session.
- Attended Mysore Park Workshop on “The Future of Debugging”, Mysore, during February -March 2012.

## **K. Narayan Kumar**

- Visited LSV, ENS de Cachan in May-June 2011 and November 2011 on the ARCUS project as well as the CNRS LIA “Informel”.
- Attended 31st Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2011) at IIT Bombay, Mumbai, in December 2011.
- Attended 15th International Conference on the Foundations of Software Science and Computation Structures (FoSSaCS 2012), as part of ETAPS 2012, at Tallin, Estonia, in March 2012.

## **Pramathanath Sastry**

- Attended Workshop on local cohomology at IIT-B in July 2011.
- Gave series of lectures on “Geometric Invariant theory and Mumford’s conjecture” in the advanced ATM workshop on Invariant theory held at CMI in December 2011.

- Attended CMI-IMSc Maths colloquium, in Jan 2012.
- Attended Commutative Algebra and Algebraic Geometry conference at Pondicherry in March 2012.

## **Samir Datta**

- Visited Kristoffer Hansen at Aarhus University, Denmark, in August 2011.

## **S. Senthamarai Kannan**

- Gave a talk in RMS held at the University of Allahabd during October 2011.
- Gave a talk in the Vaidhyanadha Samy Memorial lecture at Ramanujan Institute for Advanced Study in Mathematics, Chennai.

## **K.V. Subrahmanyam**

- Attended 31st Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2011) at IIT Bombay, Mumbai, in December 2011.
- Gave 5 lectures on “Grobner basis and the Hilbert Basis theorem” at the Advanced School for Lecturers held in Kumaon University, Almora campus in February 2012.

## **Clare D’Cruz**

- Attended Summer School in Commutative Algebra at ISI, Kolkata, during July-August 2012.
- Assisted in tutorial of the Summer School in Commutative Algebra in July 2011 at the Indian Institute of Technology, Mumbai.
- Gave lectures on Groebner Basis and Introduction to the package “Singular”: ATMW Computational Commutative Algebra and Algebraic Geometry in January 2012.

## **Govind S. Krishnaswami**

- Gave a talk on “A KdV-like wave equation with some remarkable properties”, at IISER Thiruvananthapuram, in August 2011.

## K. Narayan

- Attended “Conference on Cold Materials, Hot Nuclei and Black Holes: Applied Gauge/Gravity Duality held at the Abdus Salam ICTP, Trieste, Italy, in August 2011.
- ICGC2011 (International Conference on Gravitation and Cosmology) conference, Goa, in December 2011 and gave a talk on “Cosmological singularities, AdS/CFT and de Sitter deformations.
- Visited TIFR String theory group, in July 2011, and December 2011.

## Purusottam Rath

- Gave a talk in the Institut de Mathematiques de Jussieu in May 2011 on Non-vanishing of periodic L-functions, irrationality and a question of Chowla.
- Gave a talk in the international conference on Number theory at HRI in December 2011 on Subspace theorem and complexity.
- Gave a series of lectures on transcendence and diophantine approximation in IMSc in relation to the Special year in Number theory.
- Co-organiser of the Special year in Number theory at IMSc.

## R. Srinivasan

- Attended a workshop on “Functional Analysis of Quantum Information Theory” at The Institute of Mathematical Sciences, Chennai, during December 2011-January 2012.
- Attended the conference on “Quantum Probability, Noncommutative Geometry, Quantum Information.” held at ICMS, Edinburgh, Scotland, in January 2012, and gave a talk titled “Hilbert Von Neumann Modules”.
- Attended an Instructional Workshop on “Subfactors and planar algebras” held at The Institute of Mathematical Sciences, Chennai, during March -April 2012.
- Attended the SunderFest held at The Institute of Mathematical Sciences, Chennai, during April 2012 and gave a talk titled “EO- semigroups on type II1 factors”.
- Visited the University of Lancaster, U.K., during June-July 2011 and gave a series of six lectures on “Generalized CCR flows” and “Toeplitz CAR flows”.

- Gave a talk on “CCR flows” in the ATM Workshop on Operator Algebras, held at The Institute of Mathematical Sciences, Chennai, during January -February 2012.

## **M. Sundari**

- Attended Discussion meeting in Harmonic Analysis during December 2011.

## **Upendra Kulkarni**

- Gave five lectures in Advanced Instructional School on “Lie Algebras” at CMI, in July 2011
- Visited IIT Mumbai, and gave two lectures on “Schur-Weyl duality and representation theory of  $GL(n)$ ”, in November 2011.
- Attended ATM Workshop in Representation theory of finite group of Lie-type: Deligne-Lusztig theory at TIFR, Mumbai, in December 2011.

## **M.K. Vemuri**

- Attended 2011 Georgia Topology Conference, at Athens, GA, U.S.A., in May 2011.
- Visiting ‘West Virginia University’ for entire year and gave several lectures in the WVU Geometry/Topology seminar.

## **K.G. Arun**

- Gave a colloquium on Gravitational Waves named “Audible Universe” at IIT Madras in August 2011.
- Visited Raman Research Institute, Bangalore (May, September 2011 & February 2012).
- Visited IISER Thiruvananthapuram in July 2011 for research collaborations and gave a seminar on “Parametrized Tests of Post-Newtonian theory using Gravitational Wave Observations”.
- Attended International Conference on Cosmology & Gravitation, Goa, December 2011. Gave a talk on “Generic bounds on dipolar Gravitational Radiation from inspiralling compact binaries” in the work shop session. Contributed poster on “New accurate set of PN phase parameters using singular value decomposition” with Archana Pai.

- Attended Indo-Japan Cooperative Science program (IJCSP) meeting at IISER Thiruvananthapuram in December 2011.
- Attended one week long IndIGO work shop at IUCAA, Pune in March 2012.

## **Partha Mukhopadhyay**

- Organized a Workshop on Pseudorandomness at CMI, in August 2011.

## **Prajakta Nimbhorkar**

- Attended a Workshop on Pseudorandomness at CMI, in August 2011.
- Gave a lecture on Popular matchings in IMSc Golden Jubilee Thematic Lectures in Theoretical Computer Science.

## **Shrihari Sridharan**

- Gave a lecture titled, 'SRB-measure leaks' in the in-house symposium in CMI during September 2011.
- Visited Indian Statistical Institute, Delhi during November -December 2011.
- Visited Indian Institute of Technology, Delhi during December 2011.
- Gave a short course on Symbolic dynamics in ISI Delhi and IIT Delhi during December 2011.
- Gave a lecture titled, 'Escape rate of SRB-measure' in ISI Delhi.

## **Sourav Chakraborty**

- Attended conferences WorKer 2011, FSTTCS 2011, GTOA 2011, SODA 2012. Gave a talk on "Property Testing: Sublinear Algorithms for Promise Problems" -Keynote speaker at Workshop on Kernelization (WorKer 2011) held at Vienna. Gave a talk on "Generalized Matroid Secretary Problem" at International Conference on Game Theory, Operations Research and their Applications (GTOA 2012) held at ISI Chennai.
- Visited Eldar Fischer at Technion, Israel in May and December 2011.
- Visited Raghav Kulkarni at LIAFA Paris for couple of weeks in June 2011.
- Visited Harry Buhrman at CWI, Amsterdam for couple of weeks in July 2011.

- Visited Satya Lokam at Microsoft Research, India for couple of weeks in October 2011 and couple of weeks in February 2011.
- Visited Ragesh Jaiswal at IIT Delhi, in September 2011.

## **Gautham Shenoy R**

- Attended workshop on “Finite and Algorithmic Model Theory (FAMT)” at IIT Bombay in December 2011.
- Attended the “Foundations of Software Technologies and Theoretical Computer Science” conference at IIT Bombay in December 2011.
- Attended the workshop on “Future of Debugging” at Infosys Mysore in February 2012.

## **Pranabendu Misra**

- Attended ISAAC 2011, Yokohama Japan.

## **Prateek Karandikar**

- visited LSV, ENS Cachan in the summer of 2011.
- Gave a talk at Formal Methods Update Meeting at Vellore Institute of Technology, in July 2011.
- Attended a workshop “Automata Theory and Applications” at National University of Singapore, in September 2011.
- Attended FSTTCS 2011 at IIT Bombay in December 2011.
- Attended Microsoft Research Theory Day, Bangalore in January 2012.
- Visited Tata Research Development and Design Centre, Pune in February 2012.

## **Rameshwar Pratap Yadav**

- Attended Workshop on Pseudorandomness at CMI, in August 2011.
- Attended FSTTCS, at IIT Bombay, in December 2011.
- Attended TAMC-2012, at Beijing, China, in May 2012.

## **Ramprasad Saptharishi**

- attended FSTTCS 2011, Mysore Park workshop 2011, STOC 2012, China Theory Week 2011.
- Presented a result of Saxena-Seshadri in the Mysore Park workshop 2011. Presented “Jacobian hits circuits” at Microsoft Research India.
- Presented “Jacobian hits circuits” at China Theory Week 2011.

## **Varunkumar Jayapaul**

- Attended Data Structures workshop.



## Other Professional Activities

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### **Rajeeva L. Karandikar**

- Coodrinator for the NET examination of UGC/CSIR in mathematical sciences.
- Chairman of the committee to draft syllabus at Central University, Orissa.

### **Shiva Shankar**

- Associate editor, Multidimensional Systems and Signal Processing, (Springer).

### **Madhavan Mukund**

- Member, Editorial Board, LIPIcsLeibniz International Proceedings in Informatics.
- Member, Editorial Board, Formal Methods Letters.
- Member, Editorial Board, Transactions on Petri Nets and Other Models of Concurrency (ToPNoC).
- Member, Program Committee, 22nd International Conference on Concurrency Theory (CONCUR-2011), Aachen, Germany, August 2011.
- Member, Program Committee, 32nd International Conference on Application and Theory of Petri Nets and Other Models of Concurrency (Petri Nets 2011), Newcastle, UK, June 2011.
- Member, Program Committee, 9th IEEE International Conference on Software Engineering and Formal Methods (SEFM 2011), Montevideo, Uruguay, November 2011.
- 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.
- Team Leader of the Indian team, International Olympiad in Informatics, Pattaya, Thailand, July 2011.
- Convener, 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

## **Pramathanath Sastry**

- Refereed paper for JRMS.

## **K. Narayan Kumar**

- Member, Program Committee, 31st International Conference on Foundations of Software Technology and Computer Science (FSTTCS 2011), Mumbai, December 2011.
- Coach, Indian Computing Olympiad.
- Deputy Leader of the Indian team, International Olympiad in Informatics, Pattaya, Thailand 2011.

## **K.V. Subrahmanyam**

- Along with Partha Mukhopadhyay and Sourav Chakraborty organized a workshop on Pseudorandomness at CMI in August 2011.

## **G Rajasekaran**

- Member of Scientific Steering Committee of INO.
- Chairman of Board of Studies in Physics, CMI.
- Member of Academic Council, CMI.
- As a member of the INO (India-based Neutrino Observatory) group at Chennai, the following is reported. An important milestone of the INO project was passed during 2011-12. The problem of getting the sites which was one of prime responsibilities of our group was solved. All government approvals have been

obtained and the Tamil Nadu Government has already transferred 26 hectares of land in Theni District for the underground laboratory and is transferring 12 hectares of land near Madurai city for the INO Centre. As a consequence, a major National Institution for High Energy Physics will come up in Tamil Nadu.

- A multi-institutional collaborative project for the detection of Dark Matter has been initiated. The first meeting on the proposal was held on 24 August 2011 at TIFR, Mumbai and at the second meeting at SINP, Kolkata on Dec 23-24, 2011 the project was given a more concrete form. Since the big Dark Matter detector will be mounted in the INO cavern (suitably extended), it is to be called DINO (Dark Matter at INO). A MicroDINO to establish the technological feasibility of the Si-based detector and a MiniDINO which will be internationally competitive have also been planned.

### **Govind S. Krishnaswami**

- Served on selection committee for CSIR Shyama Prasad Mukherjee Fellowships, New Delhi, July 2011.
- Refereed papers for Journal of Physics A (Mathematical and Theoretical) and Pramana.

### **K. Narayan**

- National Organizing Committee, Indian Strings Meeting (ISM 2012), international strings conference, to be held in Dec 2012.

### **Upendra Kulkarni**

- Co-organizer of Advanced Instructional School on Lie Algebras at CMI, July 2011.

### **S.P. Suresh**

- Programme Committee, M4M, the 7th Methods for Modalities workshop, November 2011. Osuna, Spain.
- Programme Committee Chair for ISLA 2012, the 4th Indian School on Logic and Applications, January 2012. Manipal University.
- Programme Committee, CiE 2013, the Computability in Europe conference. July 2013. Milan.

## **Partha Mukhopadhyay**

- Reviewer for CCC 2012, STACS 2012, FSTTCS 2012, ALNEX 2012, Theory of Computing.

## **Prajakta Nimbhorkar**

- Reviewer for Information Processing Letters, Chicago Journal of Theoretical Computer Science, STACS 2012.

## **Sourav Chakraborty**

- In the advisory board of Workshop on Kernelization (WorKer 2011).
- In the program committee of International Conference on Game Theory.
- Operations Research and their Applications (GTORA 2012).
- In the program committee of International Conference on Current Trends in Theory and Practice of Computer Science (SOFSEM 2012).

## **K.G. Arun**

- Active member of IndIGO consortium and LIGO Science collaboration.

## Visitors

- Nicolas Laillet, ENS, France. Gave a talk on “Space-time resonances for the nonlinear Schrodinger equation” (April 2011).
- Oriane Blondel, ENS, France. Gave a talk on “Kinetically constrained spin models” (April 2011).
- Rishiraj Bhattacharyya, ISI Kolkata. Gave a talk on “On the impossibility of instantiating PSS in the standard model” (April 2011).
- Dileep Jatkar, HRI, Allahabad. Gave a talk on “Non-relativistic metrics from back-reacting fermions” (May 2011).
- Jnan Maharana, IOP, Bhubaneswar. Gave a talk on “T-duality for massive states of closed bosonic string” (June 2011).
- R.V. Gurjar, TIFR, Mumbai. Gave a talk on “A generalization of Zariski’s result on cyclic multiple planes” (June 2011).
- Alok Laddha, Penn State University, U.S.A. Gave a talk on “Constraint Algebra in Loop Quantum Gravity” (June 2011).
- Rogers Mathew, IISc, Bangalore. Gave a talk on “Cubicity, Degeneracy and Crossing Number” (June 2011).
- Pallab Basu, University of Kentucky, U.S.A. Gave a talk on “Nonintegrability in String Theory” (July 2011).
- Moncy John, St Thomas College, Kozhencherry. Gave a talk on “Modified de Broglie-Bohm quantum trajectories and some insights into the Born’s probability axiom” (July 2011).
- Anurag Singh, University of Utah, Salt Lake City. Gave a talk on “Local cohomology supported at determinantal ideals” (July 2011).

- Srikanth Iyengar, University of Nebraska, Lincoln. Gave a talk on “Detecting flatness over smooth bases” (July 2011).
- Romie Banerjee, Johns Hopkins University, U.S.A. Gave a talk on “Non-abelian Grothendieck Duality” (July 2011).
- Kinjal Dasbiswas, University of Florida, U.S.A. Gave a talk on “Supersolidity in Helium: Novel Phase or Quantum Metallurgy?” (August 2011).
- J. Samuel, Raman Research Institute, Bangalore. Gave a talk on “The nonlocal Pancharatnam Phase” (August 2011).
- T.E.S. Raghavan, University of Illinois at Chicago, U.S.A. Gave a talk on “Stochastic games with perfect information” (August 2011).
- Ahmed Bouajjani, LIAFA, University of Paris 7, France. Gave a talk on “Deciding Robustness against Total Store Ordering” (August 2011).
- P. Vanchinathan, VIT University, Chennai. Gave a talk on “SAGE-Open source Mathematical Software” (August 2011).
- Vyjayanthi Chari, University of California, U.S.A. Gave a talk on “BGG reciprocity for current algebras” (August 2011).
- Hema Srinivasan, University of Missouri, U.S.A. Gave a talk on “Betti Numbers of Monomial Curves” (August 2011).
- L.C.R. Wijewardhana, University of Cincinnati, U.S.A. Gave a talk on “Black holes and black branes in Einstein-Lovelock gravity” (August 2011).
- Bobby Ezhuthachan, HRI, Allahabad. Gave a talk on “Supersymmetric Chern-Simons-Matter theory and Super Yang-Mills on  $\mathbb{R} \times S^2$ ” (August 2011).
- Sujit Sarkar, Poorna Prajna Institute, Bangalore. Gave a talk on “Perfect Entanglement Transport in Quantum Spin Chain System” (September 2011).
- Saras Bhaskar, Counseling Psychologist & Coach. Gave a talk on “Seeking Counseling help” (September 2011).
- Emre Coskun, TIFR, Mumbai. Gave a talk on “A tour of Ulrich bundles” (September 2011).
- Dinakar Ramakrishnan, California Institute of Technology. Gave a talk on “Galois symbols on the square of an elliptic curve” (September 2011).

- Gautam Bharali, IISc., Bangalore. Gave a set of lectures on “Several complex variables” (September 2011).
- S Krishnaswamy. Gave a talk on “A Different Pilgrimage (Film Screening)” (October 2011).
- Ravi Chandra, Techion, Israel. Gave a talk on “A memory saving algorithm for eigenvalue computations of quantum systems” (October 2011).
- P.S. Thiagarajan, NUS, Singapore. Gave a talk on “Computational Systems Biology: A Tutorial” (October 2011).
- David R M Irving. Gave a talk on “Intercultural Contact and the Comparative Study of Musical Instruments, 1500-1800” (October 2011).
- Katherine Butler Schofield. “Indo-Persian musical synthesis? The tanbur and rudra vina in seventeenth-century Indo-Persian treatises” (October 2011).
- Baskar Balasubramanyam, IISER, Pune. Gave a talk on “Local Galois representations attached to Hilbert modular forms” (October 2011).
- Shiv Sethi, Raman Research Institute, Bangalore. Gave a talk on “Physics Nobel prize 2011: Establishing distance scales in the universe” (October 2011).
- Arshia Sattar. Gave a talk on “Reading Ramayana in the 21st century” (November 2011).
- Partha Ghose, Bose Institute, Kolkata. Gave a talk on “Does Measurement Necessarily Destroy Coherence?” (November 2011).
- Ragunath Tewari, IIT Kharagpur. Gave a talk on “How powerful is logspace unambiguity?” (November 2011).
- Suvrat Raju, HRI, Allahabad. Gave a talk on “Reviewing BCFW etc” and Correlation Functions in AdS<sub>4</sub>/CF T<sub>3</sub>” (November 2011).
- T.N. Rengarajan, TIFR, Mumbai. Gave a talk on “A Vehicle for Space Research at Modest Cost” (November 2011).
- Parongama Sen, Kolkata University. Gave a talk on “Kinetic exchange models of wealth distribution: microscopic dynamics” (December 2011).
- Sarvesh Kumar, High Current Injector Division, Beam Transport Lab, Inter-University Accelerator Centre (IUAC), New Delhi. Gave a talk on “Accelerators and their applications at IUAC” (December 2011).

- Sutanu Roy, Mathematisches Institut, Universitaet Goettingen. Gave a talk on “Category of locally compact quantum groups” (December 2011).
- Pierre Cartier, Institut des Hautes Etudes Scientifiques, France. Gave a talk on “Multiple zeta functions” (December 2011).
- T.R. Ramadas, ICTP, Italy. Gave a talk on “Chiral field theories (vertex algebras) and function theory” (January 2012).
- Oscar Garcia Prada, ICMAT, Madrid, Spain. Gave a talk on “Milnor-Wood inequalities and rigidity” (January 2012).
- Pascal Weil, LaBRI, CNRS and Univ of Bordeaux, Talence, France. Gave two talks on “The applications of Green’s relations in the Algebraic Theory of Automata” (January 2012).
- Preyas Popat, New York University, U.S.A. Gave a talk on “Hardness of approximation and Unique games conjecture” and “On the hardness of pricing Loss Leaders” (January 2012).
- Mahan Mj, Ramakrishna-Vivekananda University, Kolkata. Gave a talk on “What is hyperbolic geometry?” (January 2012).
- Y. Bilu, University of Bordeaux 1, France Gave a talk on “Counting rational points on varieties, and applications” (January 2012).
- Amaldev Manuel. Gave two talks on “Automata and Logics for Data Languages” (January 2012).
- Jonathan Weitsman, Northeastern University, U.S.A. Gave a talk on “The geometry of the intersection ring of the moduli space of flat connections and the conjectures of Newstead and Witten” and “The topology of Hamiltonian Loop Group spaces” (January 2012).
- Aiswarya Cyriac, LSV, ENS Cachan, France. Gave a talk on “Temporal Logics for Concurrent Recursive Programs: Satisfiability and Model Checking” (January 2012).
- Laurent Lafforgue, IHES, Paris. Gave a talk on “Introduction to the Langlands’ programme as related to arithmetic algebraic geometry” (January 2012).
- Laurent Lafforgue, IHES, Paris. Gave a talk on “Introduction to Langlands’ functoriality principle” (January 2012).



- Mohan Kumar, Washington University, St Louis. Gave a series of lectures on “Small rank vector bundles on projective spaces” (January 2012).
- Xavier Viennot, LaBRI, Universite Bordeaux. Gave a talk on “Quadratic algebras, combinatorial physics and planar automata” (February 2012).
- Loic Helouet, IRISA, Rennes. Gave a talk on “Compatibility of Data-Centric Web Services” (February 2012).
- Sarang Aravamuthan, Tata Consultancy Services. Gave a talk on “e-Valuate: A Two-player Game on Arithmetic Expressions” (February 2012).
- Francisco Presas Mata, ICMAT, Madrid, Spain. Gave a talk on “Almost contact 5-folds are contact” (February 2012).
- Ahmed Bouajjaini, LIAFA, Univ. of Paris 7, France. Gave a talk on “Analysis of Recursively Parallel Programs” (February 2012).
- Nabamita Banerjee, Utrecht, the Netherlands. Gave a talk on “The off-shell 4D/5D connection” (February 2012).
- J. Samuel, Raman Research Institute, Bangalore. Gave a talk on “Atom Interferometry and Gravitational Redshift” (February 2012).
- Tanmoy Chakraborty, Harvard University. Gave a talk on “Introduction to Mechanism Design” and “Pricing vs Auctions ” (March 2012).
- Anshuman Maharana, Cambridge, U.K. Gave a talk on “Symmetry Breaking in Local Model Building” (March 2012).
- Amitabh Trehan, Industrial Engineering at Technion, Haifa, Israel. Gave a talk on “Self healing distributed networks and data structures: Forgiving Graph and Xheal” (March 2012).
- Sylvia Wiegand, University of Nebraska. Gave a talk on “Prime ideals in Noetherian rings” (March 2012).
- Christophe Mourougane, University of Rennes, France. Gave a talk on “Sections of families of hypersurfaces of large degree” (March 2012).



**N.K. Rajendiran & Co.,**  
Chartered Accountants

FORM NO. 10-B  
(See Rule 17 - B)

**AUDITOR'S REPORT**

Audit report u/s 12A (b) of the Income Tax Act 1961, in case of charitable or religious Trust or institutions

We have examined the Balance sheet of **CHENNAI MATHEMATICAL INSTITUTE**, Plot No. H1, SIPCOT IT Park, Siruseri 603 103 as at 31<sup>st</sup> March 2012 and also the Income & Expenditure Account for the year ended on that date which are in agreement with the books of accounts maintained by the said Institution.

We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our audit. In our opinion, proper books of account, have been kept by the Head Office and the Branches of the above named institution visited by us so far as appears from our examination of the books, and proper returns adequate for the purposes of Audit have been received from Branches not visited by us.

In our opinion and to the best of our information and according to the information given to us the said accounts give a true and fair view.

- i) in case of Balance Sheet, of State of affairs of the above named Institution as at 31<sup>st</sup> March 2012, and
- ii) In case of Income & Expenditure Account, Excess of Income over Expenditure for the year end on that date.

Prescribed particulars are annexed hereto.

**FOR N.K.RAJENDIRAN & CO.**  
Chartered Accountants.

Place: Chennai  
Date: 27/08/2012

*N.K. Rajendiran*  
**N.K.RAJENDIRAN**  
(PROPRIETOR)



No. 135 (Old No.147), Flat No. 3B, 3rd Floor, Nelson Manickam Road, Aminjikarai, Chennai - 600 029.  
Tel : 2374 1212, Fax : 2374 0303 E-mail : [auditornkr@yahoo.com](mailto:auditornkr@yahoo.com)

**CHENNAI MATHEMATICAL INSTITUTE**  
**PLOT NO. H1, SIPCOT IT PARK, SIRUSERI, 603 103.**

**BALANCE SHEET AS AT 31ST MARCH 2012**

<b><u>SOURCES OF FUNDS</u></b>	<b>SCH</b>	<b>31.03.2012 Rs.</b>	<b>31.03.2011 Rs.</b>
General Fund	A	33,316,865	20,361,086
Capital Fund	B	59,905,510	59,905,510
Endowment Fund	C	104,020,931	102,520,931
Other Grants	D	6,105,368	1,958,946
Loan Fund			
Unsecured Loan	.	10,000,000	.
<b>TOTAL</b>		<b>213,348,674</b>	<b>184,746,473</b>
<b><u>APPLICATION OF FUNDS</u></b>			
Fixed Assets	E	154,567,907	126,584,306
<b><u>Deposits</u></b>	F		
Endowment Fund		14,094,069	13,575,390
Other Deposits		40,946,284	35,810,018
<b><u>Current Assets, Advances &amp; Deposits</u></b>			
Current Assets	G	6,337,059	20,354,443
Advances and Deposits	H	7,767,932	4,118,781
<b>Total</b>		<b>14,104,991</b>	<b>24,473,224</b>
Less: Current Liabilities	I	10,364,577	15,696,465
Net Current Assets		3,740,414	8,776,759
<b>TOTAL</b>		<b>213,348,674</b>	<b>184,746,473</b>
Note on Accounts	J		

*[Signature]*  
**Dr. A.C. Muthiah**  
 Founder Trustee

*[Signature]*  
**Prof. C.S. Seshadri**  
 Trustee / Director-Emeritus

*[Signature]*  
**Prof. Rajeeva L. Karandikar**  
 Trustee / Director



Place : Chennai  
 Date : 27/8/2012

As per our report of even date annexed  
 For M/s. N.K. Rajendiran & Co.,  
 Chartered Accountants


*[Signature]*  
**N.K. Rajendiran**  
 Proprietor



**CHENNAI MATHEMATICAL INSTITUTE**  
**PLOT NO. H1, SIPCOT IT PARK, SIRUSERI, 603 103.**

**INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2012**

<u>INCOME</u>	SCH	31.03.2012 Rs.	31.03.2011 Rs.
Grant in Aid	K	85,000,000	81,000,000
Professional & Technical Fees	L	6,500,000	5,000,000
Fee Receipts	M	2,673,250	1,951,595
Interest on Deposits	N	4,517,262	2,894,392
Fellowship Contributions & Other Receipts	O	3,246,443	521,436
<b>TOTAL</b>		<b>101,936,955</b>	<b>91,367,423</b>
 <u>EXPENDITURE</u>			
Research & Establishment	P	69,163,704	56,260,382
Operational Expenses	Q	8,023,603	9,673,074
Administrative & General Expenses	R	4,753,709	4,198,726
Depreciation	E	7,040,160	6,328,251
<b>TOTAL</b>		<b>88,981,176</b>	<b>76,460,433</b>
<b>Excess of Income Over Expenditure transferred to Balance Sheet</b>		<b>12,955,779</b>	<b>14,906,990</b>

  
**Dr. A.C. Muthiah**  
 Founder Trustee

  
**Prof. C.S. Seshadri**  
 Trustee / Director-Emeritus

  
**Prof. Rajeeva L. Karandikar**  
 Trustee / Director



As per our report of even date annexed  
**For M/s. N.K. Rajendiran & Co.,**  
 Chartered Accountants

  
**N.K. Rajendiran**  
 Proprietor



Place: Chennai  
 Date: 27/5/2012