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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 Superieure 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

1. **Dr. A.C. Muthiah**
   Chairman
   SPIC Ltd., Chennai

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   Matrix Laboratories, Hyderabad

3. **Prof. C.S. Seshadri, F.R.S.**
   Director -Emeritus
   Chennai Mathematical Institute, Chennai

4. **Dr. M.R. Srinivasan**
   “Sunningdale”, Kothagiri Road
   Uthagamandalam 643 002

5. **Shri R. Thyagarajan**
   Chairman
   Shriram Group Companies, Chennai

6. **Shri Jawahar Vadivelu**
   Chairman
   Navia Markets Ltd., Chennai

7. **Shri S. Ramadorai**
   Vice Chairman
   Tata Consultancy Services Limited, Mumbai

8. **Dr. Anil Kakodkar**
   Trustee DAE Homi Bhabha Chair Professor,
   Bhabha Atomic Research Centre, Mumbai
Governing Council

1. **Shri A.C. Muthiah** - Chairman
   Chairman, SPIC Ltd., Chennai

2. **Shri R. Thyagarajan** - Member
   Chairman, Shriram Group Companies, Chennai

3. **Shri Jawahar Vadivelu** - Member
   Chairman, Navia Markets Ltd., Chennai

4. **Prof. R. Balasubramanian** - Member
   Director, Institute of Mathematical Sciences, Chennai

5. **Prof. M.S. Raghunathan, F.R.S.** - Member
   Professor of Eminence, Tata Institute of Fundamental Research, Mumbai

6. **Prof. Rajeeva L. Karandikar** - Member
   Director, Chennai Mathematical Institute, Chennai

7. **Prof. C.S. Seshadri, F.R.S.** - Member
   Director-Emeritus, Chennai Mathematical Institute, Chennai

8. **Prof. P.S. Thiagarajan** - Member
   National University of Singapore, Singapore

9. **Prof. S.R.S. Varadhan, F.R.S.** - Member
    Courant Institute of Mathematical Sciences
    New York University, New York, U.S.A.

10. **Prof. K. Vijayraghavan** - Member
    Director, National Centre for Biological Sciences
    Tata Institute of Fundamental Research, Bangalore

11. **Shri Arun Duggal** - Member
    Chairman, Shriram Capital Ltd., New Delhi

12. **Prof. Amitava Raychaudhuri** - Member
    Director, Harish Chandra Research Institute, Allahabad
Research Advisory Committee

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

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

**Director**  
Rajeeva L. Karandikar

**Director-Emeritus**  
C.S. Seshadri

**Professors**  
Shiva Shankar  
V. Balaji  
Madhavan Mukund  
K. Narayan Kumar  
Pramathanath Sastry  
Samir Datta  
V.V. Sreedhar  
S. Senthamarai Kannan  
K.V. Subrahmanyan

**Associate Professors**  
Clare D’Cruz  
Govind S. Krishnaswami  
K. Narayan  
Purusottam Rath  
R. Srinivasan  
M. Sundari  
S.P. Suresh  
Suresh Nayak  
Upendra Kulkarni  
M.K. Vemuri

**Assistant Professors**  
K.G. Arun  
Dishant M. Pancholi  
Krishna Hanumanthu  
Manoj Kummini  
Partha Mukhopadhyay  
Prajakta Nimbhorkar
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. Ramamoorthy
Rani Siromoney
B.V. Rao
H.K. Sahu
Shreekumar Varma
R. Sridharan
Sudarshan Ananth
A. Thyagaraja
V. Vinay
Visiting Scientist  
P. Vanchinathan - Until June 2011

Visiting Fellows  
Micah Leamer  
Archana Subhash Morye  
Sarbeswar Pal  
K. Srilata  
Yashonidhi Pandey  
Preena Samuel

Research Scholars  
Abhishek Bhrushundi  
Aneesh Chandrasekhar  
Debangshu Mukherjee  
Prakash Saivasan  
Mitra Koley  
Nagarajan Krishnamurthy  
Nitesh Jha  
Prateek Karandikar  
Rohith Varma  
Rameshwar Pratap Yadav  
Shraddha Srivastava  
Subramani Muthukrishnan  
Varunkumar Jayagopal  
Abhishek Hemantkumar Dang  
Apurv Nakade  
Gopakumar  
Parul Jain  
Nana Siddharth  
Nikhil Balaji  
Pranabendu Misra  
Rahul Singh  
Ramprasad Saptharishi  
Sayan Chakraborty  
T.R. Shyam Sundar  
Suryajith Chillara  
Vinay Kumaraswamy

NBHM Research Scholars  
Santosha Kumar Pattanayak  
Pabitra Barik

CSIR Research Scholars  
B. Narasimha Chary  
Suratno Basu

Administrative Staff  
S. Sripathy  
V. Vijayalakshmi  
Rajeshwari Nair  
Ranjini Girish  
G. Samson
Rajeeva Karandikar

Rajeeva Karandikar received his B.Sc. from Indore University, Indore (1976), M.Stat. form 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**


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


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


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


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


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

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**


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).


His research interest is: commutative algebra.

**Partha Mukhopadhyay**


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

His research interests are: Complexity Theory and Additive Combinatorics.

**Prajakta Nimbhorkar**


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**


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

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

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-Weitzenbock 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 betweeen 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 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 monotocity, 
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 (a) and the other a dipole term in the phase (ß). This two parameter representation is used to discuss typical bounds on their values using GW measurements. The expected bounds on the amplitude parameter a and the phase parameter ß 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 a to an accuracy of ~ 10^{-2} and ~ 10^{-3} and ß to an accuracy of ~ 10^{-5} and ~ 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 AdS5xS5, 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 reflection 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

Journal Articles

Mathematics


**Computer Science**


**Physics**


**Conference Papers**

**Mathematics**

Computer Science


**Physics**


**Preprints**

**Mathematics**

P1. Clare D'Cruz: Homology, mixed multiplicities and fiber cones.

P2. Clare D'Cruz and Marc Chardin: Cuves in P n of analytic spread n.


P4. Shrihari Sridharan: Smoothness of conjugacies in dynamical systems.


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.


**Computer Science**


P12. A Baskar, Prasad Naldurg, K R Raghavendra, and S P Suresh. Primal modal logic: applications to cryptography and access control.


**Physics**


**Book**

**Mathematics**


**Computer Science**


**Ph.d. Thesis**


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

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.

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neeraj Bapat</td>
<td>Masters student, Ecole Polytechnique, France.</td>
</tr>
<tr>
<td>Sirshendu Dam</td>
<td></td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Name</th>
<th>Position and University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sagnik De</td>
<td>Graduate student in Physics, University of Mississippi, U.S.A.</td>
</tr>
<tr>
<td>Sukanya Ghosh</td>
<td>Masters student in Mathematics of Cryptography and Communications, Royal Holloway College, University of London, U.K.</td>
</tr>
<tr>
<td>Pavithran Iyer</td>
<td>Graduate Student in Physics, University of Sherbrooke, Canada.</td>
</tr>
<tr>
<td>Debangshu Mukherjee</td>
<td>PhD student in Physics, CMI.</td>
</tr>
<tr>
<td>Shreyas Patankar</td>
<td>Graduate Student in Physics, University of California at Berkeley, U.S.A.</td>
</tr>
</tbody>
</table>
**M.Sc. Mathematics**

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aneesh Karthik</td>
<td>PhD student in Mathematics, CMI</td>
</tr>
<tr>
<td>Mizanur Rahaman</td>
<td></td>
</tr>
<tr>
<td>S. Padmavathi</td>
<td>PhD student in Mathematics, MIT, U.S.A.</td>
</tr>
<tr>
<td>Ramen Ghosh</td>
<td></td>
</tr>
<tr>
<td>Vinay Kumaraswamy</td>
<td>PhD student in Mathematics, CMI</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arpith Siromoney</td>
<td></td>
</tr>
<tr>
<td>Gautam Prakriya</td>
<td>PhD student in Computer Science, University of Wisconsin at Madison, U.S.A.</td>
</tr>
<tr>
<td>Jose Mathew</td>
<td>Efficient Frontier Systems, Chennai.</td>
</tr>
<tr>
<td>Prateek Karandikar</td>
<td>PhD student in Computer Science, CMI.</td>
</tr>
<tr>
<td>Rohit Babbar</td>
<td>PhD student in Computer Science, Grenoble, France.</td>
</tr>
<tr>
<td>Shambwaditya Saha</td>
<td>PhD student in Computer Science, Institute of Mathematical Sciences, Chennai.</td>
</tr>
<tr>
<td>T R Shyam Sundar</td>
<td>Clay Labs, Chennai.</td>
</tr>
<tr>
<td>Vikash Agarwal</td>
<td>Aricent Technologies, Gurgaon.</td>
</tr>
<tr>
<td>Megha Bhandari</td>
<td>Tata Consultancy Services, Mumbai.</td>
</tr>
<tr>
<td>Hina Bhatia</td>
<td>Steria, Noida.</td>
</tr>
<tr>
<td>LI Amala Fernando</td>
<td>Cognizant Technology Service, Chennai.</td>
</tr>
<tr>
<td>Shwetha Kini</td>
<td>Cognizant Technology Service, Chennai.</td>
</tr>
<tr>
<td>Rohit Kumar</td>
<td>Tata Consultancy Services - SMB, Mumbai.</td>
</tr>
<tr>
<td>Stephen Lee</td>
<td>Tata Research Development and Design Centre, Pune.</td>
</tr>
<tr>
<td>Name</td>
<td>Company/Institution</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>Srikanta Maharana</td>
<td>Bally Technologies Pvt India Ltd, Chennai.</td>
</tr>
<tr>
<td>Alok Ranjan</td>
<td>Tata Consultancy Service - USAA, Chennai.</td>
</tr>
<tr>
<td>Prabhat Sahoo</td>
<td>Bally Technologies Pvt India Ltd, Chennai.</td>
</tr>
<tr>
<td>Monika Sharma</td>
<td>Ericsson, Kolkata.</td>
</tr>
<tr>
<td>V. Madhuri</td>
<td>Accenture, Delhi.</td>
</tr>
<tr>
<td>Swarna Srinivasan</td>
<td>Tata Consultancy Services, Chennai.</td>
</tr>
<tr>
<td>S Aiswarya</td>
<td>Cognizant Technology Service, Chennai.</td>
</tr>
</tbody>
</table>

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


- Shaastra at IIT-Madras - August 2011

<table>
<thead>
<tr>
<th>Event</th>
<th>Participant</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Math Champ Set 1</td>
<td>Ronno Das</td>
<td>1st</td>
</tr>
<tr>
<td>Online Math Champ Set 2</td>
<td>Ronno Das</td>
<td>2nd</td>
</tr>
<tr>
<td>Online Math Champ Set 3</td>
<td>Ronno Das</td>
<td>2nd</td>
</tr>
</tbody>
</table>

- Shaastra Cube Open 2011 at IIT Madras - October 2011

<table>
<thead>
<tr>
<th>Participant</th>
<th>Event</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nikhil Mande</td>
<td>Rubik’s Cube(3x3)</td>
<td>3rd</td>
</tr>
<tr>
<td></td>
<td>3x3 Blindfolded</td>
<td>2nd</td>
</tr>
<tr>
<td></td>
<td>3x3 Fewest Moves</td>
<td>1st (with National Record)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Participant</th>
<th>Event</th>
<th>Place</th>
</tr>
</thead>
</table>
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.


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 Debangushu Mukherjee visited the ENS.
## Undergraduate / Graduate Courses

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

- 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

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. Subrahmanym (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.
- 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**


**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.

Unity Lectures:
P1. S. Ramanan, CMI - Three talks on classical Invariant theory.
P2. C.S. Seshadri, CMI - GIT construction of moduli of abelian varieties.

IV CMI-IMSc Mathematics Colloquium 2012 - January 2012


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)cry\vs.

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

Rajeeva L. Karandikar

- Invited speaker at India Finance Conference, IIM Bangalore.

- Visited ITAM (Instituto Technologico Autonomo de Mexico) 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 Mahabhareshwar during January 2012 and talked on “Group velocity of neutrino waves”.
- Participated in NuHoRlzon (Conference on Neutrinos) at HRI, Allahabad during February 2012 and talked on “Group velocity of neutrino waves”.
- 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, Chennai 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


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”.


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.


**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 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

Attended 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


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


- 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 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 “E0- 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.

M.K. Vemuri

- 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 Indo-Japan Cooperative Science program (IJCSP) meeting at IISER Thiruvananthapuram in December 2011.
- Attended one week long IndIGO workshop 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**
- 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 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.


- Visited Tata Research Development and Design Centre, Pune in February 2012.

### Rameshwar Pratap Yadav

- Attended Workshop on Pseudorandomness at CMI, in August 2011.


- Attended TAMC-2012, at Beijing, China, in May 2012.
Ramprasad Saptharishi

- 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

Rajeeva L. Karandikar
- Coординator 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


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.
Partha Mukhopadhyay

Prajakta Nimbhorkar

Sourav Chakraborty
- In the advisory board of Workshop on Kernalization (WorKer 2011).
- In the program committee of International Conference on Game Theory.
- 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).
- Dileep Jatkar, HRI, Allahabad. Gave a talk on “Non-relativistic metrics from back-reacting fermions” (May 2011).
- Jnan Maharana, IOP, Bhubaneshwar. 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).


Sujit Sarkar, Poorna Prajna Institute, Bengalore. 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).


David R M Irving. Gave a talk on “Intercultural Contact and the Comparative Study of Musical Instruments, 1500-1800” (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).


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 AdS4/CF T3” (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).

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 Aravamathan, 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).


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).
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 31st 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 31st 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
(PROPRIETOR)
CHENNAI MATHEMATICAL INSTITUTE  
PLOT NO. H1, SIPCOT IT PARK, SIRUSERI, 603 103.  

BALANCE SHEET AS AT 31ST MARCH 2012  

<table>
<thead>
<tr>
<th>SOURCES OF FUNDS</th>
<th>SCH</th>
<th>31.03.2012 Rs.</th>
<th>31.03.2011 Rs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Fund</td>
<td>A</td>
<td>33,316,885</td>
<td>20,361,086</td>
</tr>
<tr>
<td>Capital Fund</td>
<td>B</td>
<td>59,905,510</td>
<td>59,905,510</td>
</tr>
<tr>
<td>Endowment Fund</td>
<td>C</td>
<td>104,020,931</td>
<td>102,520,931</td>
</tr>
<tr>
<td>Other Grants</td>
<td>D</td>
<td>6,105,368</td>
<td>1,958,946</td>
</tr>
<tr>
<td>Loan Fund</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsecured Loan</td>
<td></td>
<td>10,000,000</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>213,348,674</td>
<td>184,746,473</td>
</tr>
</tbody>
</table>

APPLICATION OF FUNDS  

| Fixed Assets               | E   | 154,567,907   | 126,584,306   |
| Deposits                   | F   |               |               |
| Endowment Fund             |     | 14,094,069    | 13,575,390    |
| Other Deposits             |     | 40,946,284    | 35,810,018    |

Current Assets, Advances & Deposits  

| Current Assets             | G   | 8,337,059     | 20,354,443    |
| Advances and Deposits      | H   | 7,767,932     | 4,118,781     |
| **Total**                  | I   | 14,104,991    | 24,473,224    |

Less: Current Liabilities   |     | 10,364,577    | 15,696,465    |

Net Current Assets          |     | 3,740,414     | 8,776,759     |

**TOTAL**                   |     | 213,348,674   | 184,746,473   |

Note on Accounts  

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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  

Place: Chennai  
Date: 21st Jan 2013  

N.K. Rajendiran  
Proprietor
## Income & Expenditure Account for the Year Ended 31st March 2012

<table>
<thead>
<tr>
<th>Income</th>
<th>SCH</th>
<th>31.03.2012</th>
<th>31.03.2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant in Aid</td>
<td>K</td>
<td>85,000,000</td>
<td>81,000,000</td>
</tr>
<tr>
<td>Professional &amp; Technical Fees</td>
<td>L</td>
<td>6,500,000</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Fee Receipts</td>
<td>M</td>
<td>2,673,250</td>
<td>1,951,595</td>
</tr>
<tr>
<td>Interest on Deposits</td>
<td>N</td>
<td>4,517,262</td>
<td>2,894,392</td>
</tr>
<tr>
<td>Fellowship Contributions &amp; Other Receipts</td>
<td>O</td>
<td>3,246,443</td>
<td>521,436</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>101,936,955</strong></td>
<td><strong>91,367,423</strong></td>
</tr>
</tbody>
</table>

## Expenditure

<table>
<thead>
<tr>
<th>Expenditure</th>
<th>SCH</th>
<th>31.03.2012</th>
<th>31.03.2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research &amp; Establishment</td>
<td>P</td>
<td>69,163,704</td>
<td>56,260,382</td>
</tr>
<tr>
<td>Operational Expenses</td>
<td>Q</td>
<td>8,023,603</td>
<td>9,673,074</td>
</tr>
<tr>
<td>Administrative &amp; General Expenses</td>
<td>R</td>
<td>4,753,709</td>
<td>4,198,726</td>
</tr>
<tr>
<td>Depreciation</td>
<td>E</td>
<td>7,040,160</td>
<td>6,328,251</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>88,981,176</strong></td>
<td><strong>76,460,433</strong></td>
</tr>
</tbody>
</table>

Excess of Income Over Expenditure transferred to Balance Sheet

<table>
<thead>
<tr>
<th>Excess of Income Over Expenditure transferred to Balance Sheet</th>
<th>31.03.2012</th>
<th>31.03.2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12,955,779</td>
<td>14,906,990</td>
</tr>
</tbody>
</table>

**Signatures**

Dr. A.C. Muthiah  
Founder Trustee

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

Prof. Rajeeva L. Karandikar  
Trustee / Director

**Note**

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

Place: Chennai  
Date: 2-3-2012

N.K. Rajendiram  
Proprietor