ANNUAL REPORT

Apr 2014 - Mar 2015
Foreword

The Institute of Mathematical Sciences, Chennai has completed 53 years and I am pleased to present the annual report for 2014-2015 and note the strength of the institute and the distinctive achievements of its members.

Our PhD students strength is around 140, and our post-doctoral student strength is presently 45.

We are very pleased to note that an increasing number of students in the country are benefiting from our outreach programmes (for instance, Enriching Collegiate Education 2015, One Percent 2014), and we are proud of the efforts of our faculty, both at an individual and at institutional level in this regard.

IMSc has started a monograph series this year. We plan to publish at least one book every year.

Academic productivity of the members of Institute has remained high. There were several significant publications reported in national and international journals and our faculty have authored a few books as well. Six students were awarded Ph.D., five students have submitted their Ph.D. theses. One student was awarded M.Phil., degree. Five students were awarded M.Sc. by Research, and a student has submitted master’s thesis under the supervision of our faculty.

16 conferences and workshops were organized at IMSc during 2014-2015. These include Mock Modular Forms and Physics, Aspects of Mathematics, Dynamics Days Asia Pacific 08, Fracture: From Micro-Scale Processes to Macro-Scale Response, Sage Days workshop on combinatorics and representation theory, 18th workshop on elliptic curve cryptology, Master Class in Modular Theory of von Neumann algebras, Indo-UK Workshop on Computational Complexity Theory, Second Conference on Creative Mathematical Sciences Communication, to name but a few. There were 51 lectures/lecture series conducted at the Institute during the reporting period. In addition, 3 lecture courses were given at Chennai Mathematical Institute for their National Undergraduate Programme. The list of off-site conferences organized by IMSc faculty also continues to be impressive. This academic year 12 conferences were organized outside including, Annual Foundational School–II, AIS on Schemes and Cohomology, OTOA 2014, FSTTCS, Workshop on New Developments in Exact Algorithms and Lower Bounds.

We are proud to note the awards and honors bestowed on our faculty at the individual level. Prof. Partha Sarathi Chakraborty was awarded SwarnaJayanti Fellowship and NASI-SCOPUS Young Scientist Award-2014; Dr. Areejit Samal was awarded Ramanujan Fellowship of the Department of Science and Technology (DST), India, a Max Planck DST Mobility Grant for the period 2015-2018, and a Simons Associateship of the Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy for the period 2015-2020. Dr. C.M. Chandrashekar was awarded Ramanujan Fellowship for the year 2015.

This report was compiled through the efforts of the IMSc Annual Report Committee comprising of Drs. C. R. Subramanian, Shrihari Gopalakrishna, Pralay Chatterjee, Paul Pandian and Usha Devi. I owe my gratitude to all of them.

July, 2015

V. Arvind
# Contents

1 The Institute  

1.1 Governing Board ............................................ 1  
1.2 Executive Council ........................................... 3  
1.3 Faculty ..................................................... 4  
1.4 Other Senior Academic Members .............................. 6  
1.5 Scientific Staff ............................................... 6  
1.6 Project Consultant ........................................... 7  
1.7 Project Engineer ............................................. 7  
1.8 Project Staff ................................................ 7  
1.9 Post-Doctoral Fellows ........................................ 8  
1.10 Ph.D. Students .............................................. 10  
1.11 Administrative Staff ....................................... 16  
1.12 Administrative Trainees .................................... 16

2 Research and Teaching  

2.1 Computational Biology ....................................... 17  
2.1.1 Research Summary .......................................... 17  
2.1.2 List of Publications ....................................... 18  
2.2 Mathematics .................................................. 19  
2.2.1 Research Summary .......................................... 19  
2.2.2 List of Publications ....................................... 24  
2.3 Physics ........................................................ 32  
2.3.1 Research Summary .......................................... 32  
2.3.2 List of Publications ....................................... 45
2.4 Theoretical Computer Science ........................................ 55
  2.4.1 Research Summary ............................................. 55
  2.4.2 List of Publications ............................................ 62

2.5 Student Programmes .............................................. 68
  2.5.1 Degrees Awarded ................................................ 68
  2.5.2 Lecture Courses During 2014 – 2015. ......................... 70
  2.5.3 Summer Students ............................................... 72
  2.5.4 Other Students ................................................ 74

2.6 Honours and Awards .............................................. 75

3 Other Professional Activities ........................................ 77

4 Colloquia ................................................................. 87
  4.1 Conferences/Workshops Held at IMSc ......................... 87
    4.1.1 Mock Modular Forms and Physics .......................... 87
    4.1.2 Aspects of Mathematics, a two-day mathematics programme .... 88
    4.1.3 Dynamics Days Asia Pacific 08 ............................ 88
    4.1.4 Sage Days workshop on combinatorics and representation theory ... 88
    4.1.5 IMSc-IITB-IISERP Research Meeting on Physiological Modeling ... 88
    4.1.6 18th workshop on elliptic curve cryptology .................. 88
    4.1.7 Enriching Mathematics Education ............................ 89
    4.1.8 Master Class in Modular Theory of von Neumann algebras ...... 89
    4.1.9 Research in Mathematics .................................... 89
    4.1.10 One Percent .................................................. 90
    4.1.11 Second Conference on Creative Mathematical Sciences Communication 90
    4.1.12 Indo-UK Workshop on Computational Complexity Theory .... 90
    4.1.13 Fracture: From Micro-scale Processes to Macro Scale Response .... 91
    4.1.14 Instructional Seminar on Logical Aspects of Multi-Agent Systems ... 91
    4.1.15 Enriching Collegiate Education ................................ 91
    4.1.16 IMSc School in Theoretical Physics (ISTP) 2-14 June 2014 .... 92
  4.2 Other Conferences/Workshops Organized by IMSc .............. 93
    4.2.1 Annual Foundational School-II ............................... 93
4.2.2 Mathematics Workshop for Students (MWS) 2014 .......................... 93
4.2.3 INSA Award Function (IIT, Chennai) 4 August 2014 .................... 93
4.2.4 Annual meeting of the Indian Academy of Science ....................... 93
4.2.5 AIS on Schemes and Cohomology ........................................... 93
4.2.6 OTOA 2014 ............................................................................. 93
4.2.7 Winter School on modular functions in one and several variables . 93
4.2.8 Indian Strings Meeting ............................................................. 94
4.2.9 Indian Science Congress 2015, University of Mumbai, 3-7 January 2015, Symposium on HEP ......................................................... 94
4.2.10 Asian Logic conference ............................................................ 94
4.2.11 Social Networking Workshop, 7th International Conference on COM- munication Systems and NETworkS (COMSNETS) .............................. 94
4.2.12 Workshop on Design and Analysis of Algorithms ...................... 95

4.3 Seminars ...................................................................................... 96

5 External Interactions ...................................................................... 117

5.1 Collaborative Projects with Other Institutions .............................. 117
5.1.1 Algorithms and Complexity of Algebraic problems ..................... 117
5.1.2 Arithmetic circuits computing polynomials .................................. 117
5.1.3 Computational methods for identifying and analyzing design features of metabolic networks ....................................................... 117
5.1.4 Correctness by Construction (CORCON) .................................... 118
5.1.5 India-based Neutrino Observatory (INO) .................................... 118
5.1.6 India-EU program on Mathematics for Health and Disease ......... 118
5.1.7 Indo-German research grant funded by the Humboldt Foundation ... 119
5.1.8 ITRA-Media Lab Asia Project on De-congesting India’s transportation networks using mobile devices ................................. 119
5.1.9 Mechanism of Active Intracellular Transport: Connecting Theory and Experiment ................................................................. 119
5.1.10 Quantitative analysis of Mitochondrial positioning in C. elegans axons 119

5.2 Institute Associateships ................................................................. 120

5.3 Conference Participation and Visits to Other Institutions ................ 121
5.4 Visitors from Other Institutions ........................................... 144

6 Infrastructure ................................................................. 159

6.1 Computer Facilities ....................................................... 159

6.2 The Library ................................................................. 161
Chapter 1

The Institute

1.1 Governing Board

Thiru. P. Palaniappan, Hon’ble Minister for Higher Education, Government of Tamil Nadu, Fort St. George, Chennai 600 009
(Chairman)

Dr. R.K. Sinha, Chairman, AEC & Secretary to Government of India, Department of Atomic Energy, CSM Marg, Mumbai 400 001
(Vice-Chairman)

Prof. S. K. Joshi, Honorary Scientist Emeritus CSIR, Vikram Sarabhai Professor, National Physical Laboratory, Dr. K. S. Krishnan Road, New Delhi 110 012
(Member)

Prof. Mustansir Barma, Distinguished Professor, Tata Institute of Fundamental Research, Mumbai 400 005
(Member)

Prof. C. S. Seshadri, Director-Emeritus, Chennai Mathematical Institute, Plot Nos. D19 & D20, SIPCOT Information Technology Park, Padur Post, Siruseri-603 103
(Member)

Prof. Amitava Raychaudhuri, Sir Tarak Nath Palit Professor of Physics, University of Calcutta, 92 Acharya Profulla Chandra Road, Kolkata - 700 009
(Member)

Prof. R. Thandavan, Vice Chancellor, University of Madras, Chennai 600 005
(Member)

Prof. Sudhanshu Jha, 402 Vignanshila, Juhu-Version Link Road, Seven Bungalow, Andheri(W), Mumbai 400 061
(Member)
Shri **Pradeep R. Baviskar**, IAS, Joint Secretary (R&D), Department of Atomic Energy, CSM Marg, Mumbai 400 001
(Member up to 64th Board Meeting)

Shri **Pranay Verma**, IFS, Joint Secretary (R&D) to Government of India, Department of Atomic Energy, CSM Marg, Mumbai 400 001
(Member Forthcoming Meeting)

Shri **R.A. Rajeev**, IAS, Joint Secretary (Finance) to Government of India, Department of Atomic Energy, CSM Marg, Mumbai 400 001
(Member)

Shri **Hemant Kumar Sinha**, IAS, Principal Secretary to Government, Secretariat, Higher Education Department, Govt of Tamil Nadu, Fort St. George, Chennai - 600 009
(Member up to 64th Board Meeting)

Selvi **Apoorva**, IAS, Secretary to Government, Secretariat, Higher Education Department, Govt of Tamil Nadu, Fort St. George, Chennai - 600 009
(Member Forthcoming Meetings)

Prof. **R. Balasubramanian**, Director, The Institute of Mathematical Sciences, CIT Campus, Taramani, Chennai - 600 113
(Member Secretary up to 22/12/14)

Prof. **V. Arvind**, Director-in-Charge, The Institute of Mathematical Sciences, CIT Campus, Taramani, Chennai - 600 113
(Member Secretary with effect from 22/12/14)
1.2 Executive Council

Prof. S. K. Joshi, Honorary Scientist Emeritus CSIR, Vikram Sarabhai Professor, National Physical Laboratory, Dr. K. S. Krishnan Road, New Delhi 110 012
(Chairman)

Prof. Mustansir Barma, Distinguished Professor, Tata Institute of Fundamental Research, Mumbai 400 005
(Member)

Prof. C. S. Seshadri, Director-Emeritus, Chennai Mathematical Institute, Plot Nos. D19 & D20, SIPCOT Information Technology Park, Padur Post, Siruseri - 603 103
(Member)

Prof. Amitava Raychaudhuri, Sir Tarak Nath Palit Professor of Physics, University of Calcutta, 92 Acharya Prafulla Chandra Road, Kolkata - 700 009
(Member)

Shri Pradeep R. Baviskar, IAS, Joint Secretary (R&D) Government of India, Department of Atomic Energy, CSM Marg, Mumbai 400 001
(Member upto 49th EC Meeting)

Shri Pranay Verma, IFS, Joint Secretary (R&D) to Government of India, Department of Atomic Energy, CSM Marg, Mumbai 400 001
(Member Forthcoming Meeting)

Shri R.A. Rajeev, IAS, Joint Secretary (Finance) to Government of India, Department of Atomic Energy, CSM Marg, Mumbai 400 001
(Member with effect from 50th EC Meeting)

Shri Hemant Kumar Sinha, IAS, Principal Secretary to Government, Secretariat, Higher Education Department, Govt of Tamil Nadu, Fort St. George, Chennai - 600 009
(Member upto 49th EC Meeting)

Selvi Apoorva, IAS, Secretary to Government, Secretariat, Higher Education Department, Govt of Tamil Nadu, Fort St. George, Chennai - 600 009
(Member Forthcoming Meetings)

Prof. R. Balasubramanian, Director, The Institute of Mathematical Sciences, CIT Campus, Taramani, Chennai - 600 113
(Member Secretary upto 22/12/14)

Prof. V. Arvind, Director-in-Charge, The Institute of Mathematical Sciences, CIT Campus, Taramani, Chennai - 600 113
(Member Secretary with effect from 22/12/14)
### 1.3 Faculty

<table>
<thead>
<tr>
<th>Name</th>
<th>Userid</th>
<th>Tel. Ext.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computational Biology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Menon, Gautam I.</td>
<td>menon</td>
<td>266</td>
</tr>
<tr>
<td>Samal, Areejit</td>
<td>asamal</td>
<td>219</td>
</tr>
<tr>
<td>Siddharthan, Rahul</td>
<td>rsidd</td>
<td>204</td>
</tr>
<tr>
<td>Sinha, Sitabhra</td>
<td>sitabhra</td>
<td>301</td>
</tr>
<tr>
<td>Vemparala, Satyavani</td>
<td>vani</td>
<td>257</td>
</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balasubramanian, R.</td>
<td>balu</td>
<td>200</td>
</tr>
<tr>
<td>Chakraborty, Partha Sarathi</td>
<td>parthac</td>
<td>252</td>
</tr>
<tr>
<td>Chatterjee, Pralay</td>
<td>pralay</td>
<td>305</td>
</tr>
<tr>
<td>Gun, Sanoli</td>
<td>sanoli</td>
<td>202</td>
</tr>
<tr>
<td>Iyer, Jaya N.</td>
<td>jniyer</td>
<td>306</td>
</tr>
<tr>
<td>Kesavan, S.</td>
<td>kesh</td>
<td>209</td>
</tr>
<tr>
<td>Kodiyalam, Vijay</td>
<td>vijay</td>
<td>212</td>
</tr>
<tr>
<td>Maddaly, Krishna</td>
<td>krishna</td>
<td>309</td>
</tr>
<tr>
<td>Mohari, Anilesh</td>
<td>anilesh</td>
<td>314</td>
</tr>
<tr>
<td>Mukhopadhyay, Anirban</td>
<td>anirban</td>
<td>251</td>
</tr>
<tr>
<td>Nagaraj, D. S.</td>
<td>dsn</td>
<td>271</td>
</tr>
<tr>
<td>Prasad, Amritanshu</td>
<td>amri</td>
<td>207</td>
</tr>
<tr>
<td>Raghavan, K. N.</td>
<td>knr</td>
<td>264</td>
</tr>
<tr>
<td>Sankaran, P.</td>
<td>sankaran</td>
<td>211</td>
</tr>
<tr>
<td>Srinivas, K.</td>
<td>sринi</td>
<td>215</td>
</tr>
<tr>
<td>Sunder, V. S.</td>
<td>sunder</td>
<td>210</td>
</tr>
<tr>
<td>Viswanath, S.</td>
<td>svis</td>
<td>214</td>
</tr>
<tr>
<td>Name</td>
<td>Initial</td>
<td>Page</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>Adhikari, Ronojoy</td>
<td>rjoy</td>
<td>253</td>
</tr>
<tr>
<td>Anishetty, Ramesh</td>
<td>ramesha</td>
<td>321</td>
</tr>
<tr>
<td>Ashok, Sujay K.</td>
<td>sashok</td>
<td>265</td>
</tr>
<tr>
<td>Bagchi, Manjari</td>
<td>manjari</td>
<td>205</td>
</tr>
<tr>
<td>Chandrashekar, C.M.</td>
<td>chandru</td>
<td>205</td>
</tr>
<tr>
<td>Chaudhuri, Pinaki</td>
<td>pinakic</td>
<td>325</td>
</tr>
<tr>
<td>Date, G.</td>
<td>shyam</td>
<td>304</td>
</tr>
<tr>
<td>Digal, Sanatan</td>
<td>digal</td>
<td>259</td>
</tr>
<tr>
<td>Ganesh, Ramachandran</td>
<td>ganesh</td>
<td>311</td>
</tr>
<tr>
<td>Ghosh, Sibasish</td>
<td>sibasish</td>
<td>216</td>
</tr>
<tr>
<td>Gopalakrishna, Shrihari</td>
<td>shri</td>
<td>315</td>
</tr>
<tr>
<td>Hassan, Syed Raghib</td>
<td>shassan</td>
<td>261</td>
</tr>
<tr>
<td>Indumathi, D.</td>
<td>indu</td>
<td>302</td>
</tr>
<tr>
<td>Kaul, Romesh K.</td>
<td>kaul</td>
<td>317</td>
</tr>
<tr>
<td>Laad, Mukul S.</td>
<td>mslaad</td>
<td>254</td>
</tr>
<tr>
<td>Menon, Gautam I.</td>
<td>menon</td>
<td>266</td>
</tr>
<tr>
<td>Mishra, A.K.</td>
<td>mishra</td>
<td>323</td>
</tr>
<tr>
<td>Mukhopadhyay, Partha</td>
<td>parthamu</td>
<td>260</td>
</tr>
<tr>
<td>Nemani, Venkata Suryanarayana</td>
<td>nemani</td>
<td>263</td>
</tr>
<tr>
<td>Rajesh, Ravindran</td>
<td>rrajesh</td>
<td>255</td>
</tr>
<tr>
<td>Rama, S. Kalyana</td>
<td>krama</td>
<td>313</td>
</tr>
<tr>
<td>Ravindran, V.</td>
<td>ravindra</td>
<td>208</td>
</tr>
<tr>
<td>Ray, Purusattam</td>
<td>ray</td>
<td>319</td>
</tr>
<tr>
<td>Sathiapalan, Balachandran</td>
<td>bala</td>
<td>320</td>
</tr>
<tr>
<td>Shankar, R.</td>
<td>shankar</td>
<td>327</td>
</tr>
<tr>
<td>Siddharthan, Rahul</td>
<td>rsidd</td>
<td>204</td>
</tr>
<tr>
<td>Sinha, Nita</td>
<td>nita</td>
<td>267</td>
</tr>
<tr>
<td>Sinha, Rahul</td>
<td>sinha</td>
<td>268</td>
</tr>
<tr>
<td>Sinha, Sitabhra</td>
<td>sitabhra</td>
<td>301</td>
</tr>
</tbody>
</table>
Vemparala, Satyavani  
vani  257

Theoretical Computer Science

Arvind, V.  
arvind  218
Bhattacharya, Sayan  
bsayan  203
Lodaya, Kamal  
kamal  310
Mahajan, Meena  
meena  307
Raman, Venkatesh  
vraman  220
Ramanujam, R.  
jam  269
Saurabh, Saket  
saket  213
Sharma, Vikram  
vikram  312
Subramanian, C.R.  
crs  324

1.4 Other Senior Academic Members

Balakrishnan, Radha.  
radha  219
Baskaran, G.  
baskaran  303
Murthy, M.V.N.  
murthy  326
Rajasekaran, G.  
graj  206
Simon, R.  
simon  120

1.5 Scientific Staff

Subramoniam G.  
gsmoni  221
Raveendra Reddy B.  
ravi  222
Paul Pandian M.  
pandian  383
Mohan S.  
smohan  300
Usha Devi P.  
usaha  385
Sundar M.  
msundar  247
1.6  Project Consultant

Jayaraj V  
Jayaraj  171

1.7  Project Engineer

Sinnakaruppan S.  
Sskp  248

1.8  Project Staff

Abdul Majith  
majithabdul  183
Balachander M.  
mchander  249
Chandrashekar K. A.  
kachandra  183
Gajendra Singh Badwal
Gayathri S.  
gayathris  373
Hari Priya T. V.  
tvhpriya  228
Jahir Hussain M.  
jahir  165
Janaki Raghavan  
rjanaki  186
Jayakumar P.  
jayakumarp  149
Jegannathan J.  
jjegan  249
Kandavel P. A.  
kandavel  149
Karthik M.  
mkarthik  249
Kirubananth P  
kirubananth  373
Krishna Balaji R.  
rkbalaji  180
Mangala Pandi P.  
mangal  217
Md. Izhar Ashraf  
ashraf  186
Moovendan M.  
moovendan  149
Pavithraa S.  
pavithraas  279
Ramakrishnan S.  
skrishman  226
Rethinasamy D.  
drsamy  226
Sakthivel Murugan E.  
esakthi  249
Srinivasan G.  
Surendra Singh Badwal 
Saveetha H.  
Shakthi N. Menon  
Sivasubbu Raj B.  
Soumya Easwaran  
Sundaralingam V.  
Thirusenthil R.  
Varsha Sreenivasan  
Vimalraj J.  
Vinod Kumar T.  

1.9 Post-Doctoral Fellows

Computational Biology
Charulatha Venkataraman  
Varuni Prabhakar

Mathematics
Anirban Bose  
Antony Selvam A.  
Bakkyaraj T.  
Balaji S.  
Biswajit Ransingh  
Kalyan Banerjee  
Karimilla Bi N.  
Lakshman Mahto  
Mamta Balodi  
Manoj Verma  
Neeraj Kumar  
Prasad T.
Pabitra Barik

Saibal Ganguli

Sebastien Palcoux

Senthil Kumar K.

Souradeep Majumder

Shreedevi K. Masuti

Subburam S.

Sumesh K.

Sumit Kumar Upadhyay

Vivek Sadhu

Abhijit Chakraborty

Abhishek Majhi

Amit Sharma

Arghya Dutta

Eleonora Dell Aquila

Indrakshi Raychowdhury

Jaya Maji

Meduri C. Kumar

Nitin Chandra

Rahul Srivastava

Rakesh Chatterjee

Rawoot Vaibhav Subhash

Sasidevan V.

Saumia P. S.

Saurabh Niyogi

Soumyajyoti Biswas

Sunando Kumar Patra

Vivek M. Vyas

Zodinmawia

Physics

Abhijit Chakraborty

abhijitc 380

Abhishek Majhi

abhim 382

Amit Sharma

amits 376

Arghya Dutta

darghya 379

Eleonora Dell Aquila

edellaquila 316

Indrakshi Raychowdhury

indrakshi 379

Jaya Maji

jayam 256

Meduri C. Kumar

mckumar 380

Nitin Chandra

nitinc 258

Rahul Srivastava

rahuls 101

Rakesh Chatterjee

rakeshch 382

Rawoot Vaibhav Subhash

vaibhavr 272

Sasidevan V.

sasidevan 258

Saumia P. S.

saumia 308

Saurabh Niyogi

sniyogi 378

Soumyajyoti Biswas

sbiswas 379

Sunando Kumar Patra

sunandokp 275

Vivek M. Vyas

vivekmv 105

Zodinmawia

zodin 381
### Theoretical Computer Science

**Pradeesha Ashok**
- **Userid**: pradeesha
- **Tel. Ext.**: 105

**Ragukumar P.**
- **Userid**: ragukumar
- **Tel. Ext.**: 377

### 1.10 Ph.D. Students

<table>
<thead>
<tr>
<th>Name</th>
<th>Userid</th>
<th>Tel. Ext.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computational Biology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anand Babu, N.B.</td>
<td>anandb</td>
<td>240</td>
</tr>
<tr>
<td>Ankit Agrawal</td>
<td>aagrawal</td>
<td>189</td>
</tr>
<tr>
<td>Devanand T.</td>
<td>devanandt</td>
<td>108</td>
</tr>
<tr>
<td>Kiranmayi Vadlamudi</td>
<td>kiranmayiv</td>
<td>188</td>
</tr>
<tr>
<td>Ria Ghosh</td>
<td>riaghosh</td>
<td>193</td>
</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anish Mallick</td>
<td>anishm</td>
<td>241</td>
</tr>
<tr>
<td>Arghya Mondal</td>
<td>arghya</td>
<td>106</td>
</tr>
<tr>
<td>Arun G. Kumar</td>
<td>gakumar</td>
<td>239</td>
</tr>
<tr>
<td>Avijit Nath</td>
<td>avijitnath</td>
<td>190</td>
</tr>
<tr>
<td>Biplab Paul</td>
<td>biplabpaul</td>
<td>190</td>
</tr>
<tr>
<td>Biswajyoti Saha</td>
<td>biswajyoti</td>
<td>114</td>
</tr>
<tr>
<td>Chandan Maity</td>
<td>cmaity</td>
<td>109</td>
</tr>
<tr>
<td>Dhriti Ranjan Dolai</td>
<td>dhriti</td>
<td>107</td>
</tr>
<tr>
<td>Ekta Saha</td>
<td>ekatas</td>
<td>114</td>
</tr>
<tr>
<td>Issan Patri</td>
<td>issanp</td>
<td>119</td>
</tr>
<tr>
<td>Jyothsnaa S.</td>
<td>jyothsnaa</td>
<td>237</td>
</tr>
<tr>
<td>Kamalakshya Mahatab</td>
<td>kamalakshya</td>
<td>121</td>
</tr>
<tr>
<td>Keshab Chandra Bakshi</td>
<td>keshabcb</td>
<td>112</td>
</tr>
<tr>
<td>Krishanu Dan</td>
<td>krishanu</td>
<td>122</td>
</tr>
<tr>
<td>Krishanu Roy</td>
<td>krishanur</td>
<td>187</td>
</tr>
</tbody>
</table>
Nabanita Roy nabanitar 236
Narayanan P. A. panarayanan 239
Pranendu Darbar dpranendu 240
Priyamvad Srivastav priyamvads 242
Ravinder B. bravinder 121
Rekha Biswal rekha 121
Rupam Karmakar rupamk 194
Sandipan de sandipande 238
Snehajit Misra snehajitm 236
Sohan Lal Saini slsaini 187
Souvik Pal souvikpal 239
Sumit Giri gsumit 242
Surajit Biswas surajitb 240
Uday Bhaskar Sharma udaybs 239

Physics

Abhrajit Laskar abhra 116
Abinash Kumar Nayak abinashkn 242
Ajay Chandrashekar ajaycs 189
Amlan Chakraborty amlanchak 193
Anand Pathak anandb 186
Anirban Karan kanirban 242
Ankita Chakrabarti ankitac 238
Anupam A. H. anupam 241
Anvy Moly Tom anvym 113
Archana Mishra amishra 115
Aritra Biswas aritrab 241
Aritra Saha aritrasaha 241
Arindam Mallick marindam 184
Arnab Priya Saha arnabps 194
Arya Mitra aryam 193
<table>
<thead>
<tr>
<th>Name</th>
<th>Code</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arya S.</td>
<td>aryas</td>
<td>115</td>
</tr>
<tr>
<td>Ashutosh Dash</td>
<td>ashutoshd</td>
<td>181</td>
</tr>
<tr>
<td>Atanu Bhatta</td>
<td>batanu</td>
<td>194</td>
</tr>
<tr>
<td>Chinmay Mishra</td>
<td>chimmaym</td>
<td>273</td>
</tr>
<tr>
<td>Dhargyal</td>
<td>dhargyal</td>
<td>237</td>
</tr>
<tr>
<td>Dheeraj Kumar Mishra</td>
<td>dkmishra</td>
<td>189</td>
</tr>
<tr>
<td>Dibyakrupa Sahoo</td>
<td>sdibyakrupa</td>
<td>115</td>
</tr>
<tr>
<td>Dipanjan Mandal</td>
<td>mdipanjan</td>
<td>184</td>
</tr>
<tr>
<td>Ekta</td>
<td>ektaphys</td>
<td>113</td>
</tr>
<tr>
<td>Gunjan Sharan Gola</td>
<td>gunjan</td>
<td>118</td>
</tr>
<tr>
<td>Jesrael K. Mani</td>
<td>jkmani</td>
<td>190</td>
</tr>
<tr>
<td>Jilmy P. Joy</td>
<td>jilmyo</td>
<td>191</td>
</tr>
<tr>
<td>Joyjit Kundu</td>
<td>joyit</td>
<td>122</td>
</tr>
<tr>
<td>Kamal Tripathi</td>
<td>kamalt</td>
<td>274</td>
</tr>
<tr>
<td>Madhav Krishnan V.</td>
<td>madhavkv</td>
<td>122</td>
</tr>
<tr>
<td>Madhusudhan Raman</td>
<td>madhur</td>
<td>185</td>
</tr>
<tr>
<td>Mahesh Jha</td>
<td>maheshj</td>
<td>276</td>
</tr>
<tr>
<td>Minati Biswal</td>
<td>mbiswal</td>
<td>107</td>
</tr>
<tr>
<td>Narayan Rana</td>
<td>rana</td>
<td>185</td>
</tr>
<tr>
<td>Nirmalya Kajuri</td>
<td>nirmalya</td>
<td>111</td>
</tr>
<tr>
<td>Parthasarathi Dey</td>
<td>parthasd</td>
<td>187</td>
</tr>
<tr>
<td>Pinaki Banerjee</td>
<td>pinakib</td>
<td>236</td>
</tr>
<tr>
<td>Prafulla Oak</td>
<td>prafullao</td>
<td>183</td>
</tr>
<tr>
<td>Prasanna Kumar Dhani</td>
<td>prasannakd</td>
<td>242</td>
</tr>
<tr>
<td>Prashanth Raman</td>
<td>prashanthr</td>
<td>182</td>
</tr>
<tr>
<td>Prathik Cherian J.</td>
<td>prathikcj</td>
<td>192</td>
</tr>
<tr>
<td>Prathyush Manchala</td>
<td>prathyushm</td>
<td>181</td>
</tr>
<tr>
<td>Pritham Sen</td>
<td>pritansen</td>
<td>181</td>
</tr>
<tr>
<td>Prosenjit Haldar</td>
<td>prosenjit</td>
<td>190</td>
</tr>
<tr>
<td>Pulak Banerjee</td>
<td>bpulak</td>
<td>189</td>
</tr>
<tr>
<td>Rajesh Singh</td>
<td>rsingh</td>
<td>116</td>
</tr>
<tr>
<td>Name</td>
<td>Initials</td>
<td>Page</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>Rathul Nath</td>
<td>rathulnr</td>
<td>191</td>
</tr>
<tr>
<td>Ravi Kunjwal</td>
<td>rkunj</td>
<td>242</td>
</tr>
<tr>
<td>Renjan Rajan John</td>
<td>renjan</td>
<td>111</td>
</tr>
<tr>
<td>Ria Sain</td>
<td>riasain</td>
<td>188</td>
</tr>
<tr>
<td>Rishu Kumar Singh</td>
<td>rksingh</td>
<td>119</td>
</tr>
<tr>
<td>Rohan Raghava Poojary</td>
<td>ronp</td>
<td>111</td>
</tr>
<tr>
<td>Rusa Mandal</td>
<td>rusam</td>
<td>236</td>
</tr>
<tr>
<td>Sagnik Chakraborty</td>
<td>csagnik</td>
<td>184</td>
</tr>
<tr>
<td>Sanjoy Mandal</td>
<td>smandal</td>
<td>184</td>
</tr>
<tr>
<td>Shantu Karmakar</td>
<td>shanuk</td>
<td>193</td>
</tr>
<tr>
<td>Shibasis Roy</td>
<td>shibasisr</td>
<td>238</td>
</tr>
<tr>
<td>Shilpa Kastha</td>
<td>shilpakastha</td>
<td>185</td>
</tr>
<tr>
<td>Subadeep Roy</td>
<td>sroy</td>
<td>238</td>
</tr>
<tr>
<td>SK Jahanur Hoque</td>
<td>jahanur</td>
<td>113</td>
</tr>
<tr>
<td>Soumya Sadhukan</td>
<td>soumyasad</td>
<td>112</td>
</tr>
<tr>
<td>Soumyadeep Bhattacharya</td>
<td>sbhtta</td>
<td>118</td>
</tr>
<tr>
<td>Sourav Ballav</td>
<td>sballav</td>
<td>237</td>
</tr>
<tr>
<td>Sriluckshmy P. V.</td>
<td>sriluckus</td>
<td>119</td>
</tr>
<tr>
<td>Srivatsa N. S.</td>
<td>srivatsans</td>
<td>106</td>
</tr>
<tr>
<td>Subhankar Khatua</td>
<td>shubankark</td>
<td>187</td>
</tr>
<tr>
<td>Tanmoy Mitra</td>
<td>tmitra</td>
<td>191</td>
</tr>
<tr>
<td>Tanmay Singal</td>
<td>stanmay</td>
<td>109</td>
</tr>
<tr>
<td>Tanmoy Modak</td>
<td>tanmoyy</td>
<td>114</td>
</tr>
<tr>
<td>Taushif Ahmed</td>
<td>taushif</td>
<td>194</td>
</tr>
<tr>
<td>Trisha Nath</td>
<td>trishan</td>
<td>241</td>
</tr>
<tr>
<td>Tuhin Subhra Mukherjee</td>
<td>tuhin</td>
<td>107</td>
</tr>
<tr>
<td>Upayan Baul</td>
<td>upayanb</td>
<td>241</td>
</tr>
<tr>
<td>Varun Sethi</td>
<td>varunsethi</td>
<td>113</td>
</tr>
<tr>
<td>Vigneshwar N.</td>
<td>vigneshwarn</td>
<td>185</td>
</tr>
<tr>
<td>Name</td>
<td>Username</td>
<td>ID</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>Anantha Padmanabha</td>
<td>ananthap</td>
<td>182</td>
</tr>
<tr>
<td>Anil Shukla</td>
<td>anilsh</td>
<td>106</td>
</tr>
<tr>
<td>Anuj Vijay Tawari</td>
<td>anujvt</td>
<td>182</td>
</tr>
<tr>
<td>Anup Basil Mathew</td>
<td>upbasil</td>
<td>110</td>
</tr>
<tr>
<td>Ashutosh Rai</td>
<td>ashutosh</td>
<td>181</td>
</tr>
<tr>
<td>Diptapriyo Majumdar</td>
<td>diptapriyom</td>
<td>190</td>
</tr>
<tr>
<td>Divyarthi M.</td>
<td>divyarthim</td>
<td>185</td>
</tr>
<tr>
<td>Fahad P.</td>
<td>fahad</td>
<td>109</td>
</tr>
<tr>
<td>Gaurav Rattan</td>
<td>grattan</td>
<td>238</td>
</tr>
<tr>
<td>Jayakrishnan M.</td>
<td>jayakrishnanm</td>
<td>240</td>
</tr>
<tr>
<td>Joydeep Mukherjee</td>
<td>joydeepm</td>
<td>108</td>
</tr>
<tr>
<td>Nitin Saurabh</td>
<td>nitin</td>
<td>118</td>
</tr>
<tr>
<td>Pranabendu Misra</td>
<td>pranabendu</td>
<td>240</td>
</tr>
<tr>
<td>Prafullkumar P. Tale</td>
<td>pptale</td>
<td>182</td>
</tr>
<tr>
<td>Qamar Ali Bohara</td>
<td>qamarali</td>
<td>194</td>
</tr>
<tr>
<td>Raja S.</td>
<td>rajas</td>
<td>108</td>
</tr>
<tr>
<td>Ramanathan Thinniyam Srinivasan</td>
<td>thinniyam</td>
<td>110</td>
</tr>
<tr>
<td>Sankardeep Chakraborty</td>
<td>sankardeep</td>
<td>237</td>
</tr>
<tr>
<td>Swaroop N. P.</td>
<td>npswaroop</td>
<td>182</td>
</tr>
<tr>
<td>Sudeshna Kolay</td>
<td>skolay</td>
<td>192</td>
</tr>
<tr>
<td>Syed Mohammad Meesum</td>
<td>meesum</td>
<td>110</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Username</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sridhar P. Narayanan</td>
<td>sridharn</td>
<td>273</td>
</tr>
<tr>
<td>Sruthy Murali</td>
<td>sruthym</td>
<td>273</td>
</tr>
<tr>
<td>Murugan, S.P.</td>
<td>spmurugan</td>
<td>272</td>
</tr>
<tr>
<td>Amit Kumar Singh</td>
<td>amitsingh</td>
<td>276</td>
</tr>
<tr>
<td>Ashish Kumar Sharma</td>
<td>ashishkss</td>
<td>276</td>
</tr>
<tr>
<td>Avijit Nath</td>
<td>avijitnath</td>
<td>190</td>
</tr>
</tbody>
</table>

**NBHM Course Work Students**

<table>
<thead>
<tr>
<th>Name</th>
<th>Username</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sridhar P. Narayanan</td>
<td>sridharn</td>
<td>273</td>
</tr>
<tr>
<td>Sruthy Murali</td>
<td>sruthym</td>
<td>273</td>
</tr>
<tr>
<td>Murugan, S.P.</td>
<td>spmurugan</td>
<td>272</td>
</tr>
<tr>
<td>Amit Kumar Singh</td>
<td>amitsingh</td>
<td>276</td>
</tr>
<tr>
<td>Ashish Kumar Sharma</td>
<td>ashishkss</td>
<td>276</td>
</tr>
<tr>
<td>Avijit Nath</td>
<td>avijitnath</td>
<td>190</td>
</tr>
<tr>
<td>Name</td>
<td>Username</td>
<td>Roll No</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>Deepak Kumar Pradhan</td>
<td>dkpradhan</td>
<td>272</td>
</tr>
<tr>
<td>Sukhendu Bera</td>
<td>sukhendub</td>
<td>276</td>
</tr>
<tr>
<td>INO Students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lakshmi S. Mohan</td>
<td>slakshmi</td>
<td>116</td>
</tr>
<tr>
<td>Meghna K. K.</td>
<td>meghna</td>
<td>191</td>
</tr>
</tbody>
</table>
## 1.11 Administrative Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Userid</th>
<th>Tel. Ext.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vishnu Prasad S.</td>
<td>svishnu</td>
<td>150</td>
</tr>
<tr>
<td>Registrar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gayatri E.</td>
<td>gayatri</td>
<td>152</td>
</tr>
<tr>
<td>Accounts Officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indra R.</td>
<td>indra</td>
<td>151</td>
</tr>
<tr>
<td>Administrative Officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amulraj, D.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ashfack Ahmed, G.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Babu, B.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balakrishnan, J.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baskaran, R.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geetha, M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gopinath, S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Janakiraman, J.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jayanthi, S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Johnson, P.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moorthy, E.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Munuswamy, N.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muthukrishnan, M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Otheeswaran Usha</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Padmanabhan, T.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prafull Kumar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parijatham, S.M.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## 1.12 Administrative Trainees

<table>
<thead>
<tr>
<th>Name</th>
<th>Userid</th>
<th>Tel. Ext.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balaji, N. R.</td>
<td>Revathi</td>
<td>J.</td>
</tr>
<tr>
<td>Devi, T.</td>
<td>Sadhana</td>
<td>R.</td>
</tr>
<tr>
<td>Gomathi, M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indira Priyadharshini, S.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EPABX: 225453xxx, xxx=extension
email: userid@imsc.res.in

16
Chapter 2

Research and Teaching

2.1 Computational Biology

2.1.1 Research Summary

Computational Biology

A simulation model for cargo transport in the axonal processes of neurons has been developed. A collaboration with scientists at NCBS, Bangalore and TIFR, Mumbai seeks to uncover fundamental aspects of neuronal transport by relating experimental observation with simulation predictions. We have explored, in particular, the role of stationary cargo in axonal transport. We find that, far from being passive spectators to transport processes, such cargo might function to regulate transport, specifically ensuring that a steady flux is maintained. A detailed examination of the role of crowding and its significance for active transport processes is the highlight of this work [K]

A model for chromosome positioning and the properties of individual chromosomes has been extended in several ways. The model now incorporates the effects of looping in chromosomes as inferred through Hi-C data, as well as transcriptome data, as inferred from RNA-seq experiments. The prime motivation for this line of work is to see if a first-principles, predictive approach to the large-scale properties of chromatin which is cell-type specific can be developed. A number of current collaborations, specifically with Prof. Kundan Sengupta (IISER, Pune) and with Profs. D. Palakodeti and Shravanti Rampalli (INSTEM, Bangalore), will explore the combination of experiment and simulation in an effort to understand the properties of stem cell chromatin and their evolution during differentiation.

Modelling of the auxeticity (a negative Poisson’s ratio) of stem cells in a transitional state is being carried out. A simple dynamical model, coupling chromatin compaction states to the nuclear dimension, appears to reproduce significant features of the experimental data.

An image processing and analysis scheme for the analysis of labelled mitochondria in C. elegans touch neurons is being developed. Methodologies for the study of correlations in mitochondrial positions and their potential disruption in mutants and in diseased states are
We are working on quantifying mitochondrial positioning in Caenorhabditis elegans neurons. To this end, Varuni Prabhakar has developed an image analysis algorithm to process the microscope images that have been collected in Prof. Koushika’s lab (TIFR, Mumbai). Mitochondrial positioning along the axon has important effects on the movement and integrity of vesicles and signals in the axon. The developmental dynamics and control of mitochondrial positioning has not been characterized quantitatively in this system. This project aims to understand how mitochondria are positioned along an axon and how that contributes to the functioning of the neuron.

System-level properties of metabolic networks may be the direct product of natural selection or arise as a byproduct of selection on other properties. Using Markov Chain Monte Carlo (MCMC) sampling and Flux Balance Analysis (FBA), it was shown in a recent study \cite{S1} that two properties of metabolic networks, latent versatility to function in additional environments and the average carbon efficiency, increase with the number of directly constrained environments for growth and size of the networks. These results \cite{S1} expand the growing body of evidence about non-adaptive origins of key functional properties of biological networks.

Several investigations have established that the transcriptional regulatory networks (TRNs) in bacteria have an inherently hierarchical architecture, although the design principles and the specific advantages offered by this type of organization have not yet been fully elucidated. In a recent study \cite{S2}, the hierarchical structure of the TRN of the gram-positive bacterium *Bacillus subtilis* was compared with that of the gram-negative bacterium *Escherichia coli* to identify many similarities and few specific differences. Majority of the few differences in the structure of the TRNs could be explained by variations in the distribution of $\sigma$-factors across the hierarchical levels in the two organisms. Furthermore, the study \cite{S2} also investigated the differential regulation of three distinct metabolic subsystems (catabolism, anabolism and central energy metabolism) by transcriptional regulators in the two distinct bacteria.

Recent interest in cell reprogramming has revived Waddington’s concept of epigenetic landscape which represents a quasi-potential function. The quasi-potential function derived from interactions in a gene regulatory network (GRN) quantifies the relative stability of network states which determine the effort required for transitions between states of a multi-stable dynamical system. However, quasi-potential landscapes developed for continuous models of GRNs are not suitable for widely used discrete models of GRNs. In a recent study \cite{S4}, a framework was developed to determine the relative stabilities and transition rates of network states in Boolean models of GRNs. Application of the proposed framework \cite{S4} to a Boolean model of Pancreas development led to the inference of logical functions recapitulating the observed ordering of attractors during cell fate dynamics.

### 2.1.2 List of Publications

The list of publications follows the following conventions: firstly, names of (co)authors who are not IMSc members are marked with a superscript *; secondly, the citation labels used for cross-referencing with the research summary are constructed from the last name of the first IMSc author and finally the list is ordered alphabetically according to the labels.
Algebra

It is shown in [Ko1] that there is an interesting analogue of the length formula of Hoskin and Deligne for integrally closed modules over a two-dimensional regular local ring. This also has some numerical consequences relating the Buchsbaum-Rim multiplicity of the module with its length and those of its Fitting ideal.
Motivated by a series of talks of Masaki Izumi here in 2012, we show in [Ko2] that for a finite dimensional Hopf algebra, an associated natural inclusion of infinite crossed products is the crossed product by the Drinfeld double, and, more interestingly, that this is a characterisation of the double.

It is shown in [D] that a subfactor planar algebra of finite depth $k$ is generated by a single $s$-box, where $s \leq \min\{k + 4, 2k\}$.

Stability of the Chari-Pressley-Loktev bases for local Weyl modules over the current algebra of type $A_1$ was established. By passing to the direct limit, bases for level one representations of the corresponding affine algebra were obtained.

Similarity classes of matrices in fields have been well-understood from the work of Camille Jordan in 1870. Many closely related problems remain open, with a lot of interesting work in the recent past. For example, the problem of classifying simultaneous similarity classes of matrices in fields has been understood to be a “wild” problem, which means that a classification along the lines of Jordan’s work is not possible. However, by working over finite fields, this problem can be viewed as a combinatorial problem: count the number $a_{n,k}(q)$ of simultaneous similarity classes of $k$-tuples of $n \times n$ matrices with entries in a finite field of order $q$. This problem fits into the theory of representations of quivers, and a deep result, finally proved Hausel, Letellier and Rodriguez-Villegas, and separately by Mozgovoy shows that there exists a polynomial $f_{n,k}(t)$ with non-negative integer coefficients whose value at $q$ is $a_{n,k}(q)$ for every prime power $q$. In this case, the existence of the polynomial $f_{n,k}(t)$ was observed by Victor Kac as an easy consequence of Burnside’s lemma and the results of Jordan. The non-negativity of coefficients was the hard part, even after using the Weil conjectures (Deligne’s theorem).

In contrast, little is known about the number $b_{n,k}(q)$ of simultaneous similarity classes of tuples of pairwise commuting matrices in a finite field. As of now, it is not known whether $b_{n,k}(q)$ is represented by a polynomial function of $q$. The work done in [Pr4] suggests an intriguing connection with a combinatorial problem that has its origins in number theory: counting the number $c_{n,k}(q)$ of similarity classes of $n \times n$ matrices with entries in a principal ideal local ring $R$ of length $k$ and residue field of order $q$ (when $q = p$, a prime, we may take $R = \mathbb{Z}/p^n\mathbb{Z}$). It was found that $c_{n,2}(q) = b_{n,2}(q)$ for all $n$. Moreover, for $n \leq 4$, it was found that $c_{n,2}(q)$ is a polynomial with non-negative coefficients. The paper [Sh] focusses on $b_{n,k}(q)$. It begins with the observation that for each $n$, the generating function $B_n(q,t) = \sum_{k=0}^{\infty} b_{n,k}(q)t^k$ is rational in $t$ for each $q$ and goes on the compute these functions for $n \leq 4$. It is found that $b_{n,k}(q)$ is represented by a polynomial in $q$ with non-negative integer coefficients for $n \leq 4$ and for all $k$.

Let $\lambda$ be a partition and $p$ be a prime number. Let $A_{\lambda}(p)$ denote the finite abelian $p$-group obtained by taking a product of cyclic group of orders $p^m$ as $m$ runs over the parts of $\lambda$. Each $p$-primary finite abelian group $A$ is isomorphic to $A_{\lambda}(p)$ for a unique partition $\lambda$. When this happens, we say that $A$ is of type $\lambda$. Philip Hall showed that, given partitions $\lambda$, $\mu$ and $\nu$, the number of subgroups in a $p$-group of type $\lambda$ which are of type $\mu$ and induce quotients of type $\nu$ is given by the value at $t = p$ of a polynomial $H_{\mu,\nu}(t)$ whose leading term is a Littlewood-Richardson (LR) coefficient. LR coefficients occur in the representation theory of symmetric groups, and lie at the heart of a large part of algebraic combinatorics. The paper [A] is a step towards understanding whether or not similar results can be obtained.
when one counts subgroups up to automorphisms of the ambient group. In this paper, an
algorithm was found to enumerate automorphism-orbits of pairs of elements. A surprising
experimental discovery of \[A\] was that the numbers of such orbits when \(\lambda\) is fixed and \(p\)
is allowed to vary seem to be represented by polynomials in \(p\) with non-negative integer
coefficients.

**Algebraic Geometry**

Study of morphisms from projective varieties to Grassmannain is continued.

Let \(E\) be an equivariant vector bundle on a complete symmetric variety. Study of how the
properties of \(E\) can be deduced from the properties of the restriction of \(E\) to some natural
sub varieties is undertaken \([N1]\).

In a joint work by Dr. J.N.Iyer and Dr. Kalyan Banerjee, it has been proved that the
kernel of the push-forward homomorphism at the level \(k\)-cycles modulo rational equivalence,
induced by the closed embedding of the theta divisor or an ample divisor linearly equivalent
to some multiple of the theta divisor inside the Jacobian variety of a smooth projective curve
of genus \(g\), is trivial.

**Analytic Number Theory**

Let \(S\) be a subset of \(F\), where \(F\) is the finite field of \(p\) elements. Let \(d\) be a given positive
integer. In \([B1]\), we study the following question. What is the maximum value of \(k\) such
that for any subset \(D\) of \(F\) of size \(k\) and for all possible way of writing \(D\) as a disjoint union
of two subsets \(A\) and \(B\), there exists a polynomial \(P\) with coefficients in \(F\) of degree at most
\(d\), such that \(P(x)\) is in \(S\) if \(x\) is in \(A\) and \(P(x)\) is not in \(S\) if \(x\) is in \(B\)

Let \(E(n)\) be the error term in the summatory function upto \(n\) of the Euler’s phi function \(\phi\). Using an earlier result, in \([B2]\) we study the following question. Let \(S(n)\) be the summatory
function of Euler's function. For how many values of \(n\), is \(S(n)\) a square.

In \([B5]\), we consider the mean value of the product of two real valued multiplicative functions
with shifted arguments. The functions \(F\) and \(G\) under consideration are close to two nicely
behaved functions \(A\) and \(B\), such that the average value of \(A(n-h)B(n)\) over any arithmetic
progression is only dependent on the common difference of the progression.

Let \(E\) be an elliptic curve defined over rational field \(\mathbb{Q}\) and \(N\) be a positive integer. Now
\(M_E(N)\) denotes the number of primes \(p\), such that the group \(E_p(\mathbb{F})\) is of order \(N\). Using the
shifted multiplicative function method defined mentioned above, in balu-2015.3, we also
compute the mean value of \(NK(N)/\phi(N)\), where \(NK(N)/\phi(N)\log N\), under a reasonable
conjecture, is the average value of \(M_E(N)\) over a large class of curves. In \([B4]\), We show that
\(M_E(N)\) follows Poisson distribution when an average is taken over a large class of curves.

Let \(A = \{a_1 < a_2 < a_3 \cdots < a_n < \cdots\}\) be an infinite sequence of non-negative integers and
let \(R_2(n) = |\{(i, j) : a_i + a_j = n; a_i, a_j \in A; i \leq j\}|\). We define \(S_k = \sum_{l=1}^{k}(R_2(2l) - R_2(2l +
1))\). In \([B3]\), we prove that if the \(L^\infty\) norm of \(S_k^+ (= \max\{S_k, 0\})\) is small, then the \(L^1\) norm
of $\frac{S_i^+}{k}$ is large.

An $\Omega$-result has been obtained for the function $\tau(n, \theta)$. Currently Working on smooth numbers in some arithmetic sequences.

**Differential Equations**

Extended earlier results obtained on the degenerate algebraic Riccati equation [?] to the parabolic case involving unbounded operators. This will be useful in the study of boundary control problems.

**Differential Geometry**

My thesis and earlier work was on spaces called quasitoric orbifolds. Orbifolds are spaces which are locally $\mathbb{R}^n / G$ where $G$ is a finite group. Quasitoric orbifolds are spaces which are generalizations of toric varieties or toric orbifolds used in algebraic geometry and string theory. Quasitorics differ from the torics in the sense they have no algebraic structure. I have provided them with smooth orbifold charts, almost complex structure existence conditions, proved a version of McKay Correspondence and Hodge structure. This year apart from the hodge structures I am focusing on Contact structures and have communicated a paper on providing contact structures on 3-dim cyclic orbifolds.

**Group Theory**

One has the notion of twisted conjugacy classes, generalizing the usual conjugacy relation in a group. The Reidemester number of an automorphism $\phi$ of a group is the number of $\phi$-twisted conjugacy classes in that group. It has been shown that groups of pure symmetric automorphism free groups (of finite rank) and the Houghton groups have the so-called $R_\infty$-property, namely that the Reidemester number of any automorphism of any these groups is infinite.

**Mathematical Physics**

In the paper [Dol1] we prove some upper and lower bounds on the integrated density of states of the Anderson model with decaying potentials outside the interval $[-2d, 2d]$.

In the paper [M2] we prove Poisson statistics for eigenfunctions of the Anderson model when the single site potentials are distributed by a Holder continuous distribution.

In [Do], eigenfunction statistics for discrete Anderson tight binding model with singular continuous distribution is studied. The eigenfunction statistics is shown to be Poisson point process.

In [M1], the Anderson model with finite rank single site potential was considered. For this model the matrix-valued spectral measure of the random self adjoint operator associated with the single site potential were shown to be mutually equivalent as measure.
Modular forms

In [Gu1], the authors consider the question of simultaneous sign change of Fourier coefficients of two modular forms with real Fourier coefficients. In an earlier work, Kohnen with Sengupta proved that two cusp forms of different (integral) weights with real algebraic Fourier coefficients have infinitely many Fourier coefficients of the same as well as opposite sign, up to the action of a Galois automorphism. In the first part of the paper, the authors strengthen their result by doing away with the dependency on the Galois conjugacy. In fact, they extend their result to cusp forms with arbitrary real Fourier coefficients. Further, they consider simultaneous sign change at prime powers of Fourier coefficients of two integral weight Hecke eigenforms which are new forms. Finally, they consider an analogous question for Fourier coefficients of two half-integral weight Hecke eigenforms.

In [Gu2], the authors extend two identities proved by Ramanujan involving the Riemann zeta function and the Dirichlet L-function associated to the non-trivial Dirichlet character modulo 4. More precisely, given two power series
\[ \sum_{n=0}^{\infty} a_n T^n \quad \text{and} \quad \sum_{n=0}^{\infty} b_n T^n \]
which are both rational functions with certain property, the authors show that
\[ \sum_{n=0}^{\infty} a_n b_n T^n \]
is again a rational function with similar property. This they do by obtaining explicit descriptions of the said rational function. They use this to explain Ramanujan’s identities and also analyse the Rankin-Selberg convolutions of automorphic L-functions.

Operator Algebras

The author of [S1] had long been wanting to have a treatment of the spectral theorem for normal operators on (separable) Hilbert space as a statement on the existence of appropriately homeomorphic continuous and measurable functional calculi which did not involve elaborate digressions into the Gelfand theory of commutative Banach algebras - in short, as a theorem in operator theory. The fruition of these ideas is [S1].

This involved coming up with some novel treatments of old theorems, as in [Ss].

Another project was the culmination of something that has taken three years in coming to fruition. The first of those years was spent trying to find a suitable and feasible set of speakers for an inter-disciplinary workshop. After the very successful workshop, in response to several suggestions that a readable set of notes would be very useful and much appreciated, the hard work of writing up such notes was taken up by the three authors of what finally became [S2].

Representation Theory

The Schur algebra \( S_K(n,d) \) is the commuting algebra for the action of the symmetric group \( S_d \) on the tensor space \( (K^n)^{\otimes d} \). Its importance in representation theory stems from the
fact that, when $K$ is an infinite field, then $S_K(n,d)$-modules are precisely representations of $GL_d(K)$ whose matrix entries are homogeneous polynomials of degree $d$ in the entries of $g \in GL_d(K)$. In the article [Ge], a combinatorial interpretation of the structure constants of $S_K(n,d)$ is given in terms of configurations of $d$ distinguishable balls in $n$ numbered boxes. An explicit construction of the primitive central idempotents of $S_K(n,d)$ (when $K$ has characteristic greater that $d$) is described in [Pr2].

Demazure modules for level 1 representations of the affine Lie algebra $\hat{sl}_2$ were studied. New bases for these modules introduced by Chari and Loktev were shown to stabilize, and to thereby define a basis for the full representation.

Let $g$ be a finite-dimensional complex simple Lie algebra with highest root $\theta$. Let $m, n$ be two non-negative integers. In [Bh], it is proved that the fusion product of $m$ copies of the level one Demazure module $D(1, \theta)$ with $n$ copies of the adjoint representation $ev_0 V(\theta)$ is independent of the parameters and given explicit defining relations. As a consequence, for $g$ simply laced, the author showed that the fusion product of a special family of Chari–Venkatesh modules is again a Chari–Venkatesh module. He also gave a description of the truncated Weyl module associated to a multiple of $\theta$.

In the article [Nr], it is proved that stability of the Chari-Pressley-Loktev bases for natural inclusions of local Weyl modules of the current algebra $\mathfrak{sl}_2[t]$. These modules being known to be Demazure submodules in the level 1 representations of the affine Lie algebra $\hat{sl}_2$, the authors obtained, by passage to the direct limit, bases for the level 1 representations themselves.

Transcendental number theory

In [Gu5], the authors generalise an identity of Lehmer. The techniques developed in this work allows them to furnish a new proof of Lehmer’s identity. Further, this generalised identity facilitates the investigation of the (conjectural) transcendental nature of generalized Briggs-Euler-Lehmer constants. Consequently, the authors strengthen their earlier work in [Gu4].

2.2.2 List of Publications

The list of publications follows the following conventions: firstly, names of (co)authors who are not IMSc members are marked with a superscript *; secondly, the citation labels used for cross-referencing with the research summary are constructed from the last name of the first IMSc author and finally the list is ordered alphabetically according to the labels.

[A]
C. P. Anilkumar and Amritanshu Prasad.
Orbits of pairs in abelian groups.
Séminaire Lotharingien de Combinatoire, 70, B70h, 2014.

[B1]
R. Balasubramanian, Cecile Dartyge*, and Elie Mosaki*.
Sur la complexite de familles d’ensembles pseudo-aleatoires.


2015.

(Submitted).

[B5] Balasubramanian R and Sumit Giri. The mean value of a product of shifted multiplicative functions and the average number of points of an elliptic curve.

2015.

(To appear in Journal of Number Theory).


*SIGMA, 10(110), 10pp., 2014.*

[C1] Partha Sarathi Chakraborty and Satyajit Guin. Connes’ calculus for the quantum double suspension.

2014.


2014.


*J Number Theory, 145, 352, 2014.*
[D] Sandipan De and Vijay Kodiyalam.
Note on infinite iterated crossed products of Hopf algebras and the Drinfeld double.
(To be published).

Eigenfunction statistics for anderson model with hölder continuous single site potential.
2014.
(Submitted).

[Dol1] Dhriti Ranjan Dolai.
Some estimates regarding integrated density of states for random schrdinger operator with
decaying random potentials.
2015.

[Dol2] Dhriti Ranjan Dolai and M. Krishna.
Poisson statistics for anderson model with singular randomness.
(To be published).

Combinatorics of finite abelian groups and Weil representations.
(To be published).

Hodge structures orbifold hodge numbers and a correspondence in quasitoric orbifolds.
2014.
1406.4596 (Submitted).

Contact structures in cyclic 3-orbifolds independent of open book decompsitions.
2015.

Graphic interpretation of the structure constants of the Schur algebra.
In *Electronic booklet of Proceedings of International Congress of Women Mathematicians*.,
Aug 2014.

[Gu1]  
S. Gun, W. Kohnen*, and P. Rath*.  
Simultaneous sign change of Fourier-coefficients of two cusp forms.  
2015.  
(Submitted).

[Gu2]  
S. Gun and R. Murty*.  
Generalization of an identity of Ramanujan.  
2015.  
(Submitted).

[Gu3]  
S. Gun and B. Saha.  
On the zeros of weakly holomorphic modular forms.  
*Archiv der Mathematik, 6(102)*, 531, 2014.

[Gu4]  
S. Gun, E. Saha, and S. Sinha*.  
Transcendence of Generalized Euler-Lehmer constants.  

[Gu5]  
S. Gun, E. Saha, and S. Sinha*.  
A generalisation of an identity of Lehmer.  
2015.  
(Submitted).

[Gun]  
Sanoli Gun and Biswajyoti Saha.  
On the zeros of weakly holomorphic modular forms.  

[K]  
S. Kesavan.  
On the general equation of the second degree.  
*Resonance*, 2015.  
(To be published).

[Ko1]  
Vijay Kodiyalam and Radha Mohan*.  
Lengths and multiplicities of integrally closed modules over a two-dimensional regular local ring.  
[Ko2] Vijay Kodiyalam and Srikanth Tupurani.
A note on generators for finite depth planar algebras.
(To be published).

[Kr] Peter D. Hislop* and M. Krishna.
Eigenvalue statistics for random Schrödinger operators with non-rank one perturbations.
2014.

Jakšić-last theorem for higher rank perturbations.
2014.
(Submitted).

Eigenfunction statistics for anderson model with holder continuous single site potential.
2014.

Translation invariant pure state on $m_d(c)$ and haag duality.

A mean ergodic theorem of an amenable group action.

Pure inductive limit state and kolmogorov’s property. ii.

Hann-banach-arveson extension theorem and kadison isomorphism.
2015.

Unique representation of integers with base $a$.

_Archiv Der Mathematik_, 2015.
(To be published).

[N1]
I. Biswas*, S. S. Kannan*, and D. S. Nagaraj.
Equivariant vector bundles on complete symmetric varieties of minimal rank.

[N2]
I. Biswas*, S. S. Kannan*, and D. S. Nagaraj.
On equivariant principal bundles over wonderful compactifications.

[Ne]
Neeraj Kumar and Senthil Kumar.
Note on vanishing of power sums of roots of unity.

[Nr]
Raghavan K. N, Ravinder B, and Viswanath Sankaran.
Stability of the chari-pressley-loktev bases for local weyl modules of $sl_2[t]$.
_Algebras and Representation Theory_, 2014.

[P]
Pierre Fima*, Kunal Mukherjee*, and Issan Patri.
On compact bicrossed products.
2015.
arXiv:1504.00092 (Submitted).

[Pa]
Pamba Paul, K. N. Raghavan, and Parameswaran Sankaran.
Borel-de Siebenthal discrete series and associated holomorphic discrete series.

[Pr1]
Jayadev S. Athreya* and Amritanshu Prasad.
Growth in right-angled groups and monoids.
2014.

[Pr2]
T. Geetha* and Amritanshu Prasad.
Centre of the Schur algebra.
(To be published).
Equivalence classes of nodes in trees and rational generating functions.
2014.

Similarity of matrices over local rings of length two.
(To be published).

Weyl type theorems for algebraically quasi-hnpHNP operators.

On class p-wa(s,t) operators.

Stability of Chari-Pressley-Loktev bases for local Weyl modules of sl2[t].
Algebras and Representation Theory, 2014.
arXiv:math/1407.0789 (To be published).

An elementary approach to the meromorphic continuation of multiple zeta functions.
2014.
(Submitted).

[S2] M. Ram Murty∗ and Biswajyoti Saha.
On the error term in a Parseval type formula in the theory of Ramanujan expansions.
2014.
(Submitted).

[Sa] Parameswaran Sankaran and Prateep Chakraborty.
Maps between certain complex Grassmann manifolds.

[Sh] Uday B. Sharma.
Simultaneous similarity classes of commuting matrices over a finite field.
2014.
arXiv:1409.2698 (Submitted).

[Ss]
Sunder V. S.
Fuglede’s theorem.
(To be published).

[V]
R. Venkatesh∗ and Sankaran Viswanath.
Chromatic polynomials of graphs from kac-moody algebras.
(To be published).

**Books/Monographs Authored/Edited**

The list below follows the same conventions as those followed for the list of publications.

[P]
Amritanshu Prasad.
Cambridge University Press, Darya Ganj, Delhi, 2015.

[R]
_Recent Developments in Algebraic and Combinatorial Aspects of Representation Theory_, volume 602 of _Contemporary Mathematics._

[S1]
V. S. Sunder.
_Operators on Hilbert Space._
(To be published).

[S2]
V. S. Sunder, Prabha Mandayam∗, and Ved P. Gupta∗.
_Functional Analysis of Quantum Information Theory_, volume 902 of _Springer LNP._
(To be published).
2.3 Physics

2.3.1 Research Summary

Astrophysics

After their death through supernova explosions, moderate mass (10 to 25 times of the Sun) stars becomes neutron stars. Neutron stars are mostly composed of neutrons and a few protons, electrons and probably other baryons. Density at the centre of a neutron star can be as high as $10^{14}$ gm cm$^{-3}$. Neutron stars usually weigh around 1.4 times that of the Sun but have radii of only around 10 km. These stars take only 1 millisecond to 1 second to complete one full rotation around their own axis. The value of the magnetic field at the surface of neutron stars usually lies between $10^8 - 10^{14}$ Gauss. These stars emit electromagnetic beams along their magnetic axis which are generally misaligned with the spin axes. Thus the beam also rotates and might fall onto earth once in each rotation, i.e., the neutron star behaves like a light-house and we call it a pulsar. Pulsars, especially when in binary systems, are excellent tools to test various theories of basic physics including general relativity and the physics of ultra-dense matter. I am interested in different types of binary pulsars. Presently, I am working on a project on population synthesis of double neutron star binaries with my collaborators in West Virginia University (USA). This project is aimed to understand the formation and evolution of such systems. My other interest is in pulsars with very low mass companions, where it is believed that the winds from the pulsars evaporate the companions. I am continuing a theoretical project with my collaborators in IEEC-CSIC (Barcelona, Spain) on this topic. I also have GMRT data for a few of such systems and data analysis is under progress. I am also involved in a big pulsar survey with my collaborators in the USA and Germany (see 2013, ApJ, 775, 51 for preliminary results) and another paper on the double neutron star system discovered in this survey is about to be submitted. I am also interested in testing gravity using binary pulsars, paying special attention to neutron star-black hole binaries.

Biological Physics

The uterus is normally an excitable medium which does not exhibit spontaneous activity. However, during pregnancy, the tissue changes its character and starts exhibiting transient episodes of self-excited oscillatory activity [Me3]. Just before giving birth these oscillations become synchronized and the resulting organ-wide coherent activity allows the fetus to be ejected. Till date there has been no experimental evidence for a specialized pacemaker region in the uterus (unlike the heart) that can help coordinate this process. An alternative hypothesis has been put forward recently that proposes the oscillation to be arising from strong coupling between excitable cells and electrically passive cells which co-occur in the uterus. It is known that during pregnancy the gap junctions that couple these cells become numerous and also increase in conductance. By numerical simulations, it has been shown that this increase in coupling is sufficient to explain the emergence of spontaneous oscillations and their gradual synchronization resulting in system-wide coherent activity, explaining one of the long-lasting puzzles in uterine electrophysiology. A key role seems to be played by the highly variable distribution of passive cells which connect to an excitable cell. This can be seen as a form of quenched disorder, similar to that seen in glass systems studied in physics.
Recently, the role of this disorder in expediting the transition from quiescence to coherent oscillations in the pregnant uterus close to term has been investigated. This has revealed the importance of the spontaneously emerging “oscillation centers” in uterine tissue through local fluctuations in the passive cell density. To validate whether the results of simplified models of excitable media are valid for the real, biological system, an investigation has been undertaken using a recently developed, highly detailed electrophysiological model of uterine myocyte cells. The study investigates how an increase in coupling between myocytes and neighbouring, electrically passive cells can give rise to spontaneous, contraction-inducing oscillatory electrical activity and finds results similar to those seen for the simpler model. In addition, the role of the strength of diffusive coupling between adjacent myocytes arranged on a two-dimensional lattice (with each myocyte coupled to a random number of passive cells that represents the structural disorder in biological tissue) on the collective dynamics has been investigated.

Intra-cellular signaling networks coordinate all the processes necessary for maintaining life by coordinating appropriate response to a wide variety of possible signals in the presence of a high degree of noise. It is important to identify the strategies used by such networks that allow them to perform efficient and robust information processing. A very important structural motif in such networks is the three-component Mitogen-Activated Protein Kinase (MAPK) signalling module. This pathway is found in all eukaryotic cells and is involved in many critical cellular functions including cell cycle control, stress response, differentiation and growth. Its crucial importance is underscored by the fact that it is seen to be affected in many diseases including cancer, as well as, immunological and degenerative syndromes and is, therefore, an important drug target. The basic linear cascade structure involves regulation of the activity of a MAPK kinase kinase (MAP3K) enzyme by an upstream signal. MAP3K on being activated can act as the enzyme for activation of a MAPK kinase (MAP2K) enzyme which in turn controls the activity of a MAPK enzyme. MAPK, on activation, can be involved in many functions, such as initiation of transcription or stimulation of other kinases. However, such linear or chain-like reaction schemes imply a rigid relation between stimulus and response, precluding the possibility of the system switching to a different response for the same signal under altered circumstances. As many linear cascades are actually part of branched pathways (e.g., the MAP3K enzyme MEKK-1 is known to activate multiple types of MAP2K enzymes in the T-cell and B-cell receptor signalling networks involved in immune response), it is important to investigate the dynamics of branched MAPK modules. In a recent study, it has been demonstrated that enzyme-substrate dynamics on such motifs allow surprisingly long-range communication in the absence of direct long-range interaction between molecules through retrograde propagation between the different (non-interacting) branches of MAPK pathways. Numerical simulations show that perturbing the activation of MAPK enzyme in one branch can result in a series of changes in the activity levels of molecules upstream to that enzyme, eventually reaching the branch-point and thence affecting the other branches. Our results have recently been verified by biological experiments (at NCCS, Pune). An important aspect of retrograde propagation in branched pathways that is distinct from previous work on retroactivity focusing exclusively on single chains is that varying the type of perturbation, e.g., between pharmaceutical agent mediated inhibition of phosphorylation or suppression of protein expression, can result in opposing responses in the other branches. This can have potential significance in designing drugs targeting key molecules which regulate multiple pathways implicated in systems-level diseases such as cancer and diabetes.

33
The representation of proteins as networks of interacting amino acids, referred to as protein contact networks (PCN), and their subsequent analysis using graph theoretic tools, can provide novel insights into the key functional roles of specific groups of residues. A recent study [Sin2] has characterized the networks corresponding to the native states of 66 proteins (belonging to different families) in terms of their core-periphery organization. The resulting hierarchical classification of the amino acid constituents of a protein arranges the residues into successive layers having higher core order with increasing connection density, ranging from a sparsely linked periphery to a densely intra-connected core (distinct from the earlier concept of protein core defined in terms of the three-dimensional geometry of the native state, which has least solvent accessibility). The results show that residues in the inner cores are more conserved than those at the periphery. Underlining the functional importance of the network core, it is seen that the receptor sites for known ligand molecules of most proteins occur in the innermost core. Furthermore, the association of residues with structural pockets and cavities in binding or active sites increases with the core order. From mutation sensitivity analysis, it is observed that the probability of deleterious or intolerant mutations also increases with the core order. It is also seen that stabilization center residues are in the innermost cores, suggesting that the network core is critically important in maintaining the structural stability of the protein. A publicly available web resource for performing core-periphery analysis of any protein whose native state is known has been made available.

Condensed Matter Physics

In this work [G2] we study the decoherence and entanglement properties for the two-site BoseHubbard model in the presence of a non-linear damping. We apply the techniques of thermo field dynamics and then use Hartree-Fock approximation to solve the corresponding master equation. The expectation values of the approximated field operators appearing in the solution of master equation are computed self-consistently. We solve this master equation for a small time $t$ so that we get the analytical solution, thereby we compute the decoherence and entanglement properties of the solution of the two-mode bosonic system. We have found that for a small initial time $t$, the entanglement of the system increases but at the same time the system decoheres exponentially.

Using computational techniques, we have studied the formation of different dynamically arrested states (e.g. glasses, gels, etc.) and also how such materials respond to external shear.

We have studied the relaxation dynamics of a model for oil-in-water microemulsion droplets linked with telechelic polymers [Cha2]. This system exhibits both gel and glass phases and we show that the competition between these two arrest mechanisms can result in a complex, three-step decay of the time correlation functions, controlled by two different localization lengthscales. For certain combinations of the parameters, this competition gives rise to an anomalous logarithmic decay of the correlation functions and a subdiffusive particle motion, which can be understood as a simple crossover effect between the two relaxation processes. We also characterize how the competition of gel and glass arrest mechanisms affects the dynamical heterogeneities and show that for certain combination of parameters these heterogeneities can be unusually large.

Understanding how flow starts from a quiescent glassy state is important for wide-ranging applications involving soft amorphous materials. For a model colloidal glass, we have in-
vestigated the onset of Poiseuille flow in a microfluidic geometry [Cha1]. Starting from the quiescent state, steady flow sets in at a time scale which increases with a decrease in applied forcing. At this onset time scale, a rapid transition occurs via the simultaneous fluidisation of regions having different local stresses. In the absence of steady flow at long times, creep is observed even in regions where the local stress is larger than the bulk yielding threshold. Finally, we show that the time scale to attain steady flow depends strongly on the history of the initial state.

**CP-Violation, Neutrinos, B-Physics and New Models**

Problems related to Dark Matter is studied from the perspective of high energy particle physics and phenomenology. As the quality of experimental searches become more satisfactory, various theoretical explanation becomes necessary. How the different Lorentz structure can help in explaining certain data and how the current experimental bounds go with such an explanation is currently being studied. The role of resonant coupled channel final state interactions, as well as weak annihilation and exchange contributions in explaining all the two body hadronic $D \to PP$ decay modes data was examined. The un-unitarized amplitudes included non-factorizable corrections as parameters and the $z$-series expansion method was used for the $q^2$ dependence of the hadronic form factors. The final state interaction effects were incorporated via a phenomenological approach with widths of resonances to various channels taken from observations where available, and others as additional parameters to be determined from fits of all the theoretical rates to the measured ones. Our results for the rather hard to explain $D \to K^+K^-, \pi^+\pi^-$ rates, were in agreement with the measured values. We demonstrated that both weak exchange as well as FSI effects are required to get the correct branching ratio for the $D^0 \to K^0\bar{K}^0$ mode. The strong phase difference between the amplitudes for $D^0 \to K^-\pi^+$ and $D^0 \to K^+\pi^-$ was evaluated and found to be in complete agreement with the recent BES III result. [Ni1]

**Foundations of Quantum Mechanics**

Entanglement breaking channels play a significant role in quantum information theory. In the work [P], we investigate qubit channels through their property of `non-locality breaking’, which is defined in a natural way but within the purview of CHSH non-locality. This also provides a different perspective on the relationship between entanglement and non-locality through the dual picture of quantum channels instead of through states. For a channel to be entanglement breaking, it is sufficient to `break’ the entanglement of maximally entangled states. We provide examples to show that for CHSH nonlocality breaking such a property does not hold in general, although for certain channels and for a restricted class of states for all channels this holds. We also consider channels whose output remains local under SLOCC and call them ‘strongly non-locality breaking’. We provide a closed-form necessary-sufficient condition for any two-qubit state to show hidden CHSH non-locality, which is likely to be useful for other purposes as well. This in turn allows us to characterize all strongly non-locality breaking qubit channels. It turns out that unital qubit channels breaking non-locality of maximally entangled states are strongly non-locality breaking while extremal qubit channels cannot be so unless they are entanglement breaking.

In this note [G7] we discuss a closed-form necessary and sufficient condition for any two-
qubit state to show hidden nonlocality w.r.t the Bell-CHSH inequality. This is then used to numerically compute the relative volume of states showing hidden Bell-CHSH non-locality, among all two-qubit states with one-sided reduction maximally mixed.

**Mathematical Physics**

The purpose of this short note [G3] is to utilize the work on isotropic lines, described by Albouy [J. Phys. A. Math. Theor., vol. 42 (2009), 072001], on Wigner distributions for finite-state systems as described by Chaturvedi et al. [J. Phys. A. Math. Theor., vol. 43 (2010), 0753075302], estimation of the state of a finite level quantum system based on Weyl operators in the L2-space over a finite field as described by Parthasarathy in [Inf. Dimens. Anal. Quantum Prob. Relat. Top., Vol. 07, Issue 4, Dec. 2004. 607-617] to display maximal abelian subsets of certain unitary bases for the matrix algebra Md of complex square matrices of order d¿3; and then, combine these special forms with constrained elementary measurements to obtain optimal ways to determine a d-level quantum state. This enables us to generalise illustrations and strengthen results related to quantum tomography by Ghosh and Singh in [G4].

The minimum error discrimination problem for ensembles of linearly independent pure states are known to have an interesting structure; for such a given ensemble the optimal POVM is given by the pretty good measurement of another ensemble which can be related to the former ensemble by a bijective mapping 8475; on the “space of ensembles”. In this work [G9] we generalize this result to ensembles of general linearly independent states (not necessarily pure) and also give an analytic expression for the inverse of the map, i.e., for 8475;8722;1. In the process of proving this we also simplify the necessary and sufficient conditions that a POVM needs to satisfy to maximize the probability of success for the MED of an LI ensemble of states. This simplification is then employed to arrive at a rotationally invariant necessary and sufficient conditions of optimality. Using these rotationally invariant conditions it is established that every state of a LI mixed state ensemble can be resolved to a pure state decomposition so that the corresponding pure state ensemble (corresponding to pure states of all mixed states together) has as its optimal POVM a pure state decomposition of the optimal POVM of mixed state ensemble. This gives the necessary and sufficient conditions for the PGM of a LI ensemble to be its optimal POVM; another generalization for the pure state case. Also, these rotationally invariant conditions suggest a technique to give the optimal POVM for an ensemble of LI states. This technique is polynomial in time and outpeforms standard barrier-type interior point SDP in terms of computational complexity.

**Nonlinear Dynamics, Solitons and Chaos**

An intriguing interpretation of the time-evolution of dynamical systems is to view it as a computation that transforms an initial state to a final one. This paradigm has been explored in discrete systems such as cellular automata models, where the relation between dynamics and computation has been examined in detail. A recent study [Me1] motivated by microfluidic experiments on arrays of chemical oscillators, shows that computation can be achieved in continuous-state, continuous-time systems by using complex spatiotemporal patterns generated through a reaction-diffusion mechanism in coupled relaxation oscillators. Two paradigms are presented that illustrate this computational capability, namely, using perturbations to (i) generate propagating configurations in a system of initially exactly syn-
chronized oscillators, and (ii) transform one time-invariant pattern to another. In particular, a possible implementation of NAND logic has been demonstrated. This raises the possibility of universal computation in such systems as all logic gates can be constructed from NAND gates. The work suggests that more complex schemes can potentially implement arbitrarily complicated computation using reaction-diffusion processes, bridging pattern formation with universal computability.

Dynamical patterns that arise in complex networks are often attributed to their non-trivial connection structure. However, the precise link between the fine topological structure of a network and the emergence of complex collective dynamics is unclear. For example, most social networks exhibit the meso-scale feature of modular organization, i.e., occurrence of communities whose members are more likely to be connected to each other than to members of other communities. A study [Ch] was undertaken to look at how the existence of modules in the contact structure of a population affects its adoption of an innovation that is characterized by a given perceived advantage. For this theoretical models of modular networks as well as the empirical social network of a village in Karnataka were considered. First, a network generalization of the well-known Bass model of diffusion, which is a variant of the SI compartmental model of contagion propagation, was applied on the empirical network and on an ensemble of degree-preserved randomized surrogates. By comparing the dynamics of the diffusion process in these networks, it was seen that the modular organization reduces the speed of adoption in the population. However, as there are limitations of the diffusion model, an alternative dynamical process based on spin-spin interaction that is inspired by statistical physics was also considered. Here, individuals try to coordinate their action with that of neighbors on the contact network, while having randomly distributed thresholds (that measures their intrinsic resistance to adoption). By varying the external field, which is a measure of the perceived advantage of the innovation, transitions of the population to a state of complete adoption were seen. While the model network with community organization shows that the occurrence of modularity increases the critical value of perceived advantage at which the transition happens, surprisingly in the empirical network the process of adoption can occur faster than in the corresponding degree-preserved randomized surrogate. By reducing the inter-modular connectivity of the empirical network, the process can indeed be made slower than the corresponding randomized networks. These results underline the critical importance of modular organization in social networks in affecting the process of adoption of innovation in society.

Why do some places evolve into large sprawling metropolitan settlements over time, while other initially similar sites decay into obscurity? Identifying the factors underlying the phenomenon of urban growth has sparked the curiosity of scientists ever since Walter Christaller proposed the Central Place Theory in order to explain the observed number, sizes and locations of settlements in southern Germany. However, lack of availability of sufficient empirical data has hampered progress in developing a quantitative understanding of this process. In order to initiate a data-driven approach to answer questions on the growth of settlements, recently a study has been undertaken to analyze a large database of economic, demographic and infrastructural factors associated with different sites of habitation in India [Sr]. Preliminary results of the analysis for a few of the most populous states of the Indian Union, viz., Maharashtra, Tamil Nadu and Uttar Pradesh, show interesting features. As rapid urbanization taking place in many parts of the country provides a window into the fast-changing rural-urban landscape, the growth/decay of population centers in these states has been investigated using information gleaned from government census reports. In particular,
combining demographic data with geographical information allows the identification of specific locations as being either growth hot-spots and decay cold-spots. In addition, the process of growth in different states (which have distinct trajectories for the evolution of the total population size) has been compared across multiple scales of settlement sizes. It is also seen that for all the states considered, the nature of the population distribution at different scales (of settlement sizes) appear to change from a sharply bounded to a long-tailed one as one considers larger settlement size scales, implying that distinct population growth processes are at work in different scales.

The study of games and their equilibria is central to developing insights for understanding many socio-economic phenomena. Recently, a dynamical systems approach to understand the equilibria of two-person, payoff-symmetric games has been undertaken [S]. In particular, using this perspective, the differences between two solution concepts for such games - namely, those of Nash equilibrium and co-action equilibrium - have been analyzed. For the Nash equilibrium, the dynamical view can provide an equilibrium refinement, selecting one equilibrium among several possibilities, thereby solving the issue of multiple equilibria that appear in some games. This dynamical perspective has been applied to understand several well known 2-person games, such as, the Prisoners Dilemma, game of Chicken and the Stag-Hunt. It is seen that in all of these cases, co-action equilibria tends to correspond to nicer strategies than those corresponding to Nash equilibria.

The heart is a fascinating example of nonlinear dynamics at work in biology [S]. Alternans response, comprising a sequence of alternating long and short action potential durations in heart tissue, seen during rapid periodic pacing can lead to conduction block resulting in potentially fatal cardiac failure. A method of pacing with feedback control has been proposed to reduce the alternans and therefore the probability of subsequent cardiac failure. The reduction is achieved by feedback control using small perturbations of constant magnitude to the original, alternans-generating pacing period \( T \), viz., using sequences of two alternating periods of \( T + \Delta T \) and \( T - \Delta T \), with \( \Delta T << T \). This alternans suppression scheme has been proposed and investigated in detail by simulations of ion-channel-based cardiac models both for a single cell and in one-dimensional spatially extended systems. Such a control scheme for alternans suppression has been verified experimentally in isolated whole heart experiments (in Academia Sinica, Taipei). The mechanism of the success of the proposed method can be understood in terms of dynamics in phase space, viz., as the state of activity of the cell being confined within a narrow volume of phase space for the duration of control, resulting in extremely diminished variation in successive action potential durations. The method is much more robust to noise than previous alternans reduction techniques based on fixed point stabilization and should thus be more efficient in terms of experimental implementation, which has implications for clinical treatment for arrhythmia.

Another fascinating aspect of cardiac dynamics is the role that spatial dimensions play in generating new types of transitions from order to disorder. While the major bulk of studies in cardiac modeling has been on two-dimensional media, as the heart wall has some thickness, investigating different aspects of activity propagation in three-dimensional excitable media is the correct approach. A natural question that can arise is whether the introduction of a third dimension introduces any novel dynamical phenomenon. In particular, if the heart wall has an inexcitable obstacle (e.g., generated as a result of an episode of myocardial infarction) that does not extend completely through the entire thickness of the medium, it is of great interest to know how it will interact with a reentrant wave. Earlier investigations in two-dimensional media suggest that a reentrant (or spiral wave) pinned to such an inexcitable
obstacle is fairly robust and does not degenerate into spatiotemporal chaos. However, in the present case, as the reentrant wave moves at different rotational speed in the region where it is wound around the obstacle compared to the region where it is free, it is easy to see that the wave will get progressively more twisted. In fact, investigations carried out recently show that this can result in a breakup of the wave into spatiotemporal chaos. This provides a novel route to fibrillation-like disorganized activity in three-dimensional excitable media as it does not involve the filament (the line joining the vortex singularities at each plane perpendicular to the axis of the obstacle) at all. This result is potentially of great significance to the clinical treatment of cardiac arrhythmia.

Analysis of time-series data of different markets have produced evidence for several stylized facts (universal features) including heavy tails characterized by power law exponents, which provide tantalizing hints of the nonlinear dynamics underlying such complex systems. It is especially important to see how these features evolve over time after the market is created and gradually develops. The recent advent of the digital currency, Bitcoin, and its growing popularity as an asset traded between agents over the last few years, provides us with an invaluable dataset for such a study. Similar to many financial markets, Bitcoin is de-centralized and its value is not controlled by a single institution, (e.g., a central bank. A recent study \[E\] has analyzed high-frequency Bitcoin trading data (with a resolution of one tick, i.e., a single trading event). It is shown that the distribution of price fluctuation (measured in terms of logarithmic return) has a heavy tail. The exponent of the tail implies that Bitcoin fluctuations follow an inverse square law, in contrast to the inverse cubic law exhibited by most financial and commodities markets. The distribution of transaction sizes and trading volume are seen to have Levy-stable distribution. Multi-scale analysis show the presence of long term memory effects in market behavior.

QCD effects for Higgs, Drell-Yan productions and beyond at the LHC

2loop corrections to the production of a real graviton associated with a jet at the LHC: New physics may show up as tiny deviations from the prediction of the Standard Model (SM)! To exploit this possibility it is absolutely necessary to make the theoretical predictions at very high accuracy within the SM and beyond. Multiloop computations play a crucial role to achieve this golden task. The complexity of these computations grows very rapidly with the increase of number of loops and/or external particles. We have performed a similar computation of 2loop virtual corrections to the production of a real graviton associated with a jet within the framework of massless QCD. The process, in particular, involves three massless gluons and one massive spin-2 graviton as external particles. We assume, spin-2 graviton couples to SM fields through SM energymomentum tensor (large extradimension model). In the process of computation, a large number of Feynman diagrams, generated using QGRAF, have been encountered, namely, 108 at 1loop and 2362 at 2loop order. Due to presence of a large number of Feynman diagrams and, additionally, involvement of spin-2 field, the computation becomes highly tedious and challenging! Color simplification and most of the other manipulations have been done with the help of some inhouse routines written in FORM and Mathematica. We have made use of integrationbyparts (IBP) and Lorentzinvariant (LI) identities to reduce the number of independent integrals, to be computed, substantially. For this purpose, one Mathematica based package named LiteRed has been used. Upon substituting the results of these integrals and performing the QCD UV renormalization, we get the final 1loop as well as 2loop results. The final results contain some additional divergences arising from infrared and collinear sectors, which we call IRdivergences.
Our results exhibit the correct and universal IRdivergences which confirms the correctness of our computation. This computation explicitly verifies the fact that even in the presence of a spin-2 field the universal structure of QCD IR divergence at 2loop holds true. Also, our result is very general in the sense that it can be used to study the production of a jet with missing energy due to KKgraviton escaping the detector or a process with resonant massive spin-2 particle in association with a jet.

2loop corrections to the production of the Higgs boson associated with a jet from bottom antibottom annihilation: Though the observables associated with the Higgs boson production get dominant contributions from gluon initiated partonic subprocesses, it is important to include the subdominant ones coming from other channels to test the SM to an unprecedented accuracy and see the possible physics beyond SM. We have worked on one such channel, namely, the Higgs boson production in association with a jet in bottom antibottom annihilation process. We compute relevant amplitude $H \rightarrow b + \bar{b} + g$ up to two loop level in QCD where Higgs couples to bottom quark through Yukawa coupling. We use projection operators to obtain the coefficients for each tensorial structure appearing in this process. Remaining calculation is similar to the earlier one. We have demonstrated that the renormalized amplitudes do have the right infrared structure predicted by the QCD factorization in dimensional regularization.

The Drell-Yan and Higgs boson productions at threshold in N$^3$LO QCD: Precise theoretical predictions for Drell-Yan (DY) production of pair of leptons and the Higgs boson production in gluon fusion at next to next to leading order (NNNLO) in perturbative Quantum Chromodynamics (pQCD) have played an important role to test the Standard Model to an unprecedented accuracy. The recent computation, by Anastasiou et. al., on the full threshold contributions to the Higgs boson production at N$^3$LO in QCD contains valuable information on the soft gluons resulting from virtual and real emission partonic subprocesses. Extracting that relevant information and exploiting the factorization property of QCD amplitude along with Sudakov resummation of soft gluons and renormalization group invariance, we have established an elegant framework to compute the crosssection and rapidity distribution of the processes, in which the final state particle is colorless, to all order in QCD perturbation theory. Using this framework, we have computed the following observables:

Crosssection of Drell-Yan production at threshold in N$^3$LO QCD,

Rapidity distribution of Drell-Yan and the Higgs boson (from gluon fusion) productions at threshold in N$^3$LO QCD,

Crosssection of the Higgs boson production through $b\bar{b}$ annihilation at threshold in N$^3$LO QCD and

Rapidity distribution of the Higgs boson produced through $b\bar{b}$ annihilation at threshold in N$^3$LO QCD.

We have shown the numerical impact of these results in the context of LHC. These are indeed very important step towards the high precision result.

RS resonance in di-final state production at the LHC to NLO+PS accuracy. A selection of the results has been presented with PDF and scale uncertainties for various distributions. Using the di-lepton and di-photon final states, we present the search sensitivity, for the 14 TeV LHC at 50 fb$^{-1}$ luminosity.
Associated production of Higgs boson with vector boson at threshold $N^3\text{LO}$ in QCD. We find that the inclusion of such corrections do reduce theoretical uncertainties resulting from the renormalization scale.

Ongoing works: Computing the the inclusive crosssection of the Higgs boson produced through gluon-gluon fusion at threshold beyond $N^3\text{LO}$ QCD and analyzing the numerical impact of threshold contribution, Real graviton production at hadron colliders in NNLO QCD in the context of large extra dimensions and Three photon production in LED model at NLO + PS accuracy at the LHC. Renormalisation group invariant approach to Higgs production at the LHC. Three loop form factors for energy momentum tensor in QCD.

**QFT, Topological QFT, Conformal Field Theory**

Non-perturbative aspects of QFTs are an area of active research. Currently some projects studying topological charges in QFTs and their implications to various physical properties are being pursued, with the central theme being interplay of symmetry and topological charge. Topological charges in presence of non-trivial vacua like vortices and solitons, and its consequences are also being studied. Some projects looking at aspects of gauge invariance in QFTs are also being pursued.

**Quantum Computations**

In the present paper [G1], we extend Simon’s separability criterion for Gaussian states to the multi-mode Gaussian states using the Marchenko-Pastur theorem. We show that the Marchenko-Pastur theorem from random matrix theory is necessary and sufficient for separability of multi-mode Gaussian states.

Maximally entangled statesa resource for quantum information processingcan only be shared through noiseless quantum channels, whereas in practice channels are noisy. Here [G6] we ask: Given a noisy quantum channel, what is the maximum attainable purity (measured by singlet fraction) of shared entanglement for single channel use and local trace preserving operations? We find an exact formula of the maximum singlet fraction attainable for a qubit channel and give an explicit protocol to achieve the optimal value. The protocol distinguishes between unital and nonunital channels and requires no local postprocessing. In particular, the optimal singlet fraction is achieved by transmitting part of an appropriate pure entangled state, which is maximally entangled if and only if the channel is unital. A linear function of the optimal singlet fraction is also shown to be an upper bound on the distillable entanglement of the mixed state dual to the channel.

Inspired by the work done by Belavkin [BelavkinV.P.Stochastics,1,315(1975)] and C. Moehn [Phys.Rev.A73,032328,(2006)], we formulate [G8] the problem of minimum error discrimination of an ensemble of n linearly independent pure states by embedding the optimal conditions in a matrix equation and matrix inequality. This isolates the rotationally invariant aspect of the problem from the rotationally covariant part of it. Employing the implicit function theorem in the matrix equation we get a set of first-order coupled ordinary nonlinear differential equations which can be used to drag the solution from an initial point (where solution is known) to another point (whose solution is sought). This can be done through a simple taylor series expansion and analytic continuation when required. Thus, we
complete the work done by Belavkin and C. Mochon by ultimately leading their theory to a solution for the MED problem of LI pure state ensembles. We also compare the computational complexity of this technique with a barrier-type interior point method of SDP and show that our technique is computationally less expensive than the SDP algorithm, with the added advantage of being simpler to implement.

Statistical Mechanics

Statistical physics and phase transitions and different phases are studied in \(Z(q)\) symmetric spin systems. Ductile to brittle and quasi brittle transition is studied in fiber bundle models from the point of view of phase transitions. The microscopic process of crack nucleation is investigated First passage and universal properties of coarsening systems are studied.

The concept of networks is of great importance in studying social phenomena. In recent times there has been a surge of interest in applying statistical mechanics of such networks to understand economic phenomena [Sin1]. The recent worldwide economic crisis of 2007-09 has focused attention on the need to analyze correlations in economic systems. In this context, financial markets can be seen as complex systems that comprise many agents interacting with each other as well as responding to external information. Earlier studies on the cross-correlations of price movements of different stocks have revealed the interaction structure of various financial markets - which has resulted in the intriguing speculation that the evolution of a market from emerging or developing to developed status is accompanied by systematic changes in its interaction structure. In a recent study [C] using a very large data-base of daily price changes of equities listed in the New York Stock Exchange, the long-term changes that this financial market has undergone over a period of nearly nine decades (1925-2012) has been investigated. Spectral analysis of the daily log-return cross-correlations has been done in order to reveal the network of significant interactions between equities. It has been found that the distribution of interaction strengths varies with the state of the economy. In particular, the skewness of the distribution shows a remarkable increase in recent years. The strength distribution over the network in different periods has been investigated by treating the network as resulting from a percolation process where the threshold value of interaction strength for deciding whether to connect a pair of nodes is varied. It is seen that the formation of the giant component can occur very differently in different periods - which reflects the micro-structure of the interactions between the equities.

The movement of large numbers of vehicles along the complex network of roads in a city result in interactions between them that become stronger as the traffic density increases. The non-trivial behavior arising from the collective dynamics of vehicles include the occurrence of persistent congestion at different points of the transport network that typically reduce the efficiency of overall traffic flow. In order to understand the mechanisms responsible for the characteristic spatio-temporal patterns of urban traffic, we first need to identify statistically robust features from empirical observations, which one can then try to recreate in computational models of traffic dynamics. A recent study [M] has analyzed the GPS traces collected round the clock for more than a hundred taxis operating in a major Indian city over a period of 1 month. The available information allows precise measurement of the periods during which the vehicle is static and when it is moving. The study focuses on the intermittent patterns of rest and motion that a car exhibits during its passage through city traffic, which provides a window into key aspects of collective dynamics resulting from
congestion. The distribution of waiting time, i.e., the period during which a car is static between two successive epochs of movement, has a highly skewed nature. The bulk of the probability distribution appears to follow power-law scaling with exponent value of 1.78. As city traffic has very different densities during peak hours and off-peak hours, this distribution has been computed for different times of the day. While the power-law scaling is found to be robust, the exact value of the exponent does change slightly. The active time distribution, i.e., the period of movement between two epochs when the car is static, does not exhibit a power-law signature but rather resembles an inverse Gaussian or a log-logistic distribution. These results can be used to help understand how the statistical properties of large-scale traffic movement over complex road networks which characterize cities deviate from that of other types of collective dynamics, e.g., the diffusion of random walkers.

Many complex systems can be represented as networks of dynamical elements whose states evolve in response to interactions with neighboring elements, noise and external stimuli. The collective behavior of such systems can exhibit remarkable ordering phenomena such as chimera order corresponding to coexistence of ordered and disordered regions. Often, the interactions in such systems can also evolve over time responding to changes in the dynamical states of the elements. Link adaptation inspired by Hebbian learning, the dominant paradigm for neuronal plasticity, has been earlier shown to result in structural balance by removing any initial frustration in a system that arises through conflicting interactions. A recent study [Pa] was done to show that the rate of the adaptive dynamics for the interactions is crucial in deciding the emergence of different ordering behavior (including chimera) and frustration in networks of Ising spins. In particular, it was observed that small changes in the link adaptation rate about a critical value result in the system exhibiting radically different energy landscapes, viz., smooth landscape corresponding to balanced systems seen for fast learning, and rugged landscapes corresponding to frustrated systems seen for slow learning.

Cooling granular media, characterized by inelastic collisions, exhibit varied physical phenomena. The large scale effects of inelastic collisions are best studied in the freely cooling granular gas – a collection of ballistic particles undergoing inelastic collisions in the absence of any external driving. The temporal evolution of energy and formation of clusters were studied using large scale event driven simulations in three dimensions for a system with tangential friction. It was shown that the exponents characterizing the large time behaviour could be related to the well studied model of ballistic aggregation [Pat].

Long rods interacting only through excluded volume interactions have been studied for a long time as models for liquid crystals. In the current study, the related problem of hard rectangles with aspect ratio $k$ is studied on two dimensional lattices. The phase diagram of a system of monodispersed hard rectangles of size $m \times mk$ is determined for all $m, k$ using a combination of Monte Carlo simulations and Bethe approximations. The existence of a disordered phase, a nematic phase with orientational order, a columnar phase with orientational and partial translational order, and a crystalline sublattice phase is shown. Some of these results may be made more rigorous. The solid phase is shown to exist only when the greatest common divisor of the length and width is different from one. For the nematic–columnar transition, a systematic high density expansion is derived allowing one to estimate the critical density. When the rods are polydispersed, a transfer matrix approach allows the determination of a phase boundary separating a nematic phase from a isotropic phase [K1, N1, K2, R, K3].

The hard sphere system in two dimensional continuum is known to undergo two entropy
driven transitions with increasing density: first from a liquid phase to a hexatic phase with quasi long range orientational order and second from the hexatic phase to a solid phase with quasi long range positional order and long range orientational order. The corresponding lattice problem, relevant for the study of adsorption of gas molecules onto surfaces, is not that well understood. The \(k\)-NN hard core lattice gas model in which the first \(k\) next nearest neighbor sites of a particle are excluded from occupation by other particles is studied on a two dimensional square lattice. This model is the lattice version of the hard disc system with increasing \(k\) corresponding to decreasing lattice spacing. The lattice model has been known to show only one transition. Here, based on Monte Carlo simulations and high density expansions of the free energy and density, it is argued that for \(k = 4, 10, 11, 14, \ldots\), the lattice model undergoes multiple transitions with increasing density. These are confirmed using Monte Carlo simulations for \(k = 4, \ldots, 11\). This, in turn, resolves an existing puzzle as to why the 4-NN model has a continuous transition against the expectation of a first order transition \[N2\]

A system of particles which on undergoing a two-body collision either coalesce to form a single particle or are removed from the system have been studied using Smoluchowski equation. The system is driven to a steady state by a constant input of particles of the smallest mass. The collision kernel studied is a generic one: \(K(m_1, m_2) = (m_1^\mu m_2^\nu + m_1^\nu m_2^\mu) / 2\). The Smoluchowski equation for this kernel is analyzed using the relation between different moments, the singular structure of the generating functions, a numerical solution, and exact solutions of solvable limits. The exponents characterizing the mass distribution for small and large masses are also found.

It has been a long debated subject whether the failure mode of a disordered solid is governed by nucleation (growth of a single damage causing the failure) or percolation (distributed damages coalesce before the final failure). It is expected that the range over which the stress field within the solid is modified following a local damage plays a crucial role in determining the mode of failure. However, a specific criterion for this range was not obtained before. We have obtained \[Bi1\] a finite size scaling criterion that determines the mode of failure. In particular, we have used the fiber bundle model as prototype and obtained the scaling criterion that if the effective range of stress release scales slower than \(L^\zeta\) with \(\zeta = 2/3\), the failure is nucleation dominated. Otherwise it is percolation dominated. The results are generally expected to be valid for systems with finite (normalizable) disorder and with a form of load-sharing function that has an effective range.

In an interconnected set of nodes, each having some failure threshold, it can be an essential requirement to figure out the best possible way to redistribute the load of a failed node so that the system is maximally robust. This is an important issue for a network of power-grids and also relevant for traffic in parallel roads. We have obtained \[Bi2\] the specific redistribution rules for sudden and quasi-static loadings of the system. It is also seen that the nature of the failure transition becomes abrupt (without precursor) when the most effective redistribution rule is adopted.

**String Theory**

Earlier discussions on the exact renormalization group and loop variables on the string world sheet for closed and open string backgrounds are continued. The world sheet action
with a UV regulator is written in a generally background covariant way by introducing a background metric. It is shown that the renormalization group gives background covariant equations of motion - this is the gauge invariance of the graviton. Interaction is written in terms of gauge invariant and generally covariant field strength tensors. The basic idea is to work in Riemann normal coordinates and covariantize the final equation. It turns out that the equations for massive modes are gauge invariant only if the space time curvature of the (arbitrary) background is zero. The exact RG equations give quadratic equations of motion for all the modes including the physical graviton. The level (2,2) massive field equations are used to illustrate the techniques. At this level there are mixed symmetry tensors. Gauge invariant interacting equations can be written down. In flat space an action can also be written for the free theory. [Sa3]

A proposal for solving the problem of constructing a manifestly background independent formulation of string theory is made: A simple prescription for the map from loop variables to space time fields is given whereby for arbitrary backgrounds the equations are generally covariant and gauge invariant. Extra terms involving couplings of the curvature tensor to (derivatives of) the Stueckelberg fields have to be added. The background metric is chosen to be the physical metric without any restrictions. This method thus gives manifestly background independent gauge invariant and general covariant equations of motion for both open and closed string modes [Sa4].

In a loop space description of non-linear sigma model, the semi-classical expansion is related to the tubular expansion of loop space around the submanifold of vanishing loops. In [Mu] this geometry has been worked out explicitly to all orders. The procedure involves first defining a cut-off tubular geometry at finite $N$ and then taking $N \to \infty$ limit.

### 2.3.2 List of Publications

The list of publications follows the following conventions: firstly, names of (co)authors who are not IMSc members are marked with a superscript *; secondly, the citation labels used for cross-referencing with the research summary are constructed from the last name of the first IMSc author and finally the list is ordered alphabetically according to the labels.

[A1]
Sujay K. Ashok, Marco Billo*, Eleonora DellÁquila, Marialuisa Frau*, Renjan R. John, and Alberto Lerda*.
Non-perturbative studies of n=2 conformal quiver gauge theories.
*Fortschritte der Physik (Progress of Physics)*, 2015.
1502.05581 (To be published).

[A2]
Sujay K. Ashok, Eleonora Dell’Aquila, and Jan Troost*.
Higher poles and crossing phenomena from twisted genera.

[B1]
Upayan Baul, Kenichi Kuroda*, and Satyavani Vemparala.

**[B2]**

**Upayan Baul and Satyavani Vemparala.**


**[Bi1]**

**Soumyajyoti Biswas, Subhadeep Roy, and Purusattam Ray.**


arXiv:1411.7827 (Submitted).

**[Bi2]**

**Soumyajyoti Biswas and Parongama Sen*.**

Maximizing the strength of fiber bundles under uniform loading. 2015.


**[C]**

**K. Chandrashekar, Anindya S. Chakrabarti*, and Sitabhra Sinha.**

Long-term evolution of the topological structure of interactions among stocks in the new york stock exchange 1925-2012.


**[Ch]**

**K. Chandrashekar and Sitabhra Sinha.**

Contagion, coordination and communities: Diffusion of innovations on social networks with modular organization.

In *Proc. IEEE 7th International Conference on COMmunications Systems and NETworkS (COMSNETS), Bangalore*. IEEE, Jan 2015.

**[Cha1]**

**Pinaki Chaudhuri and Juergen Horbach*.**


**[Cha2]**

**Pinaki Chaudhuri, Pablo Hurtado*, Ludovic Berthier*, and Walter Kob*.**


[G7] Rajarshi Pal and Sibasish Ghosh. A closed-form necessary and sufficient condition for any two qubit state to show hidden non
locality with respect to the Bell-CHSH inequality.

arxiv: 1410.7574 (Accepted as Poster in QIP, 2015).

[G8]
Tanmay Singal and Sibasish Ghosh.
Minimum error discrimination for an ensemble of linearly independent pure states.
arxiv: 1407.5389.

[G9]
Tanmay Singal and Sibasish Ghosh.
Algebraic structure of the minimum error discrimination problem for linearly independent
density matrices.
arxiv: 1412.7174.

[Gu]
Saurabh Gupta.
Novel symmetries in vector schwinger model.
arXiv:1312.6395 (To be published).

[K1]
Joyjit Kundu and R. Rajesh.
Phase transitions in a system of hard rectangles on the square lattice.

[K2]
Joyjit Kundu and R. Rajesh.
Asymptotic behavior of the isotropic-nematic and nematic-columnar phase boundaries for
the system of hard rectangles on a square lattice.

[K3]
Joyjit Kundu and R. Rajesh.
Phase transitions in systems of hard rectangles with non-integer aspect ratio.
2015.

[Ku1]
Ravi Kunjwal.
Fine’s theorem, noncontextuality, and correlations in specker’s scenario.

[Ku2]
Ravi Kunjwal and Sibasish Ghosh.
Minimal state-dependent proof of measurement contextuality for a qubit.


Multiple phase transitions in extended hard core lattice gas models in two dimensions.  

[Ni1]  
Aritra Biswas, Nita Sinha, and Gauhar Abbas*.  
Non-leptonic decays of charmed mesons into two pseudoscalars.  

[Ni2]  
A simulations study of the muon response of the iron calorimeter detector at the india-based neutrino observatory.  

[Ni3]  
Hijam Zeen Devi, L.Dhargyal, and Nita Sinha.  
Can the observed cp asymmetry in $\tau \to K\pi\nu_\tau$ be due to non-standard tensor interactions?  

[Ni4]  
Rupak Dutta, Nita Sinha, and Sushant K. Raut*.  
Determining neutrino mass hierarchy from electron disappearance at a low energy neutrino factory.  

[Ni5]  
Simulations study of muon response in the peripheral regions of the iron calorimeter detector at the india-based neutrino observatory.  

[P]  
Rajarshi Pal and Sibasish Ghosh.  
Non-locality breaking qubit channels: the case for chsh inequality.  

[Pa]  
Anand Pathak and Sitabhra Sinha.  
Complex ordering in spin networks: Critical role of adaptation rate for dynamically evolving interactions.  
(To be published).

[Pat]  
Sudhir N. Pathak, Dibyendu Das*, and R. Rajesh.
Inhomogeneous cooling of the rough granular gas in two dimensions.

[R]
J. Stilck* and R. Rajesh.
Polydispersed rods on the square lattice.

[Ra1]
Two-loop QCD corrections to higgs $\rightarrow b + \bar{b} + g$ amplitude.
JHEP, 1408(075), 2014.

[Ra2]
Higgs rapidity distribution in $b\bar{b}$ annihilation at threshold in n$^3$lo QCD.
JHEP, 1502(131), 2015.
(arXiv:1411.5301).

[Ra3]
Rapidity distributions in drell-yan and higgs productions at threshold to third order in QCD.

[Ra4]
T. Ahmed, N. Rana, and V. Ravindran.
Higgs boson production through $b\bar{b}$ annihilation at threshold in n$^3$lo QCD.
JHEP, 1410(139), 2014.

[Ra5]
G. Das*, P. Mathews*, V. Ravindran, and S. Seth*.
RS resonance in di-final state production at the LHC to NLO+PS accuracy.
JHEP, 1410(139), 2014.
(arXiv:1408.3970 [hep-ph]).

[Ra6]
Quark and gluon spin-2 form factors to two loops in QCD.

[Ra7]
M.C. Kumar, M.K. Mandal*, and V. Ravindran.
Associated production of higgs boson with vector boson at threshold n$^3$lo in QCD.
T. Ahmed, M. Mahakhud*, N. Rana, and V. Ravindran.
Drell-yan production at threshold to third order in QCD.

Two-loop QCD correction to massive spin-2 resonance → 3 gluons.
JHEP, 1405(107), 2014.

P. Sen* and P. Ray.
a + a → 0 model with a bias towards nearest neighbor.
2014.
arXiv:1409.7541 (Submitted).

S. Roy and P. Ray.
Criticality in fiber bundle model.
2014.

V. Sasidevan and Sitabhra Sinha.
A dynamical view of different solution paradigms in two-person symmetric games: Nash versus co-action equilibrium.

Balachandran Sathiapalan.
Loop variables and gauge invariant exact renormalization group equations for (open) string theory.

Shankhadeep Chakrabortty* and Balachandran Sathiapalan.
Schwinger effect and negative differential conductivity in holographic models.
[Sa3]
Balachandran Sathiapalan.
Gauge invariance and equations of motion for closed string modes.

[Sa4]
Balachandran Sathiapalan.
Background independence, gauge invariance and equations of motion for closed string modes.
IMSC-2014-12-13 (To be published).

[Si]
Rajesh Singh, Somdeb Ghose, and Ronojoy Adhikari.
Many-body microhydrodynamics of colloidal particles with active boundary layers.
(Submitted).

[Sin1]
Physicists’ approaches to a few economic problems.

[Sin2]
Arnold Emerson* and Sitabhra Sinha.
Analysis of core-periphery organization in protein contact networks reveals groups of structurally and functionally critical residues.
(To be published).

[Sr]
S. Sridhar, Tara Thiagarajan*, and Sitabhra Sinha.
Spatio-temporal patterns of development in India: Identifying geographical features of growth and urbanization.

[V1]
Sasidevan Vijayakumar and Sitabhra Sinha.
A dynamical view of different solution paradigms in two-person symmetric games: Nash vs co-action equilibria.
(To be published).


Books/Monographs Authored/Edited

The list below follows the same conventions as those followed for the list of publications.

[D1] Ghanashyam Date. 
*General Relativity: Basics and Beyond.*

*Desiccation Cracks and their Patterns.*

*Patterns in Excitable Media: Genesis, Dynamics and Control.*

2.4 Theoretical Computer Science

2.4.1 Research Summary

Algorithms and Data Structures

In [Ra3], explicit deterministic schemes are designed to represent a two element subset of an $m$ element universe using $O(m^{2/5})$ bits of space where membership queries can be answered using 3 bit probes. This matches a probabilistic bound shown earlier. When $t > 3$ bits can be probed to answer membership, and for representing $n > 2$ elements, improved space bounds are given.

In [Ra1], work is continued on succinct representation of equivalence classes. An earlier work gave upper and lower bounds for the representation when each of the $n$ elements should get a label from 1 to $n$. In this paper, data structures with better bounds are shown and interesting tradeoffs are obtained when the labels can take values from 1 to $cn$ for some constant $c > 1$.

In parameterized complexity each problem instance comes with a parameter $k$ and the parameterized problem is said to admit a *polynomial kernel* if there is a polynomial time algorithm (the degree of polynomial is independent of $k$), called a *kernelization* algorithm,
that reduces the input instance down to an instance with size bounded by a polynomial $p(k)$ in $k$, while preserving the answer. This reduced instance is called a $p(k)$ kernel for the problem. If $p(k) = O(k)$, then it is called a linear kernel. A central notion in parameterized complexity is fixed parameter tractability (FPT), which means, for a given instance $(x, k)$, solvability in time $f(k) \cdot p(|x|)$, where $f$ is an arbitrary function of $k$ and $p$ is a polynomial in the input size.

In the classic MINIMUM BISECTION problem we are given as input a graph $G$ and an integer $k$. The task is to determine whether there is a partition of $V(G)$ into two parts $A$ and $B$ such that $|A| - |B| \leq 1$ and there are at most $k$ edges with one endpoint in $A$ and the other in $B$. In [Sa1] we gave an algorithm for MINIMUM BISECTION with running time $O(2^{O(k^3)}n^3 \log^3 n)$. This was the first fixed parameter tractable algorithm for MINIMUM BISECTION. At the core of our algorithm lied a new decomposition theorem that states that every graph $G$ can be decomposed by small separators into parts where each part is “highly connected” in the following sense: any cut of bounded size can separate only a limited number of vertices from each part of the decomposition. Our techniques generalized to the weighted setting, where we seek for a bisection of minimum weight among solutions that contain at most $k$ edges.

In [K1] we designed linear time parameterized approximation algorithms for several problems such as, ODD CYCLE TRANSVERSAL, ALMOST-2-SAT, ABOVE GUARANTEE VERTEX COVER and DELETION BACKDOOR to $q$-HORN. Our algorithm proceeded by first reducing the given instance to an instance of the SKEW SYMMETRIC MULTICUT problem, and then computing an approximate solution to this instance. The main features of our algorithm were,

- It ran in polynomial time and returns a solution whose size is bounded quadratically in the parameter. This makes it useful in the design kernelization algorithms.
- The running time has a linear dependence on the size of the input. This makes it useful in the design of linear time FPT algorithms.

Our algorithms relied on an combinatorial object called $(L, k)$-set, which has recently been used by Ramanujan and Saurabh to design a linear time FPT algorithm for ODD CYCLE TRANSVERSAL.

In [Mi], we studied the following family of connectivity problems. For a given $\lambda$-edge connected graph $G = (V, E)$, a set of links $L$ such that $G + L = (V, E \cup L)$ is $(\lambda + 1)$-edge connected, and a positive integer $k$, the questions are

**Augmentation Problem:** whether $G$ can be augmented to a $(\lambda + 1)$-edge connected graph by adding at most $k$ links from $L$; or

**Deletion Problem:** whether it is possible to preserve $(\lambda + 1)$-edge connectivity of graph $G + L$ after deleting at least $k$ links from $L$.

We obtained the following results.

- An $9^k|V|^{O(1)}$ time algorithm for a weighted version of the augmentation problem. This improves over the previous best bound of $2^{O(k \log k)}|V|^{O(1)}$ given by Marx and
Let us remark that even for $\lambda = 1$, the best known algorithm so far due to Nagamochi [DAM 2003] runs in time $2^{O(k \log k)}|V|^{O(1)}$.

- An $2^{O(k)}|V|^{O(1)}$ algorithm for the deletion problem thus establishing that the problem is fixed-parameter tractable. Moreover, we show that the problem admits a kernel with $12k$ vertices and $3k$ links when the graph $G$ has odd-connectivity and a kernel with $O(k^2)$ vertices and $O(k^2)$ links when $G$ has even-connectivity.

Our results were based on a novel connection between augmenting sets and the Steiner Tree problem in an appropriately defined auxiliary graph.

In the Tree Deletion Set problem the input is a graph $G$ together with an integer $k$. The objective is to determine whether there exists a set $S$ of at most $k$ vertices such that $G \setminus S$ is a tree. The problem is $\text{NP}$-complete and even $\text{NP}$-hard to approximate within any factor of $\text{OPT}^c$ for any constant $c$. In [Sa2] we gave an $O(k^5)$ size kernel for the Tree Deletion Set problem. An appealing feature of our kernelization algorithm was a new reduction rule, based on system of linear equations, that we use to handle the instances on which Tree Deletion Set is hard to approximate.

In [Sa3] we studied the parameterized complexity of the following connectivity problem. For a vertex subset $U$ of a graph $G$, trees $T_1, \ldots, T_s$ of $G$ are completely independent spanning trees of $U$ if each of them contains $U$, and for every two distinct vertices $u, v \in U$, the paths from $u$ to $v$ in $T_1, \ldots, T_s$ are pairwise vertex disjoint except for end-vertices $u$ and $v$. Then for a given $s \geq 2$ and a parameter $k$, the task is to decide if a given $n$-vertex graph $G$ contains a set $U$ of size at least $k$ such that there are $s$ completely independent spanning trees of $U$. The problem is known to be $\text{NP}$-complete already for $s = 2$. We proved the following results

- For $s = 2$ the problem is solvable in time $2^{O(k)}n^{O(1)}$;
- For $s = 2$ the problem does not admit a polynomial kernel unless $\text{NP} \subseteq \text{CoNP}/\text{poly}$;
- For arbitrary $s$, we show that the problem is solvable in time $f(s, k)n^{O(1)}$ for some function $f$ of $s$ and $k$ only.

In [Sa4] we gave a fixed-parameter tractable algorithm that, given a parameter $k$ and two graphs $G_1, G_2$, either concludes that one of these graphs has treewidth at least $k$, or determines whether $G_1$ and $G_2$ are isomorphic. The running time of the algorithm on an $n$-vertex graph is $2^{O(k^5 \log k)} \cdot n^5$, and this is the first fixed-parameter algorithm for Graph Isomorphism parameterized by treewidth. Our algorithm in fact solved the more general canonization problem. We namely designed a procedure working in $2^{O(k^5 \log k)} \cdot n^5$ time that, for a given graph $G$ on $n$ vertices, either concludes that the treewidth of $G$ is at least $k$, or:

- finds in an isomorphic-invariant way a graph $\tilde{G}$ that is isomorphic to $G$;
- finds an isomorphism-invariant construction term — an algebraic expression that encodes $G$ together with a tree decomposition of $G$ of width $O(k^4)$.

Hence, the isomorphism test reduces to verifying whether the computed isomorphic copies or the construction terms for $G_1$ and $G_2$ are equal.
In the MULTICUT problem, we are given an undirected graph \( G = (V,E) \) and a family \( \{s_t \mid s_t, t \in V \} \) of pairs of requests and the objective is to find a minimum sized set \( S \subseteq V \) such that every connected component of \( G \setminus S \) contains at most one of \( s_t \) and \( t \) for any pair \( s_t \in \). In [Sa5] we gave the first non-trivial algorithm for MULTICUT running in time \( O(1.987^n) \).

A subfamily \( \mathcal{F}' \) of a set family \( \mathcal{F} \) is said to \( q \)-represent \( \mathcal{F} \) if for every \( A \in \mathcal{F} \) and \( B \) of size \( q \) such that \( A \cap B = \emptyset \) there exists a set \( A' \in \mathcal{F}' \) such that \( A' \cap B = \emptyset \). In a recent paper we gave an algorithm that given as input a family \( \mathcal{F} \) of sets of size \( p \) together with an integer \( q \), efficiently computes a \( q \)-representative family \( \mathcal{F}' \) of \( \mathcal{F} \) of size approximately \( \left( \binom{p+q}{p} \right) \), and demonstrated several applications of this algorithm. In this paper, we consider the efficient computation of \( q \)-representative sets for \emph{product} families \( \mathcal{F} \). A family \( \mathcal{F} \) is a product family if there exist families \( A \) and \( B \) such that \( \mathcal{F} = \{ A \cup B : A \in A, B \in B, A \cap B = \emptyset \} \).

In [Pa] our main technical contribution is an algorithm which given \( A, B \) and \( q \) computes a \( q \)-representative family \( \mathcal{F}' \) of \( \mathcal{F} \). The running time of our algorithm is \emph{sublinear} in \( |\mathcal{F}| \) for many choices of \( A, B \) and \( q \) which occur naturally in several dynamic programming algorithms. We also gave an algorithm for the computation of \( q \)-representative sets for product families \( \mathcal{F} \) in the more general setting where \( q \)-representation also involves independence in a matroid in addition to disjointness. This algorithm considerably outperforms the naive approach where one first computes \( \mathcal{F} \) from \( A \) and \( B \), and then computes the \( q \)-representative family \( \mathcal{F}' \) from \( \mathcal{F} \). We also gave two applications of our new algorithms for computing \( q \)-representative sets for product families. The first is a \( 3.8408^k n^{O(1)} \) deterministic algorithm for the MULTILINEAR MONOMIAL DETECTION (\( k \)-MLD) problem. The second is a significant improvement of deterministic dynamic programming algorithms for “connectivity problems” on graphs of bounded treewidth.

In CLOSEST STRING problem we are given an alphabet \( \Sigma \), a set of strings \( S = \{ s_1, s_2, \ldots, s_k \} \) over \( \Sigma \) such that \( |s_i| = n \) and an integer \( d \). The objective is to check whether there exists a string \( s \) over \( \Sigma \) such that \( d_H(s,s_i) \leq d \), \( i \in \{1, \ldots, k \} \), where \( d_H(x,y) \) denotes the number of places strings \( x \) and \( y \) differ at. CLOSEST STRING is a prototype string problem. This problem together with several of its variants such as Distinguishing String Selection and Closest Substring have been extensively studied from parameterized complexity perspective. These problems have been studied with respect to parameters that are combinations of \( k, d, |\Sigma| \) and \( n \). However, surprisingly the kernelization question for these problems (for the versions when they admit fixed parameter tractable algorithms) was not studied at all. In [B] we filled this gap in the literature and did a comprehensive study of these problems from kernelization complexity perspective. We almost settled all the problems by either obtaining a polynomial kernel or showing that the problem does not admit a polynomial kernel assuming a complexity theoretic assumption.

A backdoor set of a CNF formula is a set of variables such that fixing the truth values of the variables from this set moves the formula into a polynomial-time decidable class. In this work we obtain several algorithmic results for solving \( d \)-SAT, by exploiting backdoors to \( d \)-CNF formulas whose incidence graphs have small treewidth. For a CNF formula \( \phi \) and integer \( t \), a \emph{strong backdoor set} to treewidth \( t \) is a set of variables such that each possible partial assignment \( \tau \) to this set reduces \( \phi \) to a formula whose incidence graph is of treewidth at most \( t \). A \emph{weak backdoor set} to treewidth \( t \) is a set of variables such that there is a partial assignment to this set that reduces \( \phi \) to a \emph{satisfiable} formula of treewidth at most \( t \). In [Sa6] our main contribution was an algorithm that, given a \( d \)-CNF formula \( \phi \) and an integer \( k \), in time \( 2^k|\phi| \),
either finds a satisfying assignment of $\phi$, or

- reports correctly that $\phi$ is not satisfiable, or

- concludes correctly that $\phi$ has no weak or strong backdoor set to treewidth $t$ of size at most $k$.

As a consequence of the above, we showed that $d$-SAT parameterized by the size of a smallest weak/strong backdoor set to formulas of treewidth $t$, is fixed-parameter tractable. Prior to our work, such results were know only for the very special case of $t = 1$ (Gaspers and Szeider, ICALP 2012). Our result not only extended the previous work, it also improved the running time substantially. The running time of our algorithm is linear in the input size for every fixed $k$. Moreover, the exponential dependence on the parameter $k$ is asymptotically optimal under Exponential Time Hypothesis (ETH). One of our main technical contributions was a linear time “protrusion replacer” improving over a $O(n \log^2 n)$-time earlier procedure. The new deterministic linear time protrusion replacer has several applications in kernelization and parameterized algorithms.

The $c$-pumpkin is the graph with two vertices linked by $c \geq 1$ parallel edges. A $c$-pumpkin-model in a graph $G$ is a pair $\{A, B\}$ of disjoint subsets of vertices of $G$, each inducing a connected subgraph of $G$, such that there are at least $c$ edges in $G$ between $A$ and $B$. In [Sa7] we focused on hitting and packing $c$-pumpkin-models in a given graph in the realm of approximation algorithms and parameterized algorithms. We gave an FPT algorithm running in time $2^{O(k)} n^{O(1)}$ deciding, for any fixed $c \geq 1$, whether all $c$-pumpkin-models can be hit by at most $k$ vertices. This generalizes known single-exponential FPT algorithms for Vertex Cover and Feedback Vertex Set, which correspond to the cases $c = 1, 2$ respectively. Finally, we present an $O(\log n)$-approximation algorithm for both the problems of hitting all $c$-pumpkin-models with a smallest number of vertices, and packing a maximum number of vertex-disjoint $c$-pumpkin-models.

In [Sh] we present the first purely numerical (i.e., non-algebraic) subdivision algorithm for the isotopic approximation of a simple arrangement of curves. The arrangement is simple in the sense that any three curves have no common intersection, any two curves intersect transversally, and each curve is non-singular. A curve is given as the zero set of an analytic function $f : \mathbb{R}^2 \to \mathbb{R}^2$, and effective interval forms of $f, \frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}$ are available. Our solution generalizes the isotopic curve approximation algorithms of Plantinga-Vegter (2004) and Lin-Yap (2009). We use certified numerical primitives based on interval methods. Such algorithms have many favorable properties: they are practical, easy to implement, suffer no implementation gaps, integrate topological with geometric computation, and have adaptive as well as local complexity.

In [Ra4], the study of vertex cover reconfiguration has been continued. In this problem, we are given two vertex covers of a graph, and the question is whether there is a way to obtain one from the other by a sequence of vertex removals and additions. It was known that this problem is $W[1]$-hard for general graphs when parameterized by $\ell$, the length of the path. In this paper, it is shown that the problem remains $W[1]$-hard in bipartite graphs, NP-hard but fixed-parameter tractable in bounded degree graphs and polynomial time solvable in even-hole free graphs and cactus graphs.
In [Ra5] the complexity of the reconfiguration problem of graph coloring and constraint satisfaction problems are studied. In this problem, the aim is to modify a $k$-coloring of the graph to another, by recoloring one vertex at a time, while maintaining $k$-coloring throughout. It is shown that the problems is $W[1]$-hard when parameterized by $\ell$, the length of the path, while it is fixed-parameter tractable when parameterized by $k + \ell$.

For the more general problem of $\ell$-length bounded reconfiguration of satisfiable assignments of constraint satisfaction problems, we show it $W[2]$-hard when parameterized by $\ell$, and fixed parameter tractable when parameterized by $k + \ell + r$ where $k$ is the maximum domain size, and $r$ is the arity of the constraints.

**Automata, Logic and Concurrency**

In earlier work, it was shown that a graph-theoretic condition called structural cyclicity enables extraction of syntax from a conflict-equivalent product system of automata. In [Ph] a pairing property is introduced in the syntax which allows connection to a broader class of product systems (called product systems with matching), where the conflict-equivalence is not statically fixed. These systems have been related to labelled free choice nets in the PhD thesis of Phawade (submitted, 2014).

Work continued on many applications of logic in computer science. [R5] consider theories of play in games where it is hard to prove completeness of type spaces for players, and shows the possibility of constructible player types when interaction is logically specified. In Web Service specification, an important issue is one of realizability: [R2] considers a local temporal logic which ensures that every definable choreography is realizable. [R3] considers a simple logical language for expressing certificates used in security protocols and how they can strengthen the Dolev Yao model. The proof theoretic study here offers more general questions for complexity of intuitionistic logics with the possibility of new parameterizations ([R1]). Work was also done to survey research in epistemic temporal logics and present it in a uniform logical framework ([R4]).

**Computational Complexity**

The VP versus VNP question, introduced by Valiant, is probably the most important open question in algebraic complexity theory. Thanks to completeness results, a variant of this question, VBP versus VNP, can be succinctly restated as asking whether the permanent of a generic matrix can be written as a determinant of a matrix of polynomially bounded size. Strikingly, this restatement does not mention any notion of computational model. To get a similar restatement for the original and more fundamental question, and also to better understand the class itself, a complete polynomial for VP is needed. Ad hoc constructions yielding complete polynomials were known, but not natural examples in the vein of the determinant. In [M2], several variants of natural complete polynomials for VP are given, based on the notion of graph homomorphism polynomials.

Polynomial Identity Testing (PIT) algorithms have focussed on polynomials computed either by small alternation-depth arithmetic circuits, or by read-restricted formulas. Read-once polynomials (ROPs) are computed by read-once formulas (ROFs) and are the simplest of read-restricted polynomials. Building structures above these, in [M1], the following are
shown:

1. A deterministic polynomial-time non-black-box PIT algorithm for $\sum^{(2)} \cdot \prod \cdot \text{ROF}$.

2. Weak hardness of representation theorems for sums of powers of constant-free ROPs and for 0-justified alternation-depth-3 ROPs.

In [Ra2], it is shown that odd cycle transversal in perfect graphs has a two approximation algorithm improving on the straightforward 3-approximation. This is done using the polyhedral structure of the clique polytope in perfect graphs. This is extended to show an $\lceil (r + 1)/2 \rceil$ approximation algorithm for $r$-clique transversal in perfect graphs.

In [A3] we study the complexity of solving linear equations parameterized by the hamming weight of the solution. Given a system of linear equations over the binary field and an integer $t \geq 1$, we consider computing solutions of weight at most $t$ and of weight exactly $t$, with $t$ as parameter. A special aspect of our study is to show how the maximum multiplicity $k$ of variable occurrences influences the complexity. We show a sharp dichotomy: for $k$ more than 3 the problems are $W[1]$-hard. For $k=2$, the problems can be efficiently solved using matching algorithms.

In [A2] we study Geometric Graph Isomorphism: given two sets of $n$ points A and B with rational coordinates in $k$-dimensional euclidean space, with $k$ as fixed parameter, the problem is to decide if there is bijection between them that preserves all distances. We give a $O^*\left(k^{O(k)}\right)$ time algorithm for the problem. This is substantially faster than the previous best time bound of $O^*\left(2^{O(k^4)}\right)$ for the problem.

**Graph Theory and Combinatorics**

The problem of weighted stochastic matching (under the probe-and-commit model and subject to patience constraints) was studied. In [Mu], a natural greedy heuristic was analyzed and an upper bound of $\frac{2}{p_{\text{min}}}$ was obtained on the approximation factor of its performance. Here, $p_{\text{min}}$ refers to the minimum edge probability. No previous analysis of any greedy algorithm for the weighted stochastic matching (under the probe-and-commit model) is known. Also, a lower bound of $\frac{2}{p_{\text{min}}}$ was established on the worst-case value of the approximation ratio of the greedy heuristic. Some other greedy variants were introduced and they were also shown to have unbounded approximation ratio even if we restrict ourselves to unweighted instances.

Currently, we are working on b-coloring and Harmonious coloring of graphs. It is noted that finding the harmonious coloring[2] or b-coloring[1] of a graph is NP-complete.

Also, we work on graceful labeling and antimagic labeling of trees. It was conjectured that “All trees are graceful” by Rosa[3],Ringel and Kotzig in the year 1967. Further, in 1990, Ringel and Hartsfield[4] conjectured that Every tree than than $K_2$ is antimagic.

2.4.2 List of Publications

The list of publications follows the following conventions: firstly, names of (co)authors who are not IMSc members are marked with a superscript *; secondly, the citation labels used for cross-referencing with the research summary are constructed from the last name of the first IMSc author and finally the list is ordered alphabetically according to the labels.

[A1]
V. Arvind, S. Raja, and AV Sreejith.
On lower bounds for multiplicative circuits and linear circuits in noncommutative domains.

[A2]
V. Arvind and Gaurav Rattan.
The parameterized complexity of geometric graph isomorphism.

[A3]
V. Arvind, J. Koebler*, S. Kuhnert*, and J. Toran*.
Solving linear equations parameterized by hamming weight.

[A4]
V. Arvind and S. Raja.
The complexity of bounded register and skew arithmetic computation.

[A5]
V. Arvind, B. Das*, J. Koebler*, and S. Toda*.
Colored hypergraph isomorphism is fixed parameter tractable.
*Algorithmica*, 71(1), 120, 2015.

[A6]
V. Arvind and Y. Vasudev.
Isomorphism testing of boolean functions computable by constant-depth circuits. 

[B] 
On the kernelization complexity of string problems. 
In *20th International Conference on Computing and Combinatorics (COCOON)*, page 141, Aug 2014.

[K1] 
Sudeshna Kolay, Pranabendu Misra, M. S. M. Ramanujan*, and Saket Saurabh. 
Parameterized approximations via d-skew-symmetric multicut. 

[K2] 
Gautam Das*, Minati De*, Sudeshna Kolay, Subhas Nandy*, and Susmita Sur-Kolay*. 
Approximation algorithms for maximum independent set of a unit disk graph. 

[K3] 
Faster parameterized algorithms for deletion to split graphs. 

[M1] 
Building above read-once polynomials: identity testing and hardness of representation. 

[M2] 
Arnaud Durand*, Meena Mahajan, Guillaume Malod*, Nicolas de Rugy-Altherre*, and Nitin Saurabh. 
Homomorphism polynomials complete for VP. 

[Mi] 
Parameterized algorithms to preserve connectivity. 
In *41st International Colloquium on Automata, Languages, and Programming (ICALP)*, page 800, Jul 2014.
[Mu]
Joydeep Mukherjee and C. R. Subramanian.
Greedy heuristics and stochastic matchings.
2015.
(Submitted).

[P]
Sethuraman G. Gurusamy*, Ragukumar P. Pandurangan, and Peter J. Slater*.
Any tree with m edges can be embedded in a graceful tree with less than 4m edges and in a
planar graceful graph.
(Submitted).

[Pa]
Representative sets of product families.
In 22th Annual European Symposium on Algorithms (ESA), page 443, Sep 2014.

[Ph]
Ramchandra Phawade and Kamal Lodaya.
Kleene theorems for labelled free choice nets.
In Daniel Moldt and Heiko Rölke, editors, Proc. 8th International Workshop on Petri Nets
and Software Engineering, Tunis, pages 75–89. CEUR Workshop Proceedings, Jun 2014.

[R1]
R. Ramanujam and S. P. Suresh*.
Intuitionistic modal logics: efficient fragments and parameterized complexity.
In M. Fellows and S. Gaspers, editors, Parameterized Complexity and Computational Rea-
soning, Aug 2014.

[R2]
R. Ramanujam and S. Sheerazuddin*.
A local logic for realizability in web service choreographies.
In Maurice ter Beek and Antonio Ravara, editors, Worldwide Web Verification, page 16.

[R3]
R. Ramanujam, Vaishnavi Sundararajan*, and S. P. Suresh*.
Extending Dolev-Yao with assertions.

[R4]
Knowledge and time.
In van der Hoek van Ditmarsch, Halpern and Kooi, editors, Handbook of Epistemic Logic,
[R5]
R. Ramanujam.
Logical player types for a theory of play.

[Ra1]
Hicham El-Zein*, J. Ian Munro*, and Venkatesh Raman.
Tradeoff between label space and auxiliary space for representation of equivalence classes.

[Ra2]
Lp approaches to improved approximation algorithm for clique traversal in perfect graphs.
In Andreas S. Schulz and Dorothea Wagner, editors, European Symposium on Algorithms, page 430. Springer Verlag, Sep 2014.

[Ra3]
Moshe Lewinstein*, Ian Munro*, Pat Nicholson*, and Venkatesh Raman.
Improved explicit data structures in the bitprobe model.
In Andreas S. Schulz and Dorothea Wagner, editors, European Symposium on Algorithms, page 630. Springer Verlag, Sep 2014.

[Ra4]
Amer Mouawad*, Naomi Nishimura*, and Venkatesh Raman.
Vertex cover reconfiguration and beyond.

[Ra5]
Paul Bonsma*, Naomi Nishimura*, Amer Mouawad*, and Venkatesh Raman.
The complexity of bounded length graph recoloring and csp reconfiguration.
In International Symposium on Parameterized and Exact Computation (IPEC), page 110. Springer Verlag, Sep 2014.

[Ra6]
Venkatesh Raman and S. P. Suresh*.
Proceedings of the 34th international conference on foundations of software technology and theoretical computer science. Editors.
2014.

[Ra7]
Faster parameterized algorithms using linear programming.
Ruiwen Chen*, Valentine Kabanets*, and Nitin Saurabh.
An improved deterministic sat algorithm for small de Morgan formulas.

Minimum bisection is fixed parameter tractable.

Archontia C. Giannopoulou*, Daniel Lokshtanov*, Saket Saurabh, and Ondra Suchý*.
Tree deletion set has a polynomial kernel (but no $opt^{O(1)}$ approximation).
In 34th International Conference on Foundation of Software Technology and Theoretical Computer Science (FSTTCS), page 85, Dec 2014.

Manu Basavaraju*, Fedor V. Fomin*, Petr A. Golovach*, and Saket Saurabh.
Connecting vertices by independent trees.
In 34th International Conference on Foundation of Software Technology and Theoretical Computer Science (FSTTCS), page 73, Dec 2014.

Daniel Lokshtanov*, Marcin Pilipczuk*, Michał Pilipczuk*, and Saket Saurabh.
Fixed-parameter tractable canonization and isomorphism test for graphs of bounded treewidth.

Daniel Lokshtanov*, Saket Saurabh, and Ondra Suchý*.
Solving multicut faster than $2^n$.
In 22th Annual European Symposium on Algorithms (ESA), page 666, Sep 2014.

Solving $d$-sat via backdoors to small treewidth.
In Twenty-Sixth Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), page 630, Jan 2015.

Thomasse∗.
Hitting and harvesting pumpkins.

[Sh]
Jyh-Ming Lien∗, Vikram Sharma, Gert Vegter∗, and Chee Yap∗.
Isotopic arrangement of simple curves: An exact numerical approach based on subdivision.

[Su1]
C. R. Subramanian.
Probabilistic arguments in graph coloring (invited talk).

[Su2]
Kunal Dutta∗ and C. R. Subramanian.
Induced acyclic tournaments in random digraphs: Sharp concentration, thresholds and algorithms.
*Discussiones Mathematicae Graph Theory, 34(3), 467–495, 2014.*
2.5 Student Programmes

2.5.1 Degrees Awarded

Doctoral Degrees Awarded during 2014 – 2015

Mathematics

Name: Anilkumar, C. P.
Thesis Title: Orbits of Pairs in Finite Modules over Discrete Valuation Rings and Permutation Representations
Thesis Advisor: Prasad, Amritanshu
University: HBNI

Name: Tupurani, Srikanth
Thesis Title: Skein theories for finite depth subfactor planar algebras
Thesis Advisor: Kodiyalam, Vijay
University: HBNI

Physics

Name: Pal, Rajarshi
Thesis Title: Aspects of joint measurement and interrelation of quantum correlations and channels
Thesis Advisor: Ghosh, Sibasish
University: HBNI

Name: Pathak, Sudhir N.
Thesis Title: Large scale behaviour of the freely cooling granular gas
Thesis Advisor: Rajesh, R.
University: HBNI

Theoretical Computer Science

Name: Sreenivasaiah, Karteek
Thesis Title: On verifying proofs in constant depth, and polynomial identity testing
Thesis Advisor: Mahajan, Meena
University: HBNI

Name: Dutta, Kunal
Thesis Title: On certain invariants of random digraphs and uniform hypergraphs
Thesis Advisor: Subramanian, C. R.
University: HBNI
Doctoral Theses Submitted during 2014 – 2015

Mathematics

Name: Dolai, Dhriti Ranjan
Thesis Title: Spectral statistics for Anderson Model with decaying randomness and singular potentials.
Thesis Advisor: Krishna, M.
University: HBNI

Name: Chakraborty, Prateep
Thesis Title: Formality of Certain CW complexes and applications
Thesis Advisor: Sankaran, Parameswaran
University: HBNI

Physics

Name: Kundu, Joyjit
Thesis Title: Phase transitions in systems of hard anisotropic particles on lattices
Thesis Advisor: Rajesh, R.
University: HBNI

Theoretical Computer Science

Name: Phawade, Ramchandra B.
Thesis Title: Labelled free choice Petri nets, finite Product Automata, and Expressions
Thesis Advisor: Lodaya, Kamal
University: HBNI

Name: Vasudev, Yadu
Thesis Title: The complexity of some exact and approximate isomorphism problems
Thesis Advisor: Arvind, V.
University: HBNI

Master of Philosophy Thesis awarded during 2014 – 2015

Mathematics

Name: Raman, Viswanathan
Thesis Title: Implementation of Number Field Sieve
Thesis Advisor: Srinivas, K.
University: HBNI
Masters Degrees Awarded during 2014 – 2015

Physics

Name: Cherian, Prathik J.  
Thesis Title: Entanglement and Decoherence in Two Site Bose-Hubbard Model  
Thesis Advisor: Ghosh, Sibasish  
University: HBNI

Name: Chakraborty, Sagnik  
Thesis Title: Reality of Quantum States  
Thesis Advisor: Ghosh, Sibasish  
University: HBNI

Theoretical Computer Science

Name: Tawari, Anuj  
Thesis Title: Recent Trends in Arithmetic Complexity  
Thesis Advisor: Mahajan, Meena  
University: HBNI

Name: Lodha, Neha  
Thesis Title: Consensus through Public Communication  
Thesis Advisor: Ramanujam, R.  
University: HBNI

Name: Swaroop, N.P.  
Thesis Title: $\tau$ - Conjecture of lower bounds on arithmetic circuits  
Thesis Advisor(s): Sharma, Vikram & Arvind, Vikraman  
University: HBNI


Physics

Name: Oak, Prafulla  
Thesis Title: $c$-theorem and some peripheral aspects  
Thesis Advisor: Sathiapalan, Balachandran  
University: HBNI

2.5.2 Lecture Courses During 2014 – 2015.

The following lecture courses were offered during 2014 – 2015.
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Period</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computational Biology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology-1</td>
<td>Aug-Sep 2014</td>
<td>Samal, Areejit</td>
</tr>
<tr>
<td>Physical Biology</td>
<td>Aug-Nov 2014</td>
<td>Menon, Gautam I.</td>
</tr>
<tr>
<td>Biology-2</td>
<td>Jan-Feb 2015</td>
<td>Samal, Areejit</td>
</tr>
<tr>
<td>Infectious Diseases</td>
<td>Jan-Apr 2015</td>
<td>Menon, Gautam I.</td>
</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algebra II</td>
<td>Jan-Apr 2014</td>
<td>Raghavan, K. N.</td>
</tr>
<tr>
<td>Topology I</td>
<td>Jan-Apr 2015</td>
<td>Gun, S.</td>
</tr>
<tr>
<td>Topology-II</td>
<td>Jan-Apr 2014</td>
<td>Chatterjee, Pralay</td>
</tr>
<tr>
<td>Analytic Number theory-I</td>
<td>Aug-Nov 2014</td>
<td>Mukhopadhyay, Anirban</td>
</tr>
<tr>
<td>Complex Analysis</td>
<td>Aug-Dec 2014</td>
<td>Srinivas, K.</td>
</tr>
<tr>
<td>Lie Algebras and their Representations</td>
<td>Aug-Nov 2014</td>
<td>Raghavan, K. N.</td>
</tr>
<tr>
<td>Real Analysis</td>
<td>Aug-Dec 2014</td>
<td>Sunder, V. S.</td>
</tr>
<tr>
<td>Algebra II</td>
<td>Jan-Apr 2015</td>
<td>Kodiyalam, Vijay</td>
</tr>
<tr>
<td>Analytic number theory-II</td>
<td>Jan-Apr 2015</td>
<td>Mukhopadhyay, Anirban</td>
</tr>
<tr>
<td>Topology II</td>
<td>Jan-Apr 2015</td>
<td>Nagaraj, D. S.</td>
</tr>
<tr>
<td><strong>Physics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced Particle Physics</td>
<td>Jan-Apr 2014</td>
<td>Sinha, Nita</td>
</tr>
<tr>
<td>Gravitation and Cosmology</td>
<td>Jan-Apr 2014</td>
<td>Sathiapalan, Balachandran</td>
</tr>
<tr>
<td>Nonlinear Dynamics</td>
<td>Jan-Apr 2014</td>
<td>Sinha, Sitabhra</td>
</tr>
<tr>
<td>Quantum Information Theory (a reading course)</td>
<td>Jan-May 2014</td>
<td>Ghosh, Sibasish</td>
</tr>
<tr>
<td>Quantum Information Theory (reading course)</td>
<td>Jan-May 2014</td>
<td>Ghosh, Sibasish</td>
</tr>
<tr>
<td>Quantum Mechanics II</td>
<td>Jan-Apr 2014</td>
<td>Mukhopadhyay, Partha</td>
</tr>
<tr>
<td>Statistical Field Theory</td>
<td>Jan-Apr 2014</td>
<td>Rajesh, R.</td>
</tr>
<tr>
<td>Systems Biology</td>
<td>Jan-Apr 2014</td>
<td>Sinha, Sitabhra</td>
</tr>
<tr>
<td>Advanced Statistical Mechanics</td>
<td>May-Nov 2014</td>
<td>Ray, Purusattam</td>
</tr>
<tr>
<td>Quantum Mechanics (in IMSc School of Theoretical Physics)</td>
<td>Jun-Jun 2014</td>
<td>Rajasekaran, G.</td>
</tr>
<tr>
<td>Quantum Mechanics I</td>
<td>Aug-Nov 2014</td>
<td>Date, G.</td>
</tr>
<tr>
<td>Classical Theory of Fields</td>
<td>Jan-Apr 2015</td>
<td>Ashok, Sujay K.</td>
</tr>
<tr>
<td>Computational Neuroscience</td>
<td>Jan-Apr 2015</td>
<td>Sinha, Sitabhra</td>
</tr>
<tr>
<td>Gravitation and Cosmology</td>
<td>Jan-Apr 2015</td>
<td>Sathiapalan, Balachandran</td>
</tr>
<tr>
<td>Nonlinear Dynamics</td>
<td>Jan-Apr 2015</td>
<td>Sinha, Sitabhra</td>
</tr>
<tr>
<td>Quantum Information Theory (reading course)</td>
<td>Jan-May 2015</td>
<td>Ghosh, Sibasish</td>
</tr>
</tbody>
</table>
Quantum Mechanics II  Jan-Apr 2015  Mukhopadhyay, Partha
Statistical Field Theory  Jan-Apr 2015  Ray, Purusattam
Systems Biology  Jan-Apr 2015  Sinha, Sitabhra

**Theoretical Computer Science**

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Period</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advance Graph Algorithms</td>
<td>Jan-Apr 2014</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Computational Complexity</td>
<td>Jan-May 2014</td>
<td>Mahajan, Meena B.</td>
</tr>
<tr>
<td>Concurrency</td>
<td>Jan-May 2014</td>
<td>Lodaya, Kamal</td>
</tr>
<tr>
<td>Infinite discrete structures</td>
<td>Jan-Apr 2014</td>
<td>Ramanujam, R.</td>
</tr>
<tr>
<td>Linear Programming and Combinatorial Optimization</td>
<td>Feb-May 2014</td>
<td>Sharma, Vikram</td>
</tr>
<tr>
<td>Algorithms for solving polynomial equations</td>
<td>Aug-Dec 2014</td>
<td>Sharma, Vikram</td>
</tr>
<tr>
<td>Approximation Algorithms</td>
<td>Aug-Dec 2014</td>
<td>Subramanian, C. R.</td>
</tr>
<tr>
<td>Design and Analysis of Algorithms</td>
<td>Aug-Dec 2014</td>
<td>Raman, Venkatesh</td>
</tr>
<tr>
<td>Discrete Mathematics</td>
<td>Aug-Dec 2014</td>
<td>Mahajan, Meena</td>
</tr>
<tr>
<td>Kernelization</td>
<td>Aug-Dec 2014</td>
<td>Raman, Venkatesh</td>
</tr>
<tr>
<td>Logic I</td>
<td>Aug-Dec 2014</td>
<td>Ramanujam, R.</td>
</tr>
<tr>
<td>Logics of programs</td>
<td>Aug-Dec 2014</td>
<td>Lodaya, Kamal</td>
</tr>
<tr>
<td>Model theory</td>
<td>Aug-Dec 2014</td>
<td>Ramanujam, R.</td>
</tr>
<tr>
<td>Theory of Computation</td>
<td>Aug-Dec 2014</td>
<td>Lodaya, Kamal</td>
</tr>
<tr>
<td>Computational Complexity</td>
<td>Jan-Mar 2015</td>
<td>Arvind, V.</td>
</tr>
<tr>
<td>Dynamic Graph Algorithms</td>
<td>Jan-Apr 2015</td>
<td>Bhattacharya, Sayan</td>
</tr>
<tr>
<td>Infinite discrete structures</td>
<td>Jan-Apr 2015</td>
<td>Ramanujam, R.</td>
</tr>
<tr>
<td>Parameterized Complexity</td>
<td>Jan-Apr 2015</td>
<td>Saurabh, Saket</td>
</tr>
</tbody>
</table>

In addition, the following **lecture courses** were offered during 2014 – 2015 by IMSC faculty in the National Undergraduate programme of the Chennai Mathematical Institute.

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Period</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Particle Physics</td>
<td>Jan-Apr 2014</td>
<td>Rajasekaran, G.</td>
</tr>
<tr>
<td>Quantum Mechanics I</td>
<td>Aug-Nov 2014</td>
<td>Rajasekaran, G.</td>
</tr>
<tr>
<td>Quantum Mechanics II</td>
<td>Jan-Apr 2015</td>
<td>Rajasekaran, G.</td>
</tr>
</tbody>
</table>

### 2.5.3 Summer Students

Every summer, a small number of students from various institutes/universities come to our institution and work on some learning/research projects with some faculty member for a period of four to six weeks. The following students visited the institute during Apr, 2014 - Mar, 2015.
Computational Biology

Dev, Sunipa, IISER, Kolkata
Kashyab, Purba, IISER, Kolkata
Majumdar, Abhishek, IIT, Roorkee
Piduri, Chandrahhas,

Siddharthan, Rahul
Siddharthan, Rahul
Sinha, Sitabhra
Sinha, Sitabhra

Mathematics

Negi, Kajal, IIT, Kanpur
Sannyasi, Kunal, West Bengal
Saini, Rijul, CMI, Chennai
Jain, Tanay, CMI, Chennai
Dey, Satavisha, IITM, Chennai
Kar, Arpita, CMI, Chennai
Ray, Mishy, IISER, Mohali
Singh, Jyotiraditya, NISER, Bhubaneswar
Rajeev Tawri, Krutika, BITS Pilani, Goa
Kansal, Arpit, Indian Institute of Technology, Delhi
Singh, Jagdeep, IISER, Mohali
Barot, Aman, CMI, Chennai
Das, Nilanjan, IIT, Kanpur
Sangeetha, A., SIET College, Chennai

Balasubramanian, R.
Balasubramanian, R.
Balasubramanian, R.
Balasubramanian, R.
Gun, Sanoli
Gun, Sanoli
Gun, Sanoli
Gun, Sanoli
Mohari, Anilesh
Raghavan, K. N.
Raghavan, K. N.
Sunder, V.S.
Sunder, V.S.
Sunder, V.S.

Theoretical Physics

Bharadwaj, Lakshya, CMI, Chennai
Roy, Anarta, IISER, Bhopal
Sarangi, Sohan, IISER-Pune
Saravanan, D., University of Madras
Uprety, Sagar, BITS, Pilani
Baskaran Balakumar, Loyola College, Chennai
Syed, Rafeeq, NISER, Bhubaneswar
Sanal, Athira, MCC College, Tamaram
Varghese, Minu, IISER, Bhubaneswar
Das, Bharati Sanjeeda, Assam
Nikkin, D., SSN Engineering
Mitra, Soumik, West Bengal
Verma, Sonali, Uttar Pradesh
Banerjee, Abhishek, IISER, Kolkata
Reddy, Abhiram, NISER, Bhubaneswar
Sahoo, Abhilash, IISER, Kolkata

Ashok, Sujay
Ghosh, Sibasish
Ghosh, Sibasish
Ghosh, Sibasish
Hassan, Raghibib Syed
Hassan, Raghibib Syed
Indumathi, D.
Menon, Gautam I.
Nemani, V.S.
Sathiapalan Bala
Shankar, R.
Shankar, R.
Sinha, Nita
Vemparalarla Vani
Vemparalarla, Vani

73
### Theoretical Computer Science

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Institution</th>
<th>Faculty Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaushik, P.</td>
<td>SSN College, Chennai</td>
<td>Raman, Venkatesh</td>
</tr>
<tr>
<td>Krishnamurthy</td>
<td>Kumar Sanath, CMI, Chennai</td>
<td>Raman, Venkatesh</td>
</tr>
<tr>
<td>Naveen, Kodali</td>
<td>BITS Pilani, Hyderabad</td>
<td>Raman, Venkatesh</td>
</tr>
<tr>
<td>Umesh, Megha</td>
<td>SSN College, Chennai</td>
<td>Raman, Venkatesh</td>
</tr>
<tr>
<td>Varsha, P.</td>
<td>Anna University</td>
<td>Raman, Venkatesh</td>
</tr>
<tr>
<td>Venkatraghavan</td>
<td>S., SSN College, Chennai</td>
<td>Raman, Venkatesh</td>
</tr>
<tr>
<td>Anish, V.</td>
<td>PSG College of Technology</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Aparna, M.</td>
<td>NITK, Surathkal</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Bajpal, Nilesh</td>
<td>ISI, Kolkata</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Ghosh, Sebati</td>
<td>ISI, Kolkata</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Gupta, Chetan</td>
<td>CMI, Chennai</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Manasi, K.S.</td>
<td>PSG College of Technology</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Potukuchi, Aditya</td>
<td>CMI, Chennai</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Rajeswaran, Aravind</td>
<td>IIT Madras</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Ramachandran, Sabareesh</td>
<td>Indian Institute of Science</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Ramanathan, Varun</td>
<td>CMI, Chennai</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Ravichander, Abhilasha</td>
<td>PES Institute of Technology</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Sarkar, Soumjayoti</td>
<td>Bengal Engg Science Univ., Shibpur</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Shrivasatva, Ashish</td>
<td>IIT Madras</td>
<td>Saurabh, Saket</td>
</tr>
<tr>
<td>Sood, Saksham</td>
<td>SRM University, Chennai</td>
<td>Saurabh, Saket</td>
</tr>
</tbody>
</table>

#### 2.5.4 Other Students

Students also do their projects under the supervision of our faculty during the academic year. The following students visited the institute during Apr, 2014 - Mar, 2015.

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Faculty Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td></td>
</tr>
<tr>
<td>Abhyankar, Neeraja, IIT Madras</td>
<td>Prasad, Amritanshu</td>
</tr>
<tr>
<td>Chowdhury, Nilesh, IIT–Gwahati</td>
<td>Ghosh, Sibasish</td>
</tr>
</tbody>
</table>
2.6 Honours and Awards

**Chakraborty, Partha S.** was awarded Swarna Jayanti Fellowship 2012-13, for 2014, by the DST.

**Chakraborty, Partha S.** was awarded NASI-SCOPUS Young Scientist, 2014.

**Samal, Areejit** was awarded Ramanujan Fellowship, for 2015, by the Department of Science and Technology (DST), India.

**Samal, Areejit** was awarded Simons Associateship, for 2015, by the The Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy for the period 2015-2020.

**Samal, Areejit** was awarded Max Planck-DST Mobility Grant, for 2015, by the Max Planck Society (MPG) and Indo-German Science and Technology Centre (IGSTC) for the period 2015-2018.

**Chandrashekar** was awarded Ramanujan Fellowship, for 2015.
Chapter 3

Other Professional Activities

This chapter lists the activities carried out by the individual members of the institute in their professional capacity.

Arvind, V.

Associate Editor of ACM Transactions on Computation Theory

Editor of Computational Complexity Column of the Bulletin of the European Association of Theoretical Computer Science.

Ashok, Sujay K.

Convener of Local Organising Committee for Mock Modular Forms and Physics held at IMSc during Apr 14 – Apr 18, 2014.

Convener of Local Organising Committee for Indian Strings Meeting held at Puri during Dec 15 – Dec 20, 2014.

Bagchi, Manjari


Balasubramanian, R.

Member of Governing council of Institute of mathematics and applications, Bhubaneshwar during Mar 2014 – Mar 2015.

Chairman of Governing council of Chennai Mathematical institute

Member of DST INSPIRE Faculty award (Mathematics)

Member of Governing Council, HRI, Allahabad
Chairman of Apex committee of National Centre for Mathematics (NCM), POWAI

President of Cryptology Research Society of India, Kolkata

Member of Fellowship Scrutiny Committee The National Academy of Sciences, Allahabad

Member, Board of Management of R,C.Bose centre for cryptology and security, Indian Statistical Institute, kolkata

Chairman of National Board for Higher Mathematics


Member of Review of the mathematics Department of NISER, Bhuvaneshwar during Aug – Aug, 2014.

Chairman of Advisory committee of the Shantiswarup Bhatnagar prize in Mathematical Sciences during Sep – Sep, 2014.

Convener of Local Organising Committee for 18 th workshop on elliptic curve cryptology held at IMSc during Oct 8 – Oct 10, 2014.


Member of Governing council of Indian statistical institute, Kolkatta during Nov 2014 – Mar 2015.

Convener of Local Organising Committee for Annual meeting of the Indian Academy of Science held at IIT Madras during Nov 7 – Nov 9, 2014.

Member of Review committee of mathematics Department of IISER Kolkatta during Mar – Mar, 2015.

Chaudhuri, Pinaki P.


Date, G.

President of Indian Association for General Relativity and Gravitation
Ghosh, Sibasish

Invited speaker at Computer Society of India, Chennai Chapter on Sep 20, 2014. Gave a pedagogical talk on Quantum Computation, entitled, “Introduction to Quantum Computing and Its Potentials”.

Ganguli, Saibal

Selected as AMS Reviewer, for the year 2014, by the American Mathematical Society. 12 reviews in 10 months

Gun, S.

Convener of International Organising Committee for Winter School on modular functions in one and several variables held at Goa University, Goa during Dec 7 – Dec 17, 2014.

Managing Editor at Institute of Mathematical Sciences on Mar 15, 2015. IMSc Lecture Notes Series

Kesavan, S.

Member of Advisory Committee, Centre for Excellence in Mathematics (CEMS), Kumaon University, Almora. during Mar 2013 – Apr 2014.

Member of Editorial Board, Mathematics Newsletter, Ramanujan Mathematical Society

Member of Selection Committee, Abel Visiting Scholars Programme, International Mathematical Union

Member of Steering Board, Indo-French Centre for Applied Mathematics (IFCAM)

Secretary (Grants) of Commission for Developing Countries (CDC) of the International Mathematical Union (IMU)

Member of Academic Council, Chennai Mathematical Institute

Member of National Board for Higher Mathematics

Chair of UGC Review Committee (Mathematics), IISc, Bangalore

Member of Editorial Board, Journal of the Kerala Mathematical Association

Fellow of Forum d’ Analystes

Reviewer of Mathematical Reviews

**Krishna, M.**


**Lodaya, Kamal**

President of Association for logic in India during Feb 2013 – Jan 2015.

Member of Programme committee, 59th European logic colloquium, Vienna during Sep 2013 – Jul 2014.

Member of Programme committee, 11th Theory and applications of models of computation conference, Chennai during Nov 2013 – Apr 2014.

Member of Programme committee, 14th Automata and Formal Languages conference, Szeged during Mar – May, 2014.

Member of 21st Temporal representation and reasoning symposium, Verona during Apr – Sep, 2014.

Member of Programme committee, 34th FSTTCS, New Delhi during Jul – Dec, 2014.

Member of Programme committee, 14th Asian logic conference during Aug 2014 – Jan 2015.

**Mahajan, Meena**

Convener of International Organising Committee for Indo-UK Workshop on Computational Complexity Theory held at IMSc during Jan 5 – Jan 9, 2015.

**Menon, Gautam I.**

Member of Local Organising Committee for Dynamics Days Asia Pacific held at Held jointly between IMSc and IITM during Jul 21 – Jul 24, 2014.

**Mukhopadhyay, Partha**

Member of Local Organising Committee for Indian Strings Meeting 2014 held at Blue Lily Hotel, Puri, India during Dec 15 – Dec 20, 2014.
Nagaraj, D. S.


Prabhakar, Varuni

Maths activity sessions for schools at Besant Arundale Senior Secondary School, Kalakshetra on Sep 1, 2014. Running regular Mathematics activity sessions for students from various age groups at BASS School to help give a hands on understanding of the subject.

Prasad, Amritanshu

Convener of Local Organising Committee for Sage Days workshop on combinatorics and representation theory held at IMSc during Aug 14 – Aug 17, 2014.

Conducted a workshop for school teachers at P S Senior Secondary school, Mylapore on Jan 5, 2015. The workshop was an exploration of the Platonic solids using origami models. Part of GANIT (Growing Aptitude in Numerical Innovations Training), organized by teachers of the school.


Raghavan, K. N.

Secretary of Forum D’Analystes during Apr 2012 – Mar 2015.


Convener of Local Organising Committee for Aspects of Mathematics, a two-day mathematics programme held at IMSc during Jun 30 – Jul 1, 2014.

Acted as “mentor” at DST sponsored INSPIRE program at Vignan University, Guntur on Jun 5, 2014. Lectured to school students on mathematics and on opportunities for higher studies in mathematics.

Mentor in DST INSPIRE programme for school children at Veltech University, Avadi, Chennai on Jul 3, 2014. Lectured to school students on elementary number theory and also about opportunities for higher education in mathematics.

Mentor in DST INSPIRE programme for school students at Madras University, Guindy
Campus on Aug 25, 2014. Lectured to school students on some elementary number theory and also about opportunities for higher education in mathematics.


Mentor in DST INSPIRE programme for school students at Madras University, Guindy Campus on Oct 31, 2014. Lectured to school students on some elementary number theory and also talked about opportunities for higher education in mathematics.

Guest lecture to senior secondary school students at Bala Vidya Mandir Senior Secondary School, Adyar, Chennai on Nov 21, 2014. Gave a lecture on “permutations and combinations”.

Convener of Local Organising Committee for One Per Cent 2014 held at IMSc on Nov 28, 2014.

Mentor in DST INSPIRE programme for school students at SRM University, Kattankulathur, Chennai on Dec 30, 2014. Gave a lecture to school students on fair division of a cake.

Guest lecture during school maths week at Vidya Mandir Senior Secondary School, Mylapore, Chennai on Dec 19, 2014. Gave a lecture to X standard students on fair division of a cake.

Mentor in DST INSPIRE programme for school students at Madras University, Guindy Campus on Dec 29, 2014. Lectured to school students on fair division of a cake and also about opportunities for higher education in mathematics.

Mentor in DST INSPIRE programme for school children at Chennai Institute of Technology, Kundrathur, Chennai on Feb 23, 2015. Lectured to school students on some elementary number theory and also about opportunities for higher education in mathematics.

Convener of Local Organising Committee for Enriching Collegiate Education 2014 held at IMSc during Mar 11 – Mar 13, 2015.

Rajasekaran, G.

Convener of INSA (Chennai Chapter)

Member of Academic Council, CMI

Chairman of Board of Studies in Physics, CMI

Convener of Local Organising Committee for INSA Award Function (IIT, Chennai) 4 August 2014 held at IIT, Chennai on Aug 4, 2014.

Popular Science in TV at New Delhi on Sep 3, 2014. Participated in a live TV panel
discussion on INO and Science in general, in the Rajya Sabha TV.

Popular Science Talk at Inter-Institutional Centre for High Energy Physics, Transition Campus, Madurai on Sep 20, 2014. Talked in Tamil on “Another Great Institution For Madurai” at an INO outreach meeting.

Science in Tamil at Centre for Tamil Culture, Coimbatore on Oct 24, 2014. Talked on the need for writing many popular science books in Tamil. The Centre has accepted this suggestion and is willing to support it.

Member of Local Organising Committee for Annual Meeting of the Indian Academy of Science, IIT, Chennai, 7-9 Nov 2014 held at IIT, Chennai during Nov 7 – Nov 9, 2014.

Lectures at Department of Nuclear Physics, University of Madras on Jan 1, 2015. Lectures on Quantum Mechanics given on alternate Sundays throughout the year.

Popular Science in TV at Madurai and Chennai on Jan 1, 2015. Gave many TV interviews in Tamil on INO and Science in general, on several days.

Lectures and Discussion at Rajarajan Institute of Science Education, Madurai on Jan 17, 2015. Gave lecture in Tamil on INO and answered questions.


Convener of Local Organising Committee for Indian Science Congress 2015, University of Mumbai, 3-7 January 2015, Symposium on HEP held at University of Mumbai during Jan 3 – Jan 7, 2015.

Article in Tamil at Madurai on Feb 1, 2015. “More on INO” in Tamil was published in Muzhumai Ariviyal Udayam, 8, 6153 (2015)

Popular Science Talk at IMSc on Feb 8, 2015. Gave a talk in Tamil about INO in a meeting organized by Tamil Nadu Science Forum.

Raman, Venkatesh

Co-Chair of Program Committee of 34th FSTTCS conference during Nov 2013 – Dec 2014.


Ramanujam, R.

Member of Senate of IIIT-D&M, Kanchipuram during Apr 2011 – Mar 2015.
Member of National Resource Group of Sarva Shikhsha Abhyan, MHRD during Apr 2012 – Mar 2015.

Member of Board of studies in Computer Science, Stella Maris College, Chennai during Apr 2012 – Mar 2015.


Member of Court of Central University of Tamil Nadu, Tiruvarur during Apr 2013 – Mar 2015.


Member of Governing Board of Vigyan Prasar, DST, during Aug 2013 – Mar 2015.

Member, Program Committee of Logical Aspects of Multi-Agent Systems during Jan – Aug, 2014.

Member, Program Committee of 5th International Symposium on on Games, Automata, Logics, and Formal Verification during Feb – Sep, 2014.

Member, Program Committee of 6th Indian Conference on Logic and its Applications during Jun 2014 – Feb 2015.

Convener of International Organising Committee for Second Conference on Creative Mathematical Sciences Communication held at IMSc during Dec 9 – Dec 12, 2014.

Convener of International Organising Committee for Asian Logic conference held at IIT, Bombay during Jan 5 – Jan 8, 2015.


Ray, Purusattam


Samal, Areejit

Sankaran, Parameswaran

Member of Board of Studies, Ramanujan School of Mathematical Sciences, Pondicherry University, Pondicherry during Jan – Apr, 2014.

Member of Board of Studies, Central University of Kerala, Kasargode, Kerala.

Convener of Local Organising Committee for Research in Mathematics held at IMSc on Nov 6, 2014.

Saurabh, Saket

Committee Member of Program committee of 25th International Symposium on Algorithms and Computation(ISSAC) during Jun – Dec, 2014.

Committee member of Program Committee of 9th International Symposium on Parameterized and Exact Computation (IPEC) during Jun – Sep, 2014.

Convener of International Organising Committee for Summer school on parameterized algorithms and complexity held at Bedlewo, Poland during Aug 17 – Aug 22, 2014.


Sinha, Sitabhra

Member of Editorial Board of Frontiers in Fractal Physiology

Adjunct Faculty of National Institute of Advanced Studies

Member of Frontiers in Physics Editorial Board

Chennai Node Coordinator of National Network of Mathematical and Computational Biology

Convener of Local Organising Committee for Dynamics Days Asia Pacific 08 held at IMSc during Jul 21 – Jul 24, 2014.

Convener of Local Organising Committee for IMSc-IITB-IISERP Research Meeting on Physiological Modeling held at IMSc during Sep 1 – Sep 3, 2014.

Convener of Local Organising Committee for Social Networking Workshop, 7th International Conference on COMmunication Systems and NETworkS (COMSNETS) held at Hotel Chancery Pavillion, Bangalore on Jan 6, 2015.

85
Srinivas, K.

Vidyalaya Managing Committee member of Kendriya Vidyalaya, CLRI

Committee member of Vidyalaya Managing Committee

Guest speaker at G. S. Jain Vidyalaya, Chennai on Jul 28, 2014. Delivered a talk on *Careers in Mathematics* to XII std students.


Convener of Local Organising Committee for Enriching Mathematics Education held at IMSc during Oct 16 – Oct 17, 2014.

Convener of Local Organising Committee for One Percent held at IMSc on Nov 28, 2014.

Invited Speaker at Veliammai Engineering College, Chennai on Dec 20, 2014. Delivered a talk entitled *The mathematics behind some elementary looking problems*.


Convener of Local Organising Committee for Enriching Collegiate Education held at IMSc during Mar 11 – Mar 13, 2015.

Subramanian, C. R.

Member of Programme Committee, CALDAM-2015 (First International Conference on Algorithms and Discrete Applied Mathematics), Kanpur during Jun 2014 – Feb 2015.

Sunder, V. S.

Member of Sectional Committee of INSA for Mathematical Sciences

Convener of Local Organising Committee for Master Class in Modular Theory of von Neumann algebras held at IMSc during Nov 24 – Dec 5, 2014.

Chapter 4

Colloquia

4.1 Conferences/Workshops Held at IMSc

4.1.1 Mock Modular Forms and Physics

There have been exciting developments in recent years on mock modular forms and their appearance in a variety of situations in physics:

The discovery of the Mathieu moonshine relates the geometry of K3 surfaces to the representation theory of the Mathieu group M24, and to a certain mock modular form. The Umbral moonshine phenomena generalizes this observation to a sequence of mock modular forms that are related to a corresponding sequence of finite groups, and to the 23 Niemeier lattices.

There is a fascinating interplay between the wall-crossing phenomena in supersymmetric gauge theory and string theory, and the realization of modular or automorphic symmetries in the corresponding systems. In N=4 string compactifications, the degeneracies of supersymmetric black holes have been shown to be Fourier coefficients of mock modular forms. Although some hints have been uncovered, the corresponding general story for N=2 compactifications remains to be developed.

Mock modular forms have been realized as the supersymmetric partition functions of certain non-compact superconformal field theories. These conformal field theories play a key role in the physics of black holes and black strings, and seem to be an important piece of the above puzzles.

In all these explorations, there is a feeling among the researchers that something rich and mysterious remains unknown. It seems very likely that there are underlying structures, perhaps originating in string theory, that unify these a priori different directions. These underlying structures should have implications for representation theory, number theory, geometry, gauge theory and string theory. There has already been some work on bringing these diverse developments together from both a physical and mathematical point of view, but a lot remains to be uncovered.

The idea of the workshop is to bring together people working on different aspects of these problems in an informal environment in order to share new ideas and to encourage cross-
disciplinary collaborations. The workshop will have the participation of international experts working on the above topics, alongside local researchers and students who are new to the topic and wish to learn about it.

4.1.2 Aspects of Mathematics, a two-day mathematics programme

The programme featured eight lectures on various aspects of mathematics by experts engaged in research. It was primarily aimed at advanced undergraduate and postgraduate students of mathematics, but anybody with a college background in mathematics was welcome. About 160 registered online for the programme. About 120 actually participated.

For more information (including links to slides and videos of the lectures), visit http://www.imsc.res.in/knr/past/mathasp14/

4.1.3 Dynamics Days Asia Pacific 08

Dynamics Days Asia Pacific 08 (DDAP 08) was the eighth of a series of major international conferences with a long-standing tradition in nonlinear dynamics. This event was co-hosted by the Indian Institute of Technology-Madras (IIT-M) and Institute of Mathematical Sciences (IMSc). The meeting highlighted nonlinear science research, providing a useful forum for the exchange of ideas, for presenting research, and for catalyzing collaborative research. The scientific program for the meeting consisted of invited and contributed presentations, both oral and poster, and a set of minisymposia.

4.1.4 Sage Days workshop on combinatorics and representation theory

Sage is a community-developed open source mathematical software. It builds on top of many existing open-source packages: NumPy, SciPy, matplotlib, Sympy, Maxima, GAP, FLINT, R and many more.

The participants of the workshop were introduced to the capabilities of Sage and the development process. Time was also devoted to development of Sage.

4.1.5 IMSc-IITB-IISERP Research Meeting on Physiological Modeling

The aim of the meeting was to explore possibility of collaborations based on the connections between the work done by researchers focusing on physiological modeling in IMSc, IIT Bombay and IISER Pune. There were three broad themes. On the first day we looked at models of phenomena that show a transition from quiescent, excitable behavior to oscillatory behavior and back again (as in the uterus and urinary bladder). On the second day we looked at models of networks connecting elements with bursting activity (as in the brain and the
pancreas). The third day was devoted to looking at the worm Caenorhabditis elegans as a model system.

### 4.1.6 18th workshop on elliptic curve cryptology

ECC is an annual workshops dedicated to the study of elliptic curve cryptography and related areas, which started in Waterloo in 1977. Now it has broadened its scope and covers a wide range of areas within modern cryptography. IMSc Chennai and Indian statistical Institute organised the 18th edition with support from NBHM, KU Leuven, Microsoft research, Redmond and CRSI. Balasubramanian was a member of the scientific committee.

### 4.1.7 Enriching Mathematics Education

A two day workshop for school teachers of Chennai Higher Secondary schools was organized as part of Outreach activities of IMSc. About 90 teachers participated in this programme. Lectures and interactive sessions were conducted by IMSc mathematics faculty. This 2-day workshop was aimed at mathematics teachers of classes XI and XII.

This was the third year running that such a workshop was held. The broad goal of this series of workshops is to bring research mathematicians and school teachers together in an effort to enrich mathematics education in schools. Typical activities include lectures on school level mathematics from alternate perspectives, talks on pedagogy, and discussions related to the teaching and learning of mathematics.

In this edition there were 7 talks and one discussion hour.

Nominations for participation were invited from school heads. Nearly 100 teachers representing 40 schools participated in the programme.

For more information (including notes and videos of the entire proceedings), please visit [http://www.imsc.res.in/knr/eme14/](http://www.imsc.res.in/knr/eme14/)

### 4.1.8 Master Class in Modular Theory of von Neumann algebras

See the home-page [http://www.imsc.res.in/sunder/serbichi.html](http://www.imsc.res.in/sunder/serbichi.html) for details of this workshop; or more briefly, see the blurb [http://www.imsc.res.in/sunder/smpost.pdf](http://www.imsc.res.in/sunder/smpost.pdf) for a feeling for this quite unique workshop.

### 4.1.9 Research in Mathematics

A one-day workshop for the city science and engineering college students was organized on the eve of the Annual Meeting of the Indian Academy of Sciences. There were three talks in the morning one each by Rahul Siddharthan, Venkatesh Raman, and R. Shankar. In the afternoon, a documentary on G N Balachandran was screened. Dr R. Ramachandran, the director of the documentary presented the documentary. Finally, there was a panel discussion on ‘Research in Science as a career’.
4.1.10 One Percent

A one-day workshop for higher secondary school children from in and around chennai schools was organized as part of the Institute's Outreach activities.

This is an annual event aimed at students of classes XI and XII. The 2014 edition featured four one-hour talks and a written quiz. Two hundred students from 40 schools, along with 31 school teachers who came as escorts, participated in the event. More information (including videos of the lectures) are available on the web page of the event: http://www.imsc.res.in/ knr/onepercent14/

4.1.11 Second Conference on Creative Mathematical Sciences Communication

This was the second in a conference series that explores new ways of helping students achieve 21st Century competencies in mathematics and computer science, which includes math activities across the curriculum. The main theme of the conference was popularizing the rich mathematics underlying computer science, a new kind of mathematics much of the school / college education community is largely untouched by. The conference featured keynote talks by researchers and communicators with original work in popularizing mathematics and computer science, and sharing of experience by activists with extensive experience in education and outreach.

Details are available at: http://www.imsc.res.in/ cmsc2014/

4.1.12 Indo-UK Workshop on Computational Complexity Theory

The Indo-UK Workshop on Computational Complexity Theory was funded by the EPSRC-DST Indo-UK Initiative in Applied Mathematics, and was organised at IMSc, Chennai, during 5–9 January, 2015.

The Scientific Organisers (Principal Investigators) were Meena Mahajan from IMSc and Rahul Santhanam from the University of Edinburgh, UK. There were 10 participants from the UK, and 50 participants from India (the latter included 33 graduate students).

There were 21 talks spread out over the duration of the workshop. The talks were a mix of survey-style presentations giving an overview of an area and leading up to open problems, and focussed presentations on specific research advances obtained by the speaker. A few slots were set aside for senior graduate students too to present their work. There was one session for discussion of interesting open problems.

The detailed program, as well as abstracts of most talks, are available on the workshop webpage http://www.imsc.res.in/~meena/indo-uk-complexity-workshop-jan2015.html
4.1.13 Fracture: From Micro-scale Processes to Macro Scale Response

Fracture is a fascinating nonlinear dynamic phenomenon that occurs over many length and time scales. In brittle and quasi-brittle systems, small scale perturbations at the micro-scale often lead to large scale fragilities and catastrophic failures. Accordingly, understanding the mechanisms at different length scales and their implications for macroscopic fracture is of vital importance not only to theoretical physicists but also for many engineering, biological and geophysical applications. This meeting aims at a collective understanding of all fields related to multi-scale characterization of these processes. Possible topics may include, but are not limited to, (1) multi-scale experimental investigations of fracture toughness, (2) constitutive modeling appropriate for nucleation of fracture at the micro-scale, and (3) multi-scale computational studies of fracture.

Fracture is a fascinating nonlinear dynamic phenomenon that occurs over many length and time scales. In brittle and quasi-brittle systems, small scale perturbations at the micro-scale often lead to large scale fragilities and catastrophic failures. Accordingly, understanding the mechanisms at different length scales and their implications for macroscopic fracture is of vital importance not only to theoretical physicists but also for many engineering, biological and geophysical applications. This meeting aims at a collective understanding of all fields related to multi-scale characterization of these processes. Possible topics may include, but are not limited to, (1) multi-scale experimental investigations of fracture toughness, (2) constitutive modeling appropriate for nucleation of fracture at the micro-scale, and (3) multi-scale computational studies of fracture.

4.1.14 Instructional Seminar on Logical Aspects of Multi-Agent Systems

LAMAS is an international research network on Logical Aspects of Multi-Agent Systems. There is a growing interdisciplinary community of researchers and research groups working on logical aspects of multi-agent systems from the perspectives of philosophy, artificial intelligence, computer science, game theory, etc. ISLAMAS acted as a forum for sharing research in this area, but with an instructional flavour, largely comprising talks of a tutorial nature by eminent researchers in the area.

For details, see: http://www.imsc.res.in/jam/lamas/lamas.html

4.1.15 Enriching Collegiate Education

A three day workshop was conducted at IMSc for College/University teachers. More than 90 teachers participated in this programme. Lectures on complex analysis, differential equations, finite fields, linear algebra, group theory and number theory were delivered by IMSc faculty. This workshop is intended as an annual event and has been held for the last three years. It is aimed at college and university mathematics teachers. The 2015 edition emphasized problem solving. On each of the three days, there were four interactive sessions, each
of 75 minutes duration. Eighty nine teachers participated. More information is available from the web page of the workshop: http://www.imsc.res.in/ knr/ece15/

4.1.16 IMSc School in Theoretical Physics (ISTP) 2-14 June 2014

Helped the Convener to organize this ISTP in Quantum Mechanics for College Students in and around Chennai
4.2 Other Conferences/Workshops Organized by IMSc

4.2.1 Annual Foundational School–II

Participated as academic convener of the school. Details of the school are available at http://www.imsc.res.in/knr/14mayafs/.

4.2.2 Mathematics Workshop for Students (MWS) 2014

Participated as one of the organizers and as one of three resource persons. About 80 M.Sc. students participated in the workshop.

4.2.3 INSA Award Function (IIT, Chennai) 4 August 2014

As Convener of INSA, Chennai Chapter, organized the function in which Dr Baldev Raj was awarded the Dr Brahm Prakash Award for 2014.

4.2.4 Annual meeting of the Indian Academy of Science

80th annual meeting of the Indian academy of sciences was held at IIT chennaiduring 7-9 Nov 2014. The meeting was hosted by IMSc in association with IIT-M, CLRI, CMI, MSSRF, and IGCAR. Helped to organize a Session on “Neutrinos”

4.2.5 AIS on Schemes and Cohomology.

This is advanced instructional school for 1st year Phd students from allover India.

4.2.6 OTOA 2014


4.2.7 Winter School on modular functions in one and several variables

This advanced instructional school was primarily aimed at graduate students. We had around 30 Indian graduate student participants. There were 20 speakers from all over the world. The speakers covered a wide range of topics starting from classical elliptic modular forms to half-integral weight modular forms, Jacobi forms and its applications and Periods of modular
forms. There were also courses on algebraic Independence of periods of Elliptic curves. The lectures culminated with an initiation to the modern aspect of weakly holomorphic modular forms and Borcherds products.

4.2.8 Indian Strings Meeting

The Indian Strings Meeting 2014 is the seventh in a series of biennial international meetings held in India. These meetings are jointly organized by the Indian string community. The objective is to have a gathering of young and experienced researchers in string theory and related areas in an atmosphere which stimulates expression and elaboration of new ideas. We have a few broad review talks in addition to seminars, followed by focused discussion sessions. IMSc was the main organizer of the event this year.

4.2.9 Indian Science Congress 2015, University of Mumbai, 3-7 January 2015, Symposium on HEP

A HEP Symposium was organized as a part of Indian Science Congress. It’s main theme was to focus attention on a Deep Crisis in Fundamental Physics that can be met only by the discovery of new methods of particle acceleration such as laser plasma acceleration. The Symposium consisted of five talks: 1. A Crisis in Fundamental Physics: G Rajasekaran (IMSc/CMI) 2. Standard Model and Beyond : Shrihari Gopalakrishna (IMSc) 3. Neutrinos and INO : Naba Mondal (TIFR) 4. String Theory and Quantum Gravity: Sunil Mukhi (IISER) 5. Laser Plasma Accelerators : Srinivas Krishnagopal (BARC/CBS)

4.2.10 Asian Logic conference

The Asian Logic Conference series is sponsored by the Association for Symbolic Logic, and the meetings are major international events in mathematical logic. The series features the latest scientific developments in the fields in mathematical logic and its applications, logic in computer science, and philosophical logic. The 14th Asian Logic Conference was held at the Indian Institute of Technology, Bombay, from January 5 to 8, 2015. ALC 2015 was co-located with ICLA 2015, the 6th Indian Conference on Logic and Its Applications to be held during January 8-10, 2015.

For details, see: http://www.cse.iitb.ac.in/alc15/index.html

4.2.11 Social Networking Workshop, 7th International Conference on COMmunication Systems and NETworkS (COMSNETS)

Social networking is profoundly changing the way people communicate and interact on a daily basis. Online social networks are serving as a vital means for supporting information and resource sharing, aiding discovery of connected individuals, improving communication between globally dispersed individuals, and even measuring scientific impact. A significant
fraction of mind-share in the form of applications, diverse access interfaces, and a large economic ecosystem has developed around this field. Going past the simple characterization and enumeration of properties, the networking research community has shown significant interest in attacking various problems associated with social networks. The workshop strove to bring together academic, RD, and industry researchers from these disciplines to address both the science and engineering challenges associated with the rapidly evolving domain of social networking. Its aim was to facilitate cross-disciplinary discussion of relevance to social networking, involving novel ideas and applications, and experimental results, as well as, provide opportunities to compare and contrast the ethological approach to social behaviour in human with web-based evidence of social interaction, perceptual learning, information granulation, the behaviour of humans and affinities between web-based social networks.

4.2.12 Workshop on Design and Analysis of Algorithms

Organized the academic program and gave lectures on ‘amortization’, ‘string matching’ at IIIT, Trivandrum.
### 4.3 Seminars

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Affiliation</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4-2014</td>
<td>Tanumoy Mandal</td>
<td>IMSc/HRI</td>
<td>Phenomenology and LHC Signatures of Exotic Fermions</td>
</tr>
<tr>
<td>1-4-2014</td>
<td>P Sankaran</td>
<td>JSJ decomposition</td>
<td>Topology seminar</td>
</tr>
<tr>
<td>2-4-2014</td>
<td>V. Arvind</td>
<td>IMSc</td>
<td>Complexity Theory Day at IMSc</td>
</tr>
<tr>
<td>2-4-2014</td>
<td>Anamitra Banerjee</td>
<td>University of Tennessee, Knoxville</td>
<td>Some aspects of correlated material phenomena</td>
</tr>
<tr>
<td>2-4-2014</td>
<td>V. Arvind</td>
<td>IMSc</td>
<td>Complexity theory day</td>
</tr>
<tr>
<td>3-4-2014</td>
<td>V. Arvind and others</td>
<td>IMSc</td>
<td>Computational Complexity meeting</td>
</tr>
<tr>
<td>3-4-2014</td>
<td>Santhust Kumar</td>
<td>University of Delhi</td>
<td>Hierarchical structure of B. subtilis transcriptional regulatory network in comparison with E. coli</td>
</tr>
<tr>
<td>3-4-2014</td>
<td>Sreerup Raychaudhuri</td>
<td>Tata Institute of Fundamental Research</td>
<td>Future of SUSY</td>
</tr>
<tr>
<td>4-4-2014</td>
<td>Srikanth Tupurani</td>
<td>IMSc</td>
<td>Skein theories for finite depth subfactor planar algebras</td>
</tr>
<tr>
<td>8-4-2014</td>
<td>Probir Roy</td>
<td>Saha Institute of Nuclear Physics and Centre for Astroparticle Physics and Space Science Bose Institute, Kolkatta</td>
<td>CONSTRAINED ANALYTICAL INTERRELATIONS IN NEUTRINO MIXING</td>
</tr>
<tr>
<td>8-4-2014</td>
<td>P Sankaran</td>
<td>Topology seminar</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Speaker</td>
<td>Institution/University</td>
<td>Topic</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>9-4-2014</td>
<td>Arnab Chatterjee</td>
<td>Aalto University, Espoo, Finland</td>
<td>Statistical physics of social systems</td>
</tr>
<tr>
<td>10-4-2014</td>
<td>Probir Roy</td>
<td>SINP and CAPPS (Bose Institute), Kolkata</td>
<td>DARK ENERGY OF THE UNIVERSE</td>
</tr>
<tr>
<td>10-4-2014</td>
<td>Gautam I. Menon</td>
<td>IMSc</td>
<td>On our research works</td>
</tr>
<tr>
<td>11-4-2014</td>
<td>Panchugopal Bikram</td>
<td>Ben Gurion University</td>
<td>Infinitely many non-extendable semigroups</td>
</tr>
<tr>
<td>11-4-2014</td>
<td>Sumit Giri</td>
<td>IMSc</td>
<td>Bombieri-Vinogradov type theorems for sparse sets of moduli</td>
</tr>
<tr>
<td>14-4-2014</td>
<td>S. R. Hassan</td>
<td>IMSc</td>
<td>On our research works</td>
</tr>
<tr>
<td>15-4-2014</td>
<td>Anish Sarkar</td>
<td>Indian Statistical Institute</td>
<td>Convergence of rightmost paths in super critical oriented percolation to Brownian Web</td>
</tr>
<tr>
<td>15-4-2014</td>
<td>Kunal Dutta</td>
<td>Max-Planck Institute fur Informatik, Saarbrucken, Germany</td>
<td>On Certain Invariants of Random Digraphs and Uniform Hypergraphs</td>
</tr>
<tr>
<td>16-4-2014</td>
<td>Punit Parmananda</td>
<td>Department of Physics, IIT Bombay</td>
<td>Coupling chemo-mechanical oscillators</td>
</tr>
<tr>
<td>23-4-2014</td>
<td>N.D.Hari Dass</td>
<td>TIFR-Hyd, CMI CQIQC</td>
<td>A massive saga</td>
</tr>
<tr>
<td>25-4-2014</td>
<td>Srikanth Tupurani</td>
<td>IMSc</td>
<td>Skein theories for finite depth subfactor planar algebras</td>
</tr>
<tr>
<td>5-5-2014</td>
<td>1st year students</td>
<td>IMSc</td>
<td>Research Methodology</td>
</tr>
<tr>
<td>6-5-2014</td>
<td>1st Year Students</td>
<td>IMSc</td>
<td>Research Methodology</td>
</tr>
<tr>
<td>Date</td>
<td>Speaker</td>
<td>Affiliation</td>
<td>Title</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------</td>
<td>----------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>12-5-2014</td>
<td>A P Balachandran</td>
<td>Syracuse and IISc</td>
<td>Matrix models for QCD</td>
</tr>
<tr>
<td>15-5-2014</td>
<td>Chandan Dalawat</td>
<td>HRI, Allahabad</td>
<td>A sum worthy of Gauss</td>
</tr>
<tr>
<td>21-5-2014</td>
<td>H. Zeen Devi</td>
<td>IMSc</td>
<td>CP violation in charged leptons and neutrinos</td>
</tr>
<tr>
<td>22-5-2014</td>
<td>Nikhil Srivastava</td>
<td>Microsoft Research, Bangalore</td>
<td>The Solution of the Kadison-Singer Problem</td>
</tr>
<tr>
<td>22-5-2014</td>
<td>Rahul Srivastava</td>
<td>IMSc</td>
<td>Predictions from High Scale Mixing Unification Hypothesis</td>
</tr>
<tr>
<td>26-5-2014</td>
<td>Borun D Chowdhury</td>
<td>Arizona State University, U. S. A</td>
<td>A hole-ographic spacetime</td>
</tr>
<tr>
<td>27-5-2014</td>
<td>Borun D Chowdhury</td>
<td>Arizona State University, U. S. A</td>
<td>The case of the missing CFTs</td>
</tr>
<tr>
<td>29-5-2014</td>
<td>Srikanth Tupurani</td>
<td>IMSc</td>
<td>The Tomita-Takesaki theorem</td>
</tr>
<tr>
<td>12-6-2014</td>
<td>Ajay Ramadoss</td>
<td>Indiana University, Bloomington</td>
<td>Representation homology, Lie algebra cohomology and the derived Harish-Chandra homomorphism</td>
</tr>
<tr>
<td>17-6-2014</td>
<td>Ryan Vinroot</td>
<td>College of William and Mary</td>
<td>Rogers-Szegö polynomials: the old and the new</td>
</tr>
<tr>
<td>18-6-2014</td>
<td>R. Balaji</td>
<td>Unvi. of Colorado</td>
<td>On the Mid-Holocene Hydroclimate Wetness over India - Is the Past a Prelude?</td>
</tr>
<tr>
<td>19-6-2014</td>
<td>A T araphder</td>
<td>IIT KGP</td>
<td>Novel Physics in Transition metal dichalcogenides</td>
</tr>
<tr>
<td>20-6-2014</td>
<td>Tulika Maitra</td>
<td>IIT ROORKEE</td>
<td>Modelling correlated electrons in frustrated systems</td>
</tr>
<tr>
<td>24-6-2014</td>
<td>R. Venkatesh</td>
<td>TIFR</td>
<td>Fusion product structure of Demazure modules</td>
</tr>
</tbody>
</table>
24-6-2014  Jose Faro  
Department of Biochemistry, Genetics and Immunology, University of Vigo, Spain  
t-Independent and t-Dependent Lymphocyte Population Studies

25-6-2014  Tanmay Singal  
IMSc  
Minimum Error Discrimination For Linearly Independent States

25-6-2014  Ram Lal Awasthi  
Harich-Chandra Research Institute  
Prospects of experimentally reachable beyond Standard Model physics in non-SUSY SO(10) Grand Unification

26-6-2014  Emilio Faro  
Universidad de Vigo, Spain  
Why should I care about Category Theory?

27-6-2014  S. David  
University of Paris VII  
Baker’s Theorem

28-6-2014  S. David  
University of Paris VII  
Baker’s theorem

30-6-2014  Ravi Kunjwal  
IMSc  
Lessons for logic and quantum theory from Specker’s parable of the overprotective seer

30-6-2014  Anuj Tawari  
IMSc  
Recent Trends in Arithmetic Complexity

30-6-2014  Pierre Matsumi  
IMSc  
Fermat’s Last Theorem

30-6-2014  Sumiran Pujari  
TIFR  
Neel to Valence-Bond Solid transition on the honeycomb

2-7-2014  S. David  
University of Paris VII  
Baker’s theorem

2-7-2014  Kamalakshya Mahatab  
IMSc  
Ehrhart Polynomials

2-7-2014  Roy Joshua  
Ohio State University, Ohio  
Comparison of cohomology operations in motivic and etale cohomology
<table>
<thead>
<tr>
<th>Date</th>
<th>Name</th>
<th>Affiliation</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-7-2014</td>
<td>S. David</td>
<td>University of Paris VII</td>
<td>Baker’s theorem</td>
</tr>
<tr>
<td>3-7-2014</td>
<td>K. Sumesh</td>
<td>IMSc</td>
<td>Bures distance between completely positive maps.</td>
</tr>
<tr>
<td>3-7-2014</td>
<td>Carmen Molina-Paris</td>
<td>University of Leeds</td>
<td>IL7 and T-cell homeostasis</td>
</tr>
<tr>
<td>3-7-2014</td>
<td>Harshavardhan Solanki (summer student)</td>
<td>IIT Kanpur</td>
<td>Regular Path queries on graphs with data</td>
</tr>
<tr>
<td>3-7-2014</td>
<td>Soumyadeep Bhattacharya</td>
<td></td>
<td>Doctoral Committee Meeting</td>
</tr>
<tr>
<td>3-7-2014</td>
<td>Subhadeep Roy</td>
<td></td>
<td>Doctoral Committee Meeting</td>
</tr>
<tr>
<td>4-7-2014</td>
<td>Purabi Mukherji</td>
<td>-</td>
<td>The development of Geometrical Research in Bengal; From Sir Asutosh Mookerjee (1864 - 1924) to Professor M. C. Chaki (1931 - 2007)</td>
</tr>
<tr>
<td>4-7-2014</td>
<td>Swatee Naik</td>
<td>University of Nevada, Reno</td>
<td>Knots and Links: 3- and 4-dimensional aspects</td>
</tr>
<tr>
<td>4-7-2014</td>
<td>N.P. Swaroop</td>
<td>IMSc</td>
<td>The Tau Conjecture and Arithmetic Circuit Lower Bounds</td>
</tr>
<tr>
<td>8-7-2014</td>
<td>K. Sumesh</td>
<td>IMSc</td>
<td>Bures distance between completely positive maps.</td>
</tr>
<tr>
<td>8-7-2014</td>
<td>Rekha Biswal</td>
<td>IMSc</td>
<td>Combinatorial proof of a representation-theoretic identity</td>
</tr>
<tr>
<td>9-7-2014</td>
<td>Tarun Kanti Ghosh</td>
<td>Indian Institute of Technology, Kanpur</td>
<td>Novel properties of spin-orbit coupled two-dimensional fermionic systems</td>
</tr>
<tr>
<td>10-7-2014</td>
<td>Seshadri Chintapalli</td>
<td>TIFR, Mumbai</td>
<td>Semistability and embedding theorems</td>
</tr>
<tr>
<td>10-7-2014</td>
<td>Anish Mukherjee</td>
<td>Chennai Mathematical Institute</td>
<td>A survey on the exact exponential -time complexity of SAT</td>
</tr>
<tr>
<td>Date</td>
<td>Name</td>
<td>Affiliation</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------</td>
<td>------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>10-7-2014</td>
<td>Yeshonidhi Pandey</td>
<td>IISER, Mohali</td>
<td>Properness of degenerate quadratic bundles</td>
</tr>
<tr>
<td>10-7-2014</td>
<td>Vinod Kumarappan</td>
<td>Kansas State University</td>
<td>Laser-driven rotational wavepackets in asymmetric top molecules: A route to molecular frame measurements</td>
</tr>
<tr>
<td>11-7-2014</td>
<td>Veeky Baths</td>
<td>BITS Goa</td>
<td>Disruption of Fatty Acid Biosynthesis in Mycobacterium Tuberculosis: Using graph-theoretic approaches</td>
</tr>
<tr>
<td>15-7-2014</td>
<td>S. Govindarajan</td>
<td>Indian Institute of Technology, Madras, Chennai</td>
<td>Estimating the asymptotics of solid partitions</td>
</tr>
<tr>
<td>15-7-2014</td>
<td>T. Geetha</td>
<td>IMSc</td>
<td>Jucys-Murphy elements for Brauer Algebra</td>
</tr>
<tr>
<td>17-7-2014</td>
<td>Rahul Dandekar</td>
<td>TIFR, Mumbai</td>
<td>Growing patterns in the rotor-router model and the KPZ class</td>
</tr>
<tr>
<td>18-7-2014</td>
<td>Michael Renardy</td>
<td>Virginia Tech, USA</td>
<td>Null controllability of the linearized compressible Navier-Stokes system in one dimension</td>
</tr>
<tr>
<td>18-7-2014</td>
<td>K. Sumesh</td>
<td>IMSc</td>
<td>Bures distance and CP maps-iii</td>
</tr>
<tr>
<td>22-7-2014</td>
<td>Muthuvel Murugan</td>
<td>CMI</td>
<td>Convex Optimization - Random Walks, Localization Lemma and an Isoperimetric Inequality</td>
</tr>
<tr>
<td>22-7-2014</td>
<td>Ritwik Mukherjee</td>
<td>IMSc</td>
<td>Distribution of a biased Coin Toss</td>
</tr>
<tr>
<td>24-7-2014</td>
<td>Nanda Kishore</td>
<td>IISc, Bangaluru</td>
<td>Spectral distributions of Products of Random Matrices</td>
</tr>
<tr>
<td>25-7-2014</td>
<td>Jayadev Athreya</td>
<td>University of Illinois at Urbana-Champaign</td>
<td>Effective Quantitative Oppenheim for almost every quadratic form</td>
</tr>
<tr>
<td>28-7-2014</td>
<td>K. Sumesh</td>
<td>IMSc</td>
<td>CP maps and Bures Distance- iv</td>
</tr>
<tr>
<td>Date</td>
<td>Presenter</td>
<td>Title</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>30-7-2014</td>
<td>B Ravinder, IMSc</td>
<td>Area maximizing Gelfand-Tsetlin patterns</td>
<td></td>
</tr>
<tr>
<td>30-7-2014</td>
<td>Ekata Saha, IMSc</td>
<td>Generalized Euler Lehmer constants</td>
<td></td>
</tr>
<tr>
<td>1-8-2014</td>
<td>M. Ram Murty, Queen’s University, Canada</td>
<td>Ramanujan expansions and twin primes</td>
<td></td>
</tr>
<tr>
<td>1-8-2014</td>
<td>Snigdhayan Mahanta, University of Muenster</td>
<td>Homotopy and homology of non-commutative spaces</td>
<td></td>
</tr>
<tr>
<td>1-8-2014</td>
<td>C. P. Anilkumar, ISI Bangalore</td>
<td>Orbits of Pairs in Finite Modules over Discrete Valuation Rings and Permutation Representations</td>
<td></td>
</tr>
<tr>
<td>4-8-2014</td>
<td>K. Sumesh, IMSc</td>
<td>CP Maps and Bures Distance iv</td>
<td></td>
</tr>
<tr>
<td>5-8-2014</td>
<td>Amritanshu Prasad, IMSc</td>
<td>Length Generating Functions for Right-Angled Groups and Monoids</td>
<td></td>
</tr>
<tr>
<td>5-8-2014</td>
<td>Gloria Kang and Kaja Abbas, Department of Population Health Sciences, Virginia Tech, USA</td>
<td>Epidemiological modeling of infectious diseases</td>
<td></td>
</tr>
<tr>
<td>7-8-2014</td>
<td>Shamik Gupta, Universite Paris-Sud, Orsay</td>
<td>Thermodynamics and dynamics of systems with long-range interactions</td>
<td></td>
</tr>
<tr>
<td>7-8-2014</td>
<td>Karl-Dieter Crisman, Gordon College</td>
<td>A Sampler of the Mathematics of Voting and Choice</td>
<td></td>
</tr>
<tr>
<td>7-8-2014</td>
<td>K. Sumesh, IMSc</td>
<td>CP maps and Bures Distance</td>
<td></td>
</tr>
<tr>
<td>8-8-2014</td>
<td>Director, DAAD Information Center, Chennai</td>
<td>Research and Funding Opportunities in Germany</td>
<td></td>
</tr>
<tr>
<td>8-8-2014</td>
<td>Neha Lodha, IMSc</td>
<td>Consensus through communication</td>
<td></td>
</tr>
<tr>
<td>8-8-2014</td>
<td>E. C. G. Sudarshan, Dept. of Physics, University of Texas, Austin</td>
<td>A second look at the Quantum Zeno Effect</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Name</td>
<td>Affiliation</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------</td>
<td>--------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>8-8-2014</td>
<td>M. Ram Murty</td>
<td>Queen’s University, Kingston, Ontario, Canada</td>
<td>Ramanujan Graphs and the Kadison-Singer Problem</td>
</tr>
<tr>
<td>12-8-2014</td>
<td>Siddharth Parameswaran</td>
<td>University of California, Irvine</td>
<td>Quantum Revivals and Many-Body Localization</td>
</tr>
<tr>
<td>14-8-2014</td>
<td>Dhriti Ranjan Dolai</td>
<td>IMSc</td>
<td>Spectral Statistic of Random Schrodinger Operator with Singular Continuous Potential.</td>
</tr>
<tr>
<td>16-8-2014</td>
<td>Soma Dutta</td>
<td>IMSc</td>
<td>Godel Incompleteness Theorem 2</td>
</tr>
<tr>
<td>19-8-2014</td>
<td>Natasha Mhatre</td>
<td>University of Bristol</td>
<td>A tool to sing louder and an amplifier to hear better: biophysical innovation in a tree cricket</td>
</tr>
<tr>
<td>19-8-2014</td>
<td>Venkat Akirshnan Ramaswamy</td>
<td>Interdisciplinary Center for Neural Computation, The Hebrew University of Jerusalem</td>
<td>Theoretical Connectomics</td>
</tr>
<tr>
<td>21-8-2014</td>
<td>Nitin Saurabh</td>
<td>IMSc</td>
<td>An Improved Deterministic SAT Algorithm for Small De Morgan Formulas</td>
</tr>
<tr>
<td>21-8-2014</td>
<td>R. Parthasarathy</td>
<td>Bharatiyar University</td>
<td>Classification of Discrete series by lowest K type</td>
</tr>
<tr>
<td>25-8-2014</td>
<td>Rajesh Gupta</td>
<td>ICTP, Trieste</td>
<td>Some Developments in Computation of Quantum Entropy of Extremal Black Hole</td>
</tr>
<tr>
<td>26-8-2014</td>
<td>Fahad Panolan</td>
<td>IMSc Chennai</td>
<td>Representative Sets of Product Families</td>
</tr>
<tr>
<td>27-8-2014</td>
<td>Abhijit Chakraborty</td>
<td>S N Bose National Centre for Basic Sciences</td>
<td>Some studies of complex networks in multidisciplinary fields</td>
</tr>
<tr>
<td>28-8-2014</td>
<td>Daphne Lopez</td>
<td>VIT, Vellore</td>
<td>Big Data Analytics for Predicting Seasonal Diseases under Climate Change Conditions</td>
</tr>
<tr>
<td>Date</td>
<td>Name</td>
<td>Organization</td>
<td>Topic</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------</td>
<td>--------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>28-8-2014</td>
<td>Arghya Mondal</td>
<td>IMSc</td>
<td>The Banach-Tarski paradox and Amenability</td>
</tr>
<tr>
<td>1-9-2014</td>
<td>Ipsita Mandal</td>
<td>Perimeter Institute, Canada</td>
<td>Low Energy Physics of a Non-Fermi Liquid System</td>
</tr>
<tr>
<td>1-9-2014</td>
<td>Pranan Goel</td>
<td>IISER Pune</td>
<td>How two-timescale singular perturbation methods help understand bursting in neuronal models</td>
</tr>
<tr>
<td>1-9-2014</td>
<td>Prakash Belkale</td>
<td>University of North Carolina</td>
<td>Numerically effective divisors on the moduli space of curves from conformal field theory</td>
</tr>
<tr>
<td>2-9-2014</td>
<td>Sumilan Banerjee</td>
<td>Ohio State University</td>
<td>Quantum oscillations in high-temperature superconductors</td>
</tr>
<tr>
<td>2-9-2014</td>
<td>Rohit Manchanda</td>
<td>Department of Biosciences and Bioengineering, IIT Bombay</td>
<td>Maths and Biology: Strange Bedfells No More?</td>
</tr>
<tr>
<td>2-9-2014</td>
<td>Prakash Belkale</td>
<td>UNC Chapel Hill</td>
<td>Horn's conjecture, saturation conjecture and the Littlewood-Richardson rule</td>
</tr>
<tr>
<td>3-9-2014</td>
<td>Arunprasath</td>
<td>IISc</td>
<td>Top polarization measurement and anomalous Wtb coupling</td>
</tr>
<tr>
<td>3-9-2014</td>
<td>Arghya Mondal</td>
<td></td>
<td>Bounded cohomology</td>
</tr>
<tr>
<td>5-9-2014</td>
<td>Souradeep Majumder</td>
<td>IMSc</td>
<td>Principal bundles on root stacks</td>
</tr>
<tr>
<td>8-9-2014</td>
<td>T Jesan</td>
<td>IMSc and BARC Kalpakkam</td>
<td>Systems Biology: From the cell to society</td>
</tr>
<tr>
<td>9-9-2014</td>
<td>Rabeya Basu</td>
<td>IISER, Pune</td>
<td>Results in classical algebraic K-theory</td>
</tr>
<tr>
<td>10-9-2014</td>
<td>Arghya Mondal</td>
<td>IMSc</td>
<td>Bounded cohomology</td>
</tr>
<tr>
<td>11-9-2014</td>
<td>Prahlad Vaidyanathan</td>
<td>IISER, Bhopal</td>
<td>Classification of Continuous Fields of C* Algebras</td>
</tr>
<tr>
<td>Date</td>
<td>Name</td>
<td>Institution</td>
<td>Title</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------</td>
<td>--------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>11-9-2014</td>
<td>Neeraj Kumar</td>
<td>IMSc</td>
<td>Newton’s symmetric polynomials and some open problems</td>
</tr>
<tr>
<td>12-9-2014</td>
<td>Krishanu Dan</td>
<td>IMSc</td>
<td>Certain Vector Bundles over Symmetric Product of Curves</td>
</tr>
<tr>
<td>13-9-2014</td>
<td>Priyamvad Srivastav</td>
<td>IMSc</td>
<td>Early Approach to the Twin Prime Problem</td>
</tr>
<tr>
<td>16-9-2014</td>
<td>Amritanshu Prasad</td>
<td>IMSc</td>
<td>Cartier-Foata monoids, heaps of pieces and chromatic polynomials</td>
</tr>
<tr>
<td>17-9-2014</td>
<td>Aprameyan Parthasarathy</td>
<td>Universitt Paderborn.</td>
<td>Scattering theory on symmetric spaces</td>
</tr>
<tr>
<td>17-9-2014</td>
<td>Arghya Mondal</td>
<td>IMSc</td>
<td>Bounded cohomology</td>
</tr>
<tr>
<td>18-9-2014</td>
<td>Joyjit Kundu</td>
<td>IMSc</td>
<td>Phase transitions in hard core lattice gas models of anisotropic particles</td>
</tr>
<tr>
<td>18-9-2014</td>
<td>Prateep Chakraborty</td>
<td>ISI, Bangaluru</td>
<td>Formality of certain CW complexes and applications</td>
</tr>
<tr>
<td>18-9-2014</td>
<td>Anish Mallick</td>
<td>IMSc</td>
<td>Kotani theory for 1 dimensional jacobi matrices</td>
</tr>
<tr>
<td>19-9-2014</td>
<td>Arghya Mondal</td>
<td>IMSc</td>
<td>Bounded cohomology</td>
</tr>
<tr>
<td>22-9-2014</td>
<td>Arghya Mondal</td>
<td>IMSc</td>
<td>Bounded cohomology</td>
</tr>
<tr>
<td>24-9-2014</td>
<td>Tuhina A Mark</td>
<td>Brown University, School of Engineering, 02912 Providence RI, USA</td>
<td>Theory of stress effects on catalysis at close-packed surfaces</td>
</tr>
<tr>
<td>26-9-2014</td>
<td>Anirban Mukhopadhyay</td>
<td>IMSc</td>
<td>Smooth numbers in arithmetic progression</td>
</tr>
<tr>
<td>29-9-2014</td>
<td>Naveen Gaur</td>
<td>University of Delhi (Dyal Singh College)</td>
<td>Vector-like top-partner multiplets in a realistic mixing setup</td>
</tr>
<tr>
<td>Date</td>
<td>Name</td>
<td>Affiliation</td>
<td>Title</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------</td>
<td>---------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>1-10-2014</td>
<td>Manjari Bagchi</td>
<td>IMSc</td>
<td>Atypical Neutron Star Binaries and Triples</td>
</tr>
<tr>
<td>6-10-2014</td>
<td>Raghu Raghavan</td>
<td>Therataxis, USA</td>
<td>The Soups and The Sparks</td>
</tr>
<tr>
<td>6-10-2014</td>
<td>Raghu Raghavan</td>
<td>Therataxis, USA</td>
<td>A mechanical view of the misfolding of a-synuclein</td>
</tr>
<tr>
<td>8-10-2014</td>
<td>A.P. Balachandran</td>
<td>CHEP, IISc Bangalore</td>
<td>Dark Radiation from Self-Dual Gravity</td>
</tr>
<tr>
<td>9-10-2014</td>
<td>S. Boecherer</td>
<td></td>
<td>What is NOT known about Eisenstein series ?</td>
</tr>
<tr>
<td>10-10-2014</td>
<td>Shreedevi Masuti</td>
<td>IMSc</td>
<td>Bhattacharya and Hilbert Coefficients</td>
</tr>
<tr>
<td>14-10-2014</td>
<td>Upayan Baul</td>
<td>IMSc</td>
<td>Interaction of multiple biomimetic antimicrobial polymers with model bacterial membranes</td>
</tr>
<tr>
<td>15-10-2014</td>
<td>B Sathiapalan</td>
<td>IMSc</td>
<td>Schwinger Effect and Negative Differential Conductivity in Holographic Models</td>
</tr>
<tr>
<td>16-10-2014</td>
<td>Manimala Mitra</td>
<td>IPPP Durham University</td>
<td>On the Origin of Neutrino Mass and Experimental Searches</td>
</tr>
<tr>
<td>16-10-2014</td>
<td>Kamalakshya Mahatab</td>
<td>IMSc</td>
<td>Eliminating linear relations in combinatorial enumerations</td>
</tr>
<tr>
<td>17-10-2014</td>
<td>SAIBAL GANGULI</td>
<td>IMSc</td>
<td>MCKAY CORESPONDENCE IN QUASI-TORIC ORBIFOLDS</td>
</tr>
<tr>
<td>17-10-2014</td>
<td>Priya Ramesh</td>
<td></td>
<td>Counselling at IMSc</td>
</tr>
<tr>
<td>21-10-2014</td>
<td>Arjun Krishman</td>
<td>Princeton University</td>
<td>Understanding multicellular function and disease with human tissue-specific networks</td>
</tr>
<tr>
<td>27-10-2014</td>
<td>Prasanta Tripathy</td>
<td>IITM, Chennai</td>
<td>Multiple Single-Centered Attractors</td>
</tr>
<tr>
<td>Date</td>
<td>Speaker</td>
<td>Institution</td>
<td>Topic</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------</td>
<td>----------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>27-10-2014</td>
<td>Raghavan Rangarajan</td>
<td>Physical Research Laboratory</td>
<td>Gravitinos, Reheating and the Matter-Antimatter Asymmetry of the Universe</td>
</tr>
<tr>
<td>30-10-2014</td>
<td>Nirmalya Kajuri</td>
<td>IMSc</td>
<td>Path Integrals in Polymer Quantized Scalar Fields</td>
</tr>
<tr>
<td>31-10-2014</td>
<td>Anirban Mukhopadhyay</td>
<td>IMSc</td>
<td>Duality of large sieve and Selberg sieve</td>
</tr>
<tr>
<td>3-11-2014</td>
<td>Tridip Sadhu</td>
<td>CEA Saclay</td>
<td>Macroscopic fluctuation theory and its application.</td>
</tr>
<tr>
<td>6-11-2014</td>
<td>Krishanu Dan</td>
<td>IMSc</td>
<td>Completability of Unimodular Rows</td>
</tr>
<tr>
<td>11-11-2014</td>
<td>Satish Kitambi</td>
<td>Division of Molecular Neurobiology, Karolinska Institute, Sweden</td>
<td>The soft underbelly of cancer cells; Acquired vulnerability of glioblastoma cells to catastrophic vacuolization and death</td>
</tr>
<tr>
<td>12-11-2014</td>
<td>Hidenori Sonoda</td>
<td>Kobe University, Japan</td>
<td>Renormalization for harmonic oscillators</td>
</tr>
<tr>
<td>12-11-2014</td>
<td>Meena Mahajan</td>
<td>IMSc</td>
<td>Homomorphism polynomials complete for VP</td>
</tr>
<tr>
<td>12-11-2014</td>
<td>Anupam Kumar Singh</td>
<td>IISER Pune</td>
<td>Row-Column operations in (finite) classical groups</td>
</tr>
<tr>
<td>13-11-2014</td>
<td>Anupam Kumar Singh</td>
<td>IISER, Pune</td>
<td>Word problem in finite classical Chevalley groups</td>
</tr>
<tr>
<td>13-11-2014</td>
<td>Sayan Bhattacharya</td>
<td>IMSc</td>
<td>Deterministic fully dynamic data structures for vertex cover and matching</td>
</tr>
<tr>
<td>17-11-2014</td>
<td>Bijan Saha</td>
<td>Joint Institute for Nuclear Research, Dubna</td>
<td>Spinoor field in Cosmology and the problem of isotropization</td>
</tr>
<tr>
<td>18-11-2014</td>
<td>Hidenori Sonoda</td>
<td>Kobe University</td>
<td>Lecture on ERG</td>
</tr>
<tr>
<td>Date</td>
<td>Name</td>
<td>Institution</td>
<td>Title</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------------</td>
<td>--------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>18-11-2014</td>
<td>Debajyoti Nandi</td>
<td>Rutgers University</td>
<td>Combinatorial identities arising from representation theory of affine Lie algebras using vertex-operator-theoretic techniques</td>
</tr>
<tr>
<td>19-11-2014</td>
<td>Soumyajyoti Biswas</td>
<td>IMSC, Chennai</td>
<td>Equivalence of earthquakes and interface propagation in disordered media: Models and avalanche statistics</td>
</tr>
<tr>
<td>20-11-2014</td>
<td>Ramesh Sreekantan</td>
<td>ISI, Bangaluru</td>
<td>Algebraic Cycles and the Fundamental Group</td>
</tr>
<tr>
<td>20-11-2014</td>
<td>Hidenori Sonoda</td>
<td>Kobe University</td>
<td>Lecture on ERG</td>
</tr>
<tr>
<td>24-11-2014</td>
<td>50 - a Celebration</td>
<td>G. Baskaran</td>
<td>ICTP</td>
</tr>
<tr>
<td>25-11-2014</td>
<td>Alexander Guterman</td>
<td>Moscow State University</td>
<td>Invitation to Tropical Linear Algebra</td>
</tr>
<tr>
<td>26-11-2014</td>
<td>Saumia P. S.</td>
<td>IMSc</td>
<td>Baryons in Heavy-Ion Collisions</td>
</tr>
<tr>
<td>1-12-2014</td>
<td>Prabhakar Mateti</td>
<td>Wright State University</td>
<td>Semantics of programs</td>
</tr>
<tr>
<td>1-12-2014</td>
<td>Raghavan Rangarajan</td>
<td>Physical Research Laboratory</td>
<td>Inflation after Planck and BICEP2</td>
</tr>
<tr>
<td>2-12-2014</td>
<td>M Sivakumar</td>
<td>University of Hyderabad</td>
<td>Higher spin theories: From Dirac to Vasiliev</td>
</tr>
<tr>
<td>3-12-2014</td>
<td>Saurabh Niyogi</td>
<td>IMSc</td>
<td>Multileptons and top-jets in the hunt for gluinos in RPV Supersymmetry</td>
</tr>
<tr>
<td>4-12-2014</td>
<td>Gautami Bhowmik</td>
<td>University of Lille 1, France</td>
<td>Goldback Generating Functions</td>
</tr>
<tr>
<td>16-12-2014</td>
<td>Ayan Banerjee</td>
<td>IISER-Kolkata</td>
<td>Study and manipulation of meso-scale systems using optical tweezers</td>
</tr>
<tr>
<td>Date</td>
<td>Name</td>
<td>Institution</td>
<td>Title</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------</td>
<td>--------------------------------------------------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>17-12-2014</td>
<td>Aswin Sai Narain Seshasayee</td>
<td>NCBS Bangalore</td>
<td>Xenogene silencing, stress response and chromosome architecture in E. coli</td>
</tr>
<tr>
<td>18-12-2014</td>
<td>Anirban Bose</td>
<td>IMSc, Chennai</td>
<td>Real elements in groups of type $F_4$</td>
</tr>
<tr>
<td>22-12-2014</td>
<td>Nikolai Tyurin</td>
<td>BLTP, JINR</td>
<td>Special lagrangian submanifolds I</td>
</tr>
<tr>
<td>23-12-2014</td>
<td>Nikolai Tyurin</td>
<td>BLTP, JINR</td>
<td>Special lagrangian submanifolds II</td>
</tr>
<tr>
<td>23-12-2014</td>
<td>Deepa Thomas</td>
<td>U Texas at Austin</td>
<td>Measurements of heavy-flavour decay electrons with ALICE at LHC</td>
</tr>
<tr>
<td>29-12-2014</td>
<td>Thanu Padmanabhan</td>
<td>IUCAA, Pune</td>
<td>Emergent Gravity Paradigm: Recent Advances</td>
</tr>
<tr>
<td>1-1-2015</td>
<td>Harald Upmeier</td>
<td>University of Marburg, Germany</td>
<td>Holomorphic Vector Bundles and Intertwining Operators over Symmetric Domains</td>
</tr>
<tr>
<td>30-12-2014</td>
<td>M. Ram Murty</td>
<td>Queen’s University, Canada</td>
<td>The Chowla problem and generalizations</td>
</tr>
<tr>
<td>30-12-2014</td>
<td>Anindita Ganguly</td>
<td>Dept of Electrical Engineering, St. Thomas’ College of Engineering and Technology, Kolkata</td>
<td>Introduction to Control Theory</td>
</tr>
<tr>
<td>1-1-2015</td>
<td>Varun Sreenivasan</td>
<td>Laboratory of Sensory Processing, Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland</td>
<td>Motor control in the rodent whisker system</td>
</tr>
<tr>
<td>2-1-2015</td>
<td>Harald Upmeier</td>
<td>Univ. of Marbour</td>
<td>Dixmier trace of Toeplitz operators on bounded symmetric domains</td>
</tr>
<tr>
<td>9-1-2015</td>
<td>Karteek Sreenivasaiah</td>
<td>IMSc, Chennai</td>
<td>On verifying proofs in constant depth, and polynomial identity testing (HBNI PhD Defense)</td>
</tr>
</tbody>
</table>
9-1-2015 Rajat Bhadhuri
Mcmaster University, Hamilton, Canada
Dark Matter and Dark Energy from Bose-Einstein Condensate

9-1-2015 Kaja Abbas
Department of Population Health Sciences, Virginia Tech, USA
Epidemiological Modeling of Zoonotic Diseases

12-1-2015 S. Kalyana Rama
IMSc
Singularity Resolution + Unitary Evolution + Horizon = Firewall ?

12-1-2015 S. R. S. Varadhan
New York University
Compactness and Large Deviations

13-1-2015 Abhishek Majhi
IMSc
Energy spectrum of equilibrium black holes in LQG

13-1-2015 Kunal Dutta
Max-Planck Institute fur Informatik, Germany
Size-sensitive packing number for the Hamming cube and its consequences

14-1-2015 K. B. Athreya
Iowa State University
Statistical Estimation of integrals w.r.t infinite measures

16-1-2015 Kabir Ramola
LPTMS, Paris
Correlated Extreme Values in Branching Brownian Motion

19-1-2015 Amitabha Nandi
Max-Planck Institute for the Physics of Complex Systems, Dresden, Germany
Active mechanics and dynamics of epithelia during morphogenesis

19-1-2015 Philibert Nang
ENS, Gabon
Introduction to D-modules, definition of D-modules, coherent D-modules, characteristic variety associated to D-module, Examples

19-1-2015 S. R. S. Varadhan
New York University
Entropy and Probablity

20-1-2015 N D Hari Dass
TIFR-TCIS Hyderabad, & CQIQC
Non-GR approaches to Gravitational Radiation
<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Institution/Location</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-1-2015</td>
<td>Rakesh Chatterjee</td>
<td>IMSc Chennai</td>
<td>Statistical perspectives of symmetric and asymmetric exclusion in closed geometries</td>
</tr>
<tr>
<td>22-1-2015</td>
<td>Sujit Das</td>
<td>Martin Luther University Halle-Wittenberg</td>
<td>Antiferromagnetic coupling due to charge transfer in transition metal oxide heterostructures</td>
</tr>
<tr>
<td>22-1-2015</td>
<td>Peter Symonds</td>
<td>University of Manchester</td>
<td>Groups of power series under substitution and automorphisms of curves.</td>
</tr>
<tr>
<td>22-1-2015</td>
<td>Saptarshi Mandal</td>
<td>ICTP</td>
<td>Frustrated Magnetism on Hollandite lattice</td>
</tr>
<tr>
<td>23-1-2015</td>
<td>Ramakrishnan Natesan</td>
<td>Dept. of Bioengineering, University of Pennsylvania, USA</td>
<td>Multiscale Approaches to Understand Membrane Morphogenesis and Applications to Targeted Drug Delivery</td>
</tr>
<tr>
<td>23-1-2015</td>
<td>Atul Dixit</td>
<td>Tulane University</td>
<td>Ramanujan, Vorono summation formula, circle and divisor problems and some modular transformations</td>
</tr>
<tr>
<td>27-1-2015</td>
<td>Soavn Chakraborty</td>
<td>Max-Planck-Institut fur Physik at Munich</td>
<td>Neutrino Astrophysics: Challenges and Possibilities</td>
</tr>
<tr>
<td>28-1-2015</td>
<td>L Srimukumar</td>
<td>IIT Madras</td>
<td>Inflationary three-point functions</td>
</tr>
<tr>
<td>29-1-2015</td>
<td>Sumesh Thampi</td>
<td>Oxford University</td>
<td>Active Turbulence</td>
</tr>
<tr>
<td>2-2-2015</td>
<td>Kalyan Banerjee</td>
<td>IMSc, Chennai</td>
<td>Rational equivalence of algebraic cycles supported on a general hyperplane section</td>
</tr>
<tr>
<td>3-2-2015</td>
<td>Manikandan Narayanan</td>
<td>NIAID, NIH, Bethesda, MD, USA</td>
<td>Computational challenges in network biology: from brain tissues to single cells</td>
</tr>
<tr>
<td>Date</td>
<td>Name</td>
<td>Affiliation</td>
<td>Title</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------</td>
<td>------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>4-2-2015</td>
<td>Arun Thalapillil</td>
<td>NHETC, Rutgers University</td>
<td>The Higgs as a Probe for New Physics: Higgs Portals, Soft Yukawas and Extended Gauge Mediation</td>
</tr>
<tr>
<td>5-2-2015</td>
<td>Rahul Srivastava</td>
<td>IMSc</td>
<td>Dirac or Inverse Seesaw Neutrino Masses with B-L Gauge Symmetry and S3 Flavour Symmetry</td>
</tr>
<tr>
<td>6-2-2015</td>
<td>Sudhir N Pathak</td>
<td>IMSc</td>
<td>Large scale behaviour of the freely cooling granular gas</td>
</tr>
<tr>
<td>6-2-2015</td>
<td>Hans van Ditmarsch</td>
<td>LORIA, Nancy, France</td>
<td>Five Funny Bisimulations</td>
</tr>
<tr>
<td>9-2-2015</td>
<td>Satyajit Guin</td>
<td>ISI, Delhi</td>
<td>Differential Calculus and YM Functional in NCG</td>
</tr>
<tr>
<td>9-2-2015</td>
<td>Sanchari Goswami</td>
<td>S. N. Bose National centre for Basic Sciences</td>
<td>Quantum Random Walk: Overview and recent results</td>
</tr>
<tr>
<td>11-2-2015</td>
<td>Justin David</td>
<td></td>
<td>A universal correction to higher spin entanglement entropy</td>
</tr>
<tr>
<td>11-2-2015</td>
<td>Neeraj Manhas</td>
<td>Dept of Mathematics, NIT, Bhopal India</td>
<td>Modelling the transition from simple to complex Ca2+ oscillations in pancreatic acinar cells</td>
</tr>
<tr>
<td>12-2-2015</td>
<td>Xavier Viennot</td>
<td>Laboratoire Bordelais de Recherche en Informatique, Bordeaux</td>
<td>The birth of a New Domain: Combinatorial Physics</td>
</tr>
<tr>
<td>16-2-2015</td>
<td>Siddharth Barman</td>
<td>California Institute of Technology</td>
<td>Approximating and Testing Equilibria</td>
</tr>
<tr>
<td>16-2-2015</td>
<td>Sayak Mukherjee</td>
<td>Ohio State University, Columbus OH, USA</td>
<td>Understanding Cell Signaling: Model, Mechanism Inference</td>
</tr>
<tr>
<td>17-2-2015</td>
<td>Vidyanand Nanjundiah</td>
<td>MRDG and CES, Indian Institute of Science, Bangalore</td>
<td>A Present-Day View of Evolutionary Theory</td>
</tr>
<tr>
<td>Date</td>
<td>Name</td>
<td>Affiliation</td>
<td>Title</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------</td>
<td>------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>17-2-2015</td>
<td>Uday Bhaskar Sharma</td>
<td>IMSc</td>
<td>Asymptotic for Counting Similarity Classes of Tuples of Commuting Matrices</td>
</tr>
<tr>
<td>17-2-2015</td>
<td>Vijay Ganesh</td>
<td>University of Waterloo, Canada</td>
<td>Impact of community structure on SAT solver performance</td>
</tr>
<tr>
<td>18-2-2015</td>
<td>R. Ganesh</td>
<td>IMSc</td>
<td>Topology in a quantum magnet</td>
</tr>
<tr>
<td>18-2-2015</td>
<td>Vidyanand Nanjundiah</td>
<td>IISc Bangalore</td>
<td>Darwin’s “One Special Difficulty” as seen in the cellular slime moulds</td>
</tr>
<tr>
<td>19-2-2015</td>
<td>Dileep Jatkar</td>
<td>HRI</td>
<td>Analytic Structure of Some Interpolating Functions</td>
</tr>
<tr>
<td>20-2-2015</td>
<td>G Rajasekaran</td>
<td>IMSc CMI</td>
<td>Hundred years of Fundamental Physics and a Crisis</td>
</tr>
<tr>
<td>23-2-2015</td>
<td>Ethayaraja Mani</td>
<td>Department of Chemical Engineering, IIT-Madras</td>
<td>Finite-sized clusters in passive and active colloidal suspensions</td>
</tr>
<tr>
<td>23-2-2015</td>
<td>Saikat Guha</td>
<td>Microsoft Research India, Bangalore</td>
<td>Towards Catching Click-Spam on Facebook Ads</td>
</tr>
<tr>
<td>24-2-2015</td>
<td>Ashwin Joy</td>
<td>IPR, Gandhinagar</td>
<td>Microscopic Origin of Shear Relaxation in Strongly Coupled Yukawa Liquids</td>
</tr>
<tr>
<td>24-2-2015</td>
<td>Xavier Viennot</td>
<td>University of Bordeaux</td>
<td>Tamari Lattice and its Extensions - 1</td>
</tr>
<tr>
<td>25-2-2015</td>
<td>Upayan Baul</td>
<td>IMSc</td>
<td>Ion Hydration and Associated Defects in Hydrogen Bond Network of Water: Effects on Structural and Dynamical Properties of Water</td>
</tr>
<tr>
<td>3-3-2015</td>
<td>Pankaj Jain</td>
<td>IIT Kanpur</td>
<td>Large Scale Anisotropy in the Universe</td>
</tr>
<tr>
<td>3-3-2015</td>
<td>Xavier Viennot</td>
<td>University of Bordeaux</td>
<td>Tamari Lattice and its Extensions - 2</td>
</tr>
</tbody>
</table>
3-3-2015 Yash Lodha
EPFL, Lausanne

A new solution to the von Neumann-Day problem for finitely presented groups.

4-3-2015 Amitabh Virmani
IOP Bhubaneswar

Inverse scattering construction of the JMaRT fuzzball

4-3-2015 Yadu Vasudev

PhD thesis defence

5-3-2015 Discussion Meeting

Solids out of equilibrium

5-3-2015 Sebastien Palcoux
IMSc

Generalization of a theorem of Oystein Ore from groups to subfactor planar algebras: an easy route to the wonderland of “quantum arithmetic”

6-3-2015 Swarnendu Tripathi
Department of Physics, University of Houston and Center for Theoretical Biological Physics, Rice University, Houston, USA

Lessons in Protein Design from Combined Evolution and Structural Dynamics

10-3-2015 Jyoti Sengupta
TIFR

Determination of GL(3) Hecke Maass forms from twisted central L-values

11-3-2015 Makoto Yamashita
Ochanomizu University

Poisson boundaries of monoidal categories

12-3-2015 Soumya Bhattacharya
CIRM, Trento

Factorization of holomorphic eta quotients

13-3-2015 Vaishnavi Sundararajan
CMI

Formal verification of security protocols with certification

13-3-2015 Makoto Yamashita
Ochanomizu University

Poisson Boundaries of Monoidal Categories

16-3-2015 Biswarup Mukhopadhyaya
Harish Chandra Research Institute

The Messiah of Mass with Message of More?

16-3-2015 Makoto Yamashita
Ochanomizu University

Poisson Boundaries of Monoidal Categories
<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-3-2015</td>
<td>Amita Malik</td>
<td>Siegel norm and character values</td>
</tr>
<tr>
<td></td>
<td>UIUC</td>
<td></td>
</tr>
<tr>
<td>17-3-2015</td>
<td>D Indumathi</td>
<td>INO: The India-based Neutrino Observatory–Facts and Fiction</td>
</tr>
<tr>
<td></td>
<td>IMSc, Chennai</td>
<td></td>
</tr>
<tr>
<td>18-3-2015</td>
<td>Pinaki Chaudhuri</td>
<td>Exploring the rheology of soft disordered solids</td>
</tr>
<tr>
<td></td>
<td>IMSc, Chennai</td>
<td></td>
</tr>
<tr>
<td>18-3-2015</td>
<td>Ayan Paul</td>
<td>Probing Higgs Couplings with Kinematic Distributions</td>
</tr>
<tr>
<td></td>
<td>Universita’ di Roma La Sapienza</td>
<td></td>
</tr>
<tr>
<td>19-3-2015</td>
<td>Daciberg L. Goncaves</td>
<td>Configuration spaces, products, and fibre</td>
</tr>
<tr>
<td></td>
<td>University of Sao Paulo</td>
<td></td>
</tr>
<tr>
<td>23-3-2015</td>
<td>Sundar Naganathan</td>
<td>Active torque generation by the actomyosin cell cortex drives left-right symmetry breaking</td>
</tr>
<tr>
<td></td>
<td>MPI-CBG, Dresden</td>
<td></td>
</tr>
<tr>
<td>23-3-2015</td>
<td>Suman Ganguli</td>
<td>Energy conditions in gravitational collapse of null fluid</td>
</tr>
<tr>
<td></td>
<td>IOP Bhubaneshwar</td>
<td></td>
</tr>
<tr>
<td>24-3-2015</td>
<td>K. B. Sinha</td>
<td>Helton-Howe and Krein’s Trace Formulas</td>
</tr>
<tr>
<td></td>
<td>JNCASR</td>
<td></td>
</tr>
<tr>
<td>25-3-2015</td>
<td>Dharamvir Ahluwalia</td>
<td>Connections in Physics</td>
</tr>
<tr>
<td></td>
<td>IIT-Kanpur and University of Canterbury, New Zealand</td>
<td></td>
</tr>
<tr>
<td>26-3-2015</td>
<td>T. Bakkyaraj</td>
<td>Applications of one parameter Lie group of transformations to fractional differential equations</td>
</tr>
<tr>
<td></td>
<td>IMSc</td>
<td></td>
</tr>
<tr>
<td>26-3-2015</td>
<td>Shankar Prasad Das</td>
<td>Qualitatively different collective and single particle dynamics in a supercooled liquid</td>
</tr>
<tr>
<td></td>
<td>Jawaharlal Nehru University, Delhi</td>
<td></td>
</tr>
<tr>
<td>26-3-2015</td>
<td>Ruben Martos</td>
<td>The formulation of the Baum-Connes conjecture</td>
</tr>
<tr>
<td></td>
<td>University of Paris 7</td>
<td></td>
</tr>
<tr>
<td>27-3-2015</td>
<td>Arindam Ghosh</td>
<td>Broken symmetry states in high-performance atomically-patterned nanostructures in silicon and germanium</td>
</tr>
<tr>
<td></td>
<td>IISc, Bengaluru</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Name</td>
<td>Institution/Department</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>27-3-2015</td>
<td>Trilochan Bagarti</td>
<td>Harish-Chandra Research Institute, Allahabad</td>
</tr>
<tr>
<td>27-3-2015</td>
<td>Ruben Martos</td>
<td>University of Paris 7</td>
</tr>
<tr>
<td>30-3-2015</td>
<td>Martin Lopez-Garcia 769;</td>
<td>Department of Applied Mathematics, University of Leeds, United Kingdom</td>
</tr>
<tr>
<td>30-3-2015</td>
<td>V. Lakshmibai</td>
<td>Northeastern University, Boston</td>
</tr>
</tbody>
</table>
Chapter 5

External Interactions

5.1 Collaborative Projects with Other Institutions

5.1.1 Algorithms and Complexity of Algebraic problems

The focus of this project is on algorithms and complexity theoretic questions for algebraic
problems; more specifically, on identity testing problems, arithmetic circuit lower bounds,
and isomorphism problems.

The project is funded by the Indo Max Planck Centre for Computer Sciences (IMPECS).
The principal investigators include V Arvind and Meena Mahajan from IMSc, and Markus
Bläser from Saarland University, Germany, and runs for a duration of 5 years beginning
April 2011.

5.1.2 Arithmetic circuits computing polynomials

The aim of this project is to better understand arithmetic circuit computations of polyno-
mials and related counting and enumeration complexity questions.

The project is funded by the Indo-French Centre for the Promotion of Advanced Research
(IFCPAR/CEFIPRA). The principal investigators are Meena Mahajan from IMSc, and Guilla-
ume Malod from Institut Mathmatique de Jussieu, Universit Paris Diderot, Paris 7, and
the project runs for a duration of 3 years beginning May 2012.

5.1.3 Computational methods for identifying and analyzing design
features of metabolic networks

This proposal was funded by the Max Planck Society and Indo-German Science and Tech-
nology Centre for a period of 4 years (2015-2018) to maintain the existing collaboration
between Areejit Samal at IMSc and Jürgen Jost at Max Planck Institute for Mathematics in
the Sciences, Leipzig. The aim of the proposal is to develop improved methods for analyzing
metabolic networks to address specific challenges in systems and synthetic biology.
5.1.4 Correctness by Construction (CORCON)

This project is funded by the Marie Curie Actions – International Research Staff Exchange Scheme (IRSES) of the European Union FP7. It involves multiple nations and researchers, and runs for five years beginning January 2014. IMSc is involved in the sub-project on proof verification and proof complexity, jointly with the University of Leeds, UK. The principal investigators for this sub-project are Meena Mahajan from IMSc and Olaf Beyersdorff from the University of Leeds.

5.1.5 India-based Neutrino Observatory (INO)

During this year, INO crossed an important milestone. The project which had its birth at IMSc exactly 15 years ago, in January 2000, got the full approval of the Government of India in Jan. 2015. We have traveled quite far, but have many more miles to go.

The IMSc group (D. Indumathi, Meghna K.K., Lakshmi S. Mohan, M.V.N. Murthy, Sumanta Pal, G. Rajasekaran, Nita Sinha and project assistant, Tiru Senthil) continue to be actively involved in the detector simulations and physics analysis. The group published three papers in the Journal of Instrumentation in the last one year. One student, Sumanta Pal completed his Ph.D thesis. Members of the group also contributed significantly to the INO Physics White paper, that will be submitted to the arXiv by the collaboration, very shortly. The IMSc group has been playing a significant role in the INO project outreach. Hopefully this will yield positive results in removing opposition (including litigation) to the project.

5.1.6 India-EU program on Mathematics for Health and Disease

The main aim of this project is to set up an Indo-European Research Network in Mathematics for Health and Disease, INDOEUROPEAN-MATHDS, that will allow the transfer of knowledge, research and training between partners. The Network involves physicists, mathematicians, statisticians, probabilists, biologists, immunologists and engineers. The Network will create new collaborations between previous INTI partners (Leeds, UCL, Utrecht, Vigo, Comillas, UBC, LANL, WEHI and IISc) and new partners (Basel, Hamilton, MIT, University of Hyderabad, JNCASR, IMSc and NII), and reinforce existing ones between INTI partners, in order to develop a lasting and fruitful research cooperation between all partners. It is planned to develop mathematical and computational models of host-pathogen and virus dynamics, with a focus on pathogenic and molecular characterisation of HIV-1, and the distribution of virulence in intra-host HIV quasispecies, in order to understand if regulation of immune activation can be a potentially optimum way for disease management, to develop mathematical and computational models of immune cellular processes, such as differentiation and cellular fate, as well as ageing, validated by experimental data, with a focus on T cells, to develop stochastic mathematical models of receptor-mediated processes in health and disease, with a focus on the CCR5 receptor, VEGF receptor, T cell receptor and B cell receptor, and to develop statistical tools and methods, using evolutionary game theory, to characterise the genomic fluidity of human pathogens, in order to understand microbial pathogen evolution and what constitutes the boundary between commensal and pathogenic organisms.
5.1.7 Indo-German research grant funded by the Humboldt Foundation

This is a three year research grant (originally for the period 2011-2014, extended to 2014-2015) from the Humboldt Foundation.

5.1.8 ITRA-Media Lab Asia Project on De-congesting India’s transportation networks using mobile devices

The project envisages the use of mobile phones to estimate congestion and traffic patterns on urban roads. Based on the congestion metrics thus obtained, the project aims to develop algorithms and tools for traffic planning and management, using the mobile phone as a service platform. The proposed solution strategy consists of two distinct focus areas. The first focus area deals with the problem of estimating mobile phone densities to measure prevailing congestion and traffic patterns. The second focus area involves developing algorithms for traffic routing, control and prediction, based on the estimated congestion. The proposed work has enormous potential for applications, such as dynamic route planning, peak hour rush control, routing of emergency vehicles to and from disaster affected areas, evacuation planning, and traffic prediction. In addition, this work is expected to shed new conceptual insights into the general problem of control of complex networks with strategic agents, by bringing together ideas from several technical disciplines.

5.1.9 Mechanism of Active Intracellular Transport: Connecting Theory and Experiment

This DAE-Plan project attempts to combine experimental investigations, using fluorescence microscopy, of the motion of vesicle in axons of touch neurons of C. elegans with theoretical models. Smooth axonal transport is crucial for the healthy functioning of nerve cells and impairment of this transport is often seen in neurodegenerative disease. We plan to closely link the theory and experimental observations to come up with a detailed simulation of axonal transport mechanisms which can then be compared to experiments.

5.1.10 Quantitative analysis of Mitochondrial positioning in C. elegans axons

Under this project Varuni Prabhakar along with Prof. Gautam Menon, in collaboration with Prof. Sandhya Koushika (TIFR, Mumbai), have been working on Quantifying mitochondrial positioning in Caenorhabditis elegans neurons. Varuni Prabhakar has been working on an image analysis algorithm to process the microscope images that has been collected in Prof. Koushika’s lab in order to understand how mitochondria are positioned along axons of neurons over the development of the worm.
5.2 Institute Associateships

The Institute has established short-term associateships in Mathematics, Theoretical Physics, Theoretical Computer Science and Computational Biology to enable teachers from colleges and universities to work at the institute. The programme is envisaged to develop interaction between the members of the faculty of the institute and scientists in the university system. Under this programme, an associate can visit the institute once or twice a year, up to a total of 90 days per year, each visit lasting a minimum of three weeks. The tenure of an associate will be for a period of three years and (s)he is expected to visit the institute at least twice during this period.

The institute will bear the expenses of round-trip travel (by rail) from the Associate’s normal place of work to Chennai and will also pay a daily allowance to cover local expenses at Chennai. During their stay at Chennai, Associates will be accommodated in the institute Guest House.

Associates who visited the institute during the period 01.04.14 to 31.03.15 are:

Prof. Hans Van Ditmarsch
Loria, Vandoeuure France
11.01.2015 to 08.02.2015

Dr. S.K. Monowar Hossien
Aliah University, Kolkata
26.05.2014 to 05.07.2014

Dr. Gopal Chandra Shit
Jadavpur University, Kolkata
15.06.2014 to 06.07.2014

Dr. K. Reji Kumar
NSS College, Nilamel, Kerala
25.08.2014 to 23.09.2014
5.3 Conference Participation and Visits to Other Institutions

Agrawal, Ankit

Visited TIFR Centre for Interdisciplinary Sciences (TCIS) during Apr 14 – Apr 19, 2014. Collaboration work

Participated in *International Centre for Theoretical Physics (ICTP)* held at Trieste, Italy during Sep 15 – Sep 19, 2014. Conference on Chromosome Organization

Arvind, V.

Visited Humboldt University, Berlin, Germany during Sep 8 – Sep 20, 2014. Research. Visit supported by a joint project funded by the Humboldt Foundation.

Participated in *Dagstuhl workshop on Algebra in Computational Complexity* held at Dagstuhl Castle, Wadern, Saarland, Germany during Sep 21 – Sep 25, 2014.

Participated in *Indian-Russian workshop on Discrete Math and Cryptography* held at Moscow State University, Moscow, Russia during Oct 15 – Oct 18, 2014. Gave a talk at the workshop

Ashok, Sujay K.

Visited Tata Institute for Fundamental Research during Aug 23 – Aug 27, 2014. Invited Talk, External member for a Ph.D defense

Ravinder, B.

Participated in *Workshop on Combinatorial representation theory* held at CRM, Montreal, Canada during Apr 17 – May 17, 2014. As a part of the thematic semester on New Directions in Lie Theory.

Bagchi, Manjari


Participated in *Neutron Stars: A brainstorming workshop* held at The National Centre for Radio Astronomy Tata Institute of Fundamental Research, Pune, India during Nov 20 – Nov 21, 2014. Delivered two talks: (a) The population of neutron stars: looking through theory,
simulation and observation – invited review talk. (b) Fast Radio Bursts – contributed talk.

Balasubramanian, R.

Participated in *group discussion meeting on Mock Modular forms* held at Harishchandra Research institute, Allahabad during Apr 24 – Apr 28, 2014.

Participated in *Award Distribution function of the International Mathematical Olympiad training camp* held at Mumbai on May 19, 2014. Chief guest

Participated in *National instructional workshop on cryptology* held at MNNIT Allahabad on Jun 5, 2014. Chief guest. Also delivered a talk

Participated in *National Statistics day* held at Indian statistical institute, Chennai on Jun 29, 2014. Gave a talk on number theory

Participated in *Indocrypt, 2014* held at India habitat Centre, New Delhi during Dec 14 – Dec 17, 2014.

Participated in *80 th annual conference of Indian Math Society* held at ISM Dhanbad on Dec 28, 2014. Inagurated the conference

Participated in *Conference in Algebraic Number theory and Modular forms* held at S.P.Pune University during Jan 2 – Jan 3, 2015. Delivered a lecture on euler’s phi function

Participated in *Discussion meeting on Analytic Number theory* held at Tata Institute of Fundamental Research, Bombay during Jan 5 – Jan 7, 2015. Gave a lecture on “counting rational points on Elliptic curves ”

Participated in *CFS lecture series* held at NISER, Bhubaneshwar on Jan 13, 2015. Gave a lecture on additive number theory

Visited CRRAO AIMSCS on Jan 16, 2015. Gave Ramanujam Distinguished lecture organised by CR Rao institute under a DST sponsored project

Visited District Science Centre, Gulbarga on Jan 17, 2015. Inagurated the Maths Gallery

Participated in *Annual Conference of Odisha maths society* held at jajpur Road, odisha on Feb 7, 2015. Chief guest. Also delivered a lecture

Biswa, Soumyajyoti

Participated in *Statphys-Kolkata VIII* held at S. N. Bose National Center for Basic Sciences, Kolkata during Dec 1 – Dec 5, 2014. Presented a poster titled: Self-organized dynamics in local load sharing fiber bundle models
 Participated in *Fracmeet 2015* held at The Institute of Mathematical Sciences, Chennai during Jan 6 – Jan 9, 2015. Gave a talk titled: Nucleation versus percolation: Scaling criterion for failure in disordered solids

**Chakraborty, Abhijit**

Participated in *Short-term Course and Workshop on Machine Learning and Complex Networks* held at Indian Institute of Technology, Kharagpur, India during Feb 28 – Mar 7, 2015.

**Chaudhuri, Pinaki P.**

Participated in *Discussion Meeting on Glass Formers and Glasses* held at JNCASR, Bangalore, India during Aug 8 – Aug 9, 2014. Talk on “Yielding of confined soft glasses”

Visited ICTS, Bangalore during Sep 6 – Sep 13, 2014.


Visited TIFR Centre for Interdisciplinary Sciences, Hyderabad during Nov 18 – Nov 21, 2014.


Participated in *2nd Indian Statistical Physics Community Meeting* held at IISc, Bangalore during Feb 13 – Feb 15, 2015. Talk on “Cavitation in a model amorphous solid”

Visited TIFR Centre for Interdisciplinary Sciences, Hyderabad during Feb 27 – Mar 3, 2015.

Participated in *2nd Discussion Meeting on Glass Formers and Glasses* held at JNCASR, Bangalore during Mar 27 – Mar 28, 2015. Talk on “Cavitation in a model amorphous solid”

**Date, G.**


Participated in *Celebrating the Centenary Year of General Relativity: The 28th Meeting of the IAGRG.* held at Raman Research Institute, Bangalore during Mar 18 – Mar 20, 2015.

123
Participated in my capacity as the President of the IAGRG.

Devanand, T.

Participated in *Aspects of Gene Regulation* held at IMSc, Chennai on Dec 16, 2014.

Dolai, Dhriti Ranjan

Participated in *School on Random Schrodinger Operators* held at Pontificia Universidad Catlica de Chile, Santiago during Nov 13 – Nov 21, 2014. Participated

Participated in *Spectral Theory and Mathematical Physics* held at Pontificia Universidad Catlica de Chile, Santiago, Chile during Nov 24 – Nov 28, 2014. Gave talk on “Local statistics for some random operators”.

Dutta, Arghya


Ganguli, Saibal

Participated in *ICM satellite conference on topology of torus actions and applications in Geometry and combinatorics* held at Daejeon during Aug 7 – Aug 12, 2014. Contributed Speaker. Talked on my work Mckay Correspondence on Quasitoric Orbifolds

Ghosh, Ria

Participated in *ICTS-Pacific Institute of Mathematical Sciences, Canada-IISER Pune Program - Advances in Mathematical Biology* held at IISER Pune during Dec 7 – Dec 16, 2014.

Ghosh, Sibasish

Visited Indian Statistical Institute, Kolkata during Jun 12 – Jun 22, 2014. Visited the Physics and Applied Mathematics Unit (PAMU) of ISI, Kolkata to continue collaborative work with Prof. Guruprasad Kar and his group members as well as to give a seminar.

Participated in *Discussions Meeting on Quantum Measurement (DMQM, 2014)* held at Physics Department, IISc, Bangalore during Oct 22 – Oct 24, 2014. I participated in the
meeting as an invited participant.

Visited Bose Institute, Kolkata during Nov 14 – Nov 23, 2014. Visited the Physics department of Bose Institute, Kolkata to continue collaborative work with Dr. Somshubhro Bandyopadhyay and his group members as well as to give a seminar.


Visited IISER – Kolkata during Feb 6 – Feb 12, 2015. To discuss with Prof. Prasant Panigrahi and Dr. Chiranjib Mitra on several aspects of Quantum Information, to initiate collaborative research work, and to give a seminar.

Visited Visva-Bharati University during Mar 16 – Mar 20, 2015. To discuss (with Prof. Prasanta Chatterjee of Math. Dept.) on certain techniques of Quantum Plasma in the context of entanglement theory, and to give a seminar.

**Gun, S.**

Visited HRI during Apr 23 – May 4, 2014. Research Collaboration

Visited KSOM during May 7 – May 21, 2014. Lectured in AFS II

Participated in Discussion meeting on Analytic number theory 2015 held at TIFR, Mumbai during Jan 5 – Jan 9, 2015. Invited Speaker

**Kesavan, S.**

Visited Institut de Mathématiques, Université Paul Sabatier, Toulouse, France during Apr 28 – May 24, 2014. Visiting Professor under a project of IFCAM. Delivered a seminar talk.


Visited Hindustan University, Chennai on Oct 7, 2014. Delivered a seminar talk.

Participated in Refresher Course on Linear Algebra held at Ramanujan Institute for Ad-
Participated in Advanced Study in Mathematics (RIASM) during Nov 11 – Nov 13, 2014. Delivered a course of 6 lectures.

Participated in National Conference on Advances in Partial Differential Equations (NCAPDE) held at Periyar University, Salem during Dec 4 – Dec 5, 2014. Inaugurated the conference, delivered the keynote address, and delivered an invited talk.

Participated in Workshop on Variational Methods held at TIFR-CAM, Bangalore during Dec 15 – Dec 16, 2014. Delivered a course of 5 lectures.

Participated in Recent Advances in Partial Differential Equations held at TIFR-CAM, Bangalore on Dec 17, 2014. Delivered an invited talk.

Visited IMU Headquarters, Berlin during Mar 11 – Mar 14, 2015. Attended the meeting of the Commission for Developing Countries in the capacity of Secretary, Grants Selection.

Lodaya, Kamal

Participated in 13th Formal methods update held at IIT Kharagpur during Jul 28 – Jul 30, 2014. Gave a talk on “Automata from left and right”.


Participated in 2nd international conference on Creative Mathematical Sciences Communication held at IMSc during Dec 9 – Dec 12, 2014.


Participated in 16th international workshop on Verification of Infinite-state systems held at IIT Delhi on Dec 18, 2014.


Participated in 16th international conference on Verification, Model checking and Abstract interpretation held at TIFR, Mumbai during Jan 12 – Jan 14, 2015.

Participated in 42nd international symposium on Principles of Programming Languages held at TIFR, Mumbai during Jan 15 – Jan 17, 2015.
Participated in *Instructional seminar on Logic and Multi-agent systems* held at IMSc during Feb 1 – Feb 3, 2015.

Participated in *4th international workshop on Automata, concurrency and timed systems* held at CMI during Feb 9 – Feb 13, 2015.

Visited Tezpur University during Mar 16 – Mar 20, 2015. Gave 4 lectures on “Model checking”.

**Mahajan, Meena**

Visited Université Paris Diderot - Paris 7, France. during May 12 – Jun 3, 2014. This visit was for research collaboration under an ongoing IFCPAR project.

Participated in *Dagstuhl seminar on Algebra in Computational Complexity* held at Leibniz Centre for Informatics, Schloss Dagstuhl, Germany during Sep 21 – Sep 26, 2014. Gave a talk titled “Homomorphism Polynomials complete for VP”.

**Majumdar, Diptapriyo**

Visited Indian Institute of Technology, Delhi during Dec 13 – Dec 14, 2014. Attending Pre-FSTTCS Workshop

Participated in *New Developments in Exact Algorithms and Lower Bounds* held at Indian Institute of Technology, Delhi during Dec 13 – Dec 14, 2014. Pre-FSTTCS workshop


**Majumder, Souradeep**

Visited Centre for Quantum Geometry of Moduli Spaces, Aarhus during Jun 1 – Jun 30, 2014.

Visited Indian Statistical Institute, Bangalore during Feb 26 – Feb 28, 2015.

**Meesum, Syed M.**

Visited University of Bergen, Norway during Sep 15 – Nov 30, 2014.

**Menon, Gautam I.**

Visited TCIS, TIFR - Hyderabad during Apr 16 – Apr 19, 2014. Physics Colloquium on
“Chromosome Positioning and Active Matter”

Visited INSTEM-NCBS, Bangalore on Apr 28, 2014. Seminar on “Chromosome Positioning and Active Matter”

Visited University of Leeds, UK during May 20 – Jun 4, 2014. Academic visit to the Department of Applied Mathematics, University of Leeds in connection with an Indo-EU project on “Mathematics in Health and Disease”

Visited Wolfson-Wohl Cancer Centre, University of Glasgow, UK on May 27, 2014. Seminar on “Chromosome Positioning and Active Matter”

Visited Warwick Medical School, University of Warwick, UK on Jun 2, 2014. Seminar on “Chromosome Positioning and Active Matter”

Visited Mechanobiology Institute, National University of Singapore, Singapore on Jul 2, 2014. Colloquium on “Active Matter: Connecting Theory and Experiment”

Visited Raman Research Institute during Sep 11 – Sep 13, 2014. Colloquium on “Chromosome Positioning and Active Matter”


Visited HRI, Allahabad during Nov 16 – Nov 19, 2014. Delivered two talks, A seminar on “Chromosome Positioning” and a Colloquium on “Crowding: Why it might not be a bad idea after all”

Visited International Conference on Genome Architecture and Cell Fate Regulation, School of Life Sciences, University of Hyderabad during Dec 1 – Dec 4, 2014. Invited talk on “A Quantitative Model for Chromosome Positioning”


Visited Aspects of Gene Regulation, IMSc, Chennai on Dec 16, 2014. Invited talk on “Chromosome Positioning from Activity-based Segregation”


Visited Mechanobiology Institute, National University of Singapore, Singapore during Jan 5 – Jan 12, 2015. Visit included a number of collaborative discussions with scientists at MBI


Visited Department of Biotechnology, New Delhi during Feb 12 – Feb 13, 2015. Visit in connection with Star College Scheme of the DBT

Visited IISER-Kolkata, Kalyani during Mar 11 – Mar 12, 2015. Visit and Physics Colloquium on ”Active Matter”

Visited S.N. Bose National Centre for Basic Science, Kolkata on Mar 13, 2015. Physics Colloquium on “Active Matter”

Menon, Shakti N.

Participated in *Dynamics Days Asia Pacific 08 (DDAP 08)* held at IIT-M and IMSc, from 21 – 24, July 2014.

Participated in *Social Modelling and Simulations + Econophysics colloquium (SMSEC 2014)* held at Nichii Gakkan in Kobe, Japan from 4 – 6, Nov. 2014.

Participated in STATPHYS conference held at SN Bose Center for Basic Sciences, Kolkata from 1 – 5 Dec. 2014.

Mukhopadhyay, Anirban

Participated in *AIS school on “Diophantine Equations”* held at HP University, Shimla during Jun 16 – Jul 4, 2014. gave a course of lectures on “Circle method in Diophantine equations”

Participated in *AIS school on “Algebraic number theory”* held at CMI, Chennai during Jul 7 – Jul 26, 2014. lectured on xi “quadratic reciprocity”

Participated in *Enriching Mathematics Education 2014* held at IMSc during Oct 16 – Oct 17, 2014. gave a lecture on euclidean geometry

Participated in *Indian Math society annual conference* held at Indian school of mines, Dhanbad during Dec 27 – Dec 30, 2014. gave a talk in Number theory symposium

Mukhopadhyay, Partha

Participated in *India-JINR Forum, Frontiers in Nuclear, Elementary Particle and Condensed Matter Physics* held at Joint Institute of Nuclear Research, Dubna, Russia during
Jun 16 – Jun 20, 2014. Presented talk: Non-linear sigma model, loop space and tubular geometry

Visited Institute of Physics, Bhubaneswar during Dec 8 – Dec 14, 2014. Delivered talk: Non-linear sigma model, loop space and tubular geometry


**Nagaraj, D. S.**

Visited University of Lille 1, Lille, France. during May 1 – May 31, 2014. Participated in a conference and gave an invited talk.

Participated in “*Positivity, Vanishing Theorems, and Applications*” held at CEMPI, Lille 1, University of Lille, France. during May 12 – May 18, 2014. Gave a talk titled “Degenerate mapping of projective plane to Grassmannain”

Visited University of Paris VI, Paris during Jun 1 – Jun 30, 2014. Gave talk on Special Projections of Veronese surface at the seminar Groupe dEtude sur les ProBlemes Diophantiens
Gave a talk on Null correlation bundle on projective three space at the “Alg. Geom.” seminar, at University of Paris VI.

Participated in *Manipal days in Mathematics; Workshop on Algebraic Geometry* held at Manipal University, Manipal. Karnataka during Jan 5 – Jan 9, 2015. Gave a talk on “VECTOR BUNDLES ON SYMMETRIC PRODUCT OF CURVES”.

Participated in *Algebra and Analysis* held at central University of Tamilnadu, Thiruvaur, Tamilnadu. during Jan 31 – Feb 2, 2015. Gave 6 lectures on Algbra

**Niyogi, Saurabh**

Participated in *LHCDM-2015 (LHC and Dark Matter)* held at Indian Association for the Cultivation of Science, Kolkata during Feb 9 – Feb 13, 2015.

**Panolan, Fahad**

Participated in *FSTTCS 2014* held at India International Centre, New Delhi during Dec 15 – Dec 17, 2014. It is a annual Conference on Foundations of Software Technology and Theoretical Computer Science

**Patri, Issan**

Visited Texas A and M University during Sep 1 – Nov 24, 2014. Visiting Graduate Student
invited by Prof. Gilles Pisier.

Prabhakar, Varuni

Visited Tata Institute for Fundamental Research, Mumbai during Aug 8 – Aug 17, 2014. Collaborative work with Prof. Sandhya Koushika

Visited Tata Institute for Fundamental Research during Mar 5 – Mar 18, 2015. Collaborative work with Prof. Sandhya Koushika

Prasad, Amritanshu

Participated in *Refresher course on linear algebra* held at University of Madras during Nov 14 – Nov 17, 2014. Gave a course of lectures.

Participated in *Workshop on probability and representation theory* held at IISc, Bangalore during Mar 6 – Mar 7, 2015. Invited talk.

Raghavan, K. N.

Participated in *Sixth Summer Training Programme in Mathematics* held at Ramanujan Institute for Advanced Study, Madras University during May 29 – Jun 2, 2014. Conducted lectures and tutorials for MSc Mathematics students (from various parts of Tamilnadu) on Linear Algebra

Visited Indian Academy of Sciences, Bengaluru during Jun 6 – Jun 8, 2014. CSIR committee work


Participated in *Research in Science 2014* held at IMSc on Nov 6, 2014. Gave a lecture titled “How much is a real symmetric matrix controlled by its spectrum?”

Participated in *80th Annual Meeting of the Indian Academy of Sciences* held at Indian Institute of Technology, Chennai during Nov 7 – Nov 9, 2014. IMSc was one of the main organizers of the event. Helped in organization.

Participated in *Refresher course on Linear Algebra* held at Ramanujan Institute for Advanced Study in Mathematics, University of Madras during Nov 15 – Nov 17, 2014. Resource person
Visited Central Leather Research Institute, Chennai during Nov 22 – Nov 24, 2014. CSIR committee work


Participated in Recent Advances in Operator Theory and Operator Algebras held at Indian Statistical Institute, Bangalore during Dec 9 – Dec 13, 2014. Attended the workshop part of the meeting.

Visited University of Hyderabad on Jan 5, 2015. Gave a talk “On Gelfand Tsetlin patterns”.

Participated in Royal Society – DST India UK research meeting held at Chennai Mathematical Institute, Chennai during Jan 12 – Jan 15, 2015. This was a meeting to explore possible research collaboration in the areas of commutative algebra and modular representation theory. There were about fifteen invited participants, five from the UK, and about ten from India.

Visited Vel Tech University, Avadi, Chennai on Feb 8, 2015. Evaluation of R D projects by mathematics faculty

Participated in Workshop on Probability and Representation Theory held at Indian Institute of Science, Bangalore during Mar 6 – Mar 7, 2015. Gave a talk on “Littelmann’s LS paths and Brownian motion”

Rajasekaran, G.

Participated in INO Collaboration Meeting held at VECC, Kolkata during Apr 3 – Apr 5, 2014.

Participated in Research Science Initiative Chennai (RSIC) held at IIT, Madras during May 3 – Jun 6, 2014. Gave a talk “Hundred Years of Fundamental Physics and the Discovery of the Higgs Boson”

Participated in Science Academies’ Refresher Course on Quantum Mechanics held at Bishop Moore College, Mavelikara, Kerala during May 5 – May 10, 2014. Gave a course of Quantum Mechanics

Participated in Unification and Cosmology 2014 held at Punjab University, Chandigarh during May 13 – May 15, 2014. Gave the Keynote Talk on “High Energy Physics 2014 and its Future” and a contributed talk “ Was dark matter detected in India 40 years ago?”

Visited Indian Institute of Astrophysics, Bangaluru on Jul 3, 2014. Gave a Colloquium on “Neutrinos and INO”.

Participated in Meeting of the Science Education Panel of the Indian Academy of Sciences, Bangaluru held at Indian Academy of Sciences, Bangaluru on Jul 3, 2014.

Participated in Academy Mid-Year Meeting held at Indian Institute of Science, Bangaluru during Jul 4 – Jul 5, 2014.

Visited Chennai Mathematical Institute on Jul 31, 2014. Gave the Convocation Address and spoke on “Hundred Years of Fundamental Physics and a Crisis”


Participated in INO Collaboration Meeting held at Inter-Institutional Centre for High Energy Physics, Madurai during Sep 18 – Sep 20, 2014.


Participated in International Conference on Ultra-high Intensity Lasers held at Hotel Cidade de Goa, Goa during Oct 12 – Oct 15, 2014. I proposed that a National Task Force for Laser Plasma Accelerator must be formed and this must lead to the creation of a National Centre for Laser Plasma Accelerator and this proposal has been accepted.

Participated in International Conference on Quantum Field Theory held at Banares Hindu University during Nov 1 – Nov 5, 2014. Gave an invited talk on “Hundred Years of Fundamental Physics and a Crisis”

Participated in Annual Meeting of the Indian Academy of Sciences held at IIT, Chennai during Nov 7 – Nov 9, 2014.

Visited Institute for Plasma Research, Gandhinagar during Nov 23 – Nov 24, 2014. Gave a Colloquium “Hundred Years of Fundamental Physics and a Crisis”

Visited Physical Research Laboratory, Ahmedabad on Nov 25, 2014.


Participated in XXI DAE-BRNS HEP Symposium 2014 held at IIT, Guwahati during Dec 8 – Dec 12, 2014. Apart from chairing the Opening Session, I gave an invited review talk on Neutrino Masses and Mixing and a contributed talk “Was dark matter detected in India 40


Visited Madurai Kamaraj University during Jan 15 – Jan 17, 2015. Gave about six lectures to MSc students, as a part of a Course on High Energy Physics

Visited Tata Institute of Fundamental research, Mumbai during Feb 12 – Feb 13, 2015. Gave a Colloquium “Hundred Years of Fundamental Physics and a Crisis”

Visited BARC, Mumbai during Feb 14 – Feb 15, 2015. Participated in an important meeting to decide on the structure of the INO collaboration.

Visited Lucknow University during Feb 27 – Mar 1, 2015. Gave a Colloquium on Science Day “Hundred Years of Fundamental Physics and its Future”

Visited University of Madras, Guindy Campus on Mar 13, 2015. Gave a Colloquium Talk to Science Students “Hundred Years of Fundamental Physics and the Discovery of Higgs Boson”

Visited Madurai Kamaraj University during Mar 27 – Mar 31, 2015. Gave lectures for about 15 hours to MSc students as part of a Course on High Energy Physics

Participated in *National Symposium on Particles, Detectors and Instrumentation* held at Inter-Institutional Centre for High Energy Physics, Transit Campus, Madurai during Mar 27 – Mar 31, 2015. Chaired the first Session and gave the last talk on “Hundred Years of Fundamental Physics and a Crisis”

**Raman, Venkatesh**

Visited St. Xavier’s College for Women, Aluva on Aug 8, 2014. Gave a talk on ‘Turan’s theorem and an algorithmic application’

Participated in *New Developments in Exact Algorithms and Lower Bounds* held at IIT Delhi during Dec 13 – Dec 14, 2014. Organized the event

Participated in *IARCS 34th annual conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)* held at New Delhi during Dec 15 – Dec 17, 2014. Program Committee Co-chair
Participated in *Indo-German Workshop on Algorithms* held at ISI Kolkata during Mar 9 – Mar 12, 2015. Gave an invited talk on ‘Selection in Realistic Models’

**Ramanujam, R.**

Visited Amrita University during Apr 11 – Apr 12, 2014. Gave a talk on “Games and distributed algorithms”.

Participated in *ASL Annual Meeting on Logic* held at Boulder, Colorado, USA during May 19 – May 22, 2014. Gave a talk titled “Logical dynamics of rational choice in large games” in the Special Session on Logic and Game Theory.

Visited City University of New York, USA during May 22 – Jun 6, 2014. Gave talks on “Semantics of messages” and “Dynamics in large games”.

Participated in *Logic Colloquium* held at Vienna, Austria during Aug 4 – Aug 7, 2014. Organized a special session on “Logics of Rational Choice”

Participated in *Parameterized Complexity and Computational Reasoning* held at Vienna, Austria during Aug 5 – Aug 8, 2014. Gave a talk on “Intuitionistic proof theory and parameterized complexity”.

Participated in *World Wide Web Verification* held at Vienna, Austria during Aug 7 – Aug 8, 2014. Gave a talk on “Realizability in web service choreographies”.


Visited IIT-Madras on Mar 5, 2015. Gave a talk on “Axiom of choice: It’s so obvious that it’s a puzzle”

Visited Amrita University during Mar 7 – Mar 8, 2015. Gave a talk on “Epistemic logic and distributed systems”

Visited Tezpur University during Mar 14 – Mar 16, 2015. Gave a talk on “Challenges for Logic in AI”.

**Ransingh, Biswajit**


Participated in *Aspect of Lie theory* held at INdAM, Rome, Italy during Jan 7 – Jan 10, 2015.
Ray, Purusattam


Saha, Biswajyoti

Visited Harish-Chandra Research Institute, Allahabad during Feb 4 – May 4, 2014. Worked in a research project under supervision of Prof. Joseph Oesterle.

Participated in *Annual Foundational School-2* held at Kerala School of Mathematics, Kozhikode during May 8 – May 21, 2014. Invited as a tutor.

Participated in *Advanced Instructional School in Algebraic number theory* held at Chennai Mathematical Institute, Chennai during Jul 7 – Jul 26, 2014.

Participated in *Winter School on Modular functions in one and several variables* held at Goa University, Goa during Dec 8 – Dec 16, 2014.

Participated in *Discussion Meeting on Analytic Number Theory 2015* held at Tata Institute of Fundamental Research, Mumbai during Jan 5 – Jan 9, 2015.

Participated in *International Conference on Automorphic Forms and Applications* held at Kerala School of Mathematics, Kozhikode during Feb 13 – Feb 14, 2015. Invited speaker.

Participated in *Spring school on Characters of Representations and Modular Forms* held at Max Planck Institute for Mathematics, Bonn during Mar 23 – Mar 27, 2015.

Saha, Ekata

Participated in *Advanced Instructional School in Algebraic number theory* held at Chennai Mathematical Institute, Chennai during Jul 7 – Jul 26, 2014.

Participated in *Winter School on Modular functions in one and several variables* held at Goa University, Goa during Dec 8 – Dec 16, 2014.

Participated in *Discussion Meeting on Analytic Number Theory 2015* held at Tata Institute of Fundamental Research, Mumbai during Jan 5 – Jan 9, 2015.

Samal, Areejit


Visited Jawaharlal Nehru University, Delhi on Sep 2, 2014. Seminar on Network approaches towards understanding microRNA regulation of cardiomyocyte proliferation.


Visited Institut des hautes études scientifiques (IHES), Bures-sur-Yvette, France during Nov 10 – Nov 24, 2014. Selected as scientific visitor to collaborate on topics of systems biology.

Participated in *Aspects of Gene Regulation* held at IMSc, Chennai on Dec 16, 2014. Talk: Reconstruction and systems analysis of plant cell wall deconstruction network in filamentous fungus *Neurospora crassa*.

Visited School of Chemical and Biotechnology, SASTRA University, Thanjavur on Jan 21, 2015. Invited talk: Reconstruction and systems analysis of plant cell wall deconstruction network in filamentous fungus *Neurospora crassa*.


**Sankaran, Parameswaran**


Visited IISER Pune, on Apr 4, 2014. Gave a talk on ‘Twisted conjugacy in Richard Thompson groups’.

Participated in *Brazilian Topology Meet* held at Universidade Estadual Paulista, São José do Rio Preto Campus. during Aug 3 – Aug 9, 2014. Gave an invited talk on ‘Twisted conjugacy in certain PL homeomorphism groups’.

Participated in *Workshop in Algebraic Topology for College Lecturers* held at Kerala School of Mathematics during Sep 11 – Sep 14, 2014. Gave four lectures on applications of homology theory.
Participated in *National Seminar on Topology and Analysis* held at St Paul’s College, Kalamassery, Kochi. on Oct 9, 2014. Invited talk on ‘Borsuk-Ulam Theorem and its applications’.

Visited Cochin University of Science, Arts and Technology on Oct 10, 2014. Gave a talk on topological methods in group theory.

Participated in *Refresher course in linear algebra* held at Ramanujan Institute for Advanced Study in Mathematics, University of Madras. during Nov 8 – Nov 11, 2014. Gave three lectures on vector spaces.

Visited Indian Institute of Science, Bangalore on Nov 15, 2014. Gave a talk on ‘The BNS invariant and twisted conjugacy’.

Participated in *Annual Foundation School-I* held at NISER, Bhubaneswar during Dec 2 – Dec 6, 2014. Gave four lectures on topology.

Participated in *National Seminar on Topology* held at Sarada College, Salem during Feb 11 – Feb 12, 2015. Gave a talk on ‘The vector field problem’.


**Sathiapalan, Balachandran**

Participated in *Advanced String School* held at Puri during Sep 22 – Sep 28, 2014. Lectured on ”Applications of AdS/CFT”

**Saurabh, Nitin**


Participated in *Indo-UK workshop on Computational Complexity Theory* held at IMSc, Chennai during Jan 5 – Jan 9, 2015.
Saurabh, Saket

Participated in ICERM Semester Program on Network Science and Graph Algorithms held at Brown University, USA during Apr 20 – May 7, 2014. Invited Speaker for a workshop.

Visited Laboratory of Mathematical Logic of St. Petersburg Department of Steklov Institute of Mathematics during Sep 17 – Sep 27, 2014. Invited to give three lectures on Matroids based parameterized algorithms. Video recordings can be found at https://www.youtube.com/watch?v=yGMi6ObL25o

Participated in 25th International Workshop on Combinatorial Algorithms held at Duluth, USA during Oct 15 – Oct 17, 2014. Invited Speaker

Participated in Dagstuhl Seminar on Optimality and tight results in parameterized complexity held at Dagstuhl, Germany during Nov 2 – Nov 7, 2014. Gave an invited talk

Participated in Formal Software Technology and Theoretical Computer Science (FSTTCS) held at New Delhi during Dec 15 – Dec 17, 2014. Gave a talk

Participated in ELC/B01 Workshop on Parameterized Algorithm held at Tokyo, Japan during Feb 28 – Mar 1, 2015. Invited Speaker.

Sharma, Vikram

Participated in 4th International Congress of Mathematical Software held at Seoul, South Korea during Aug 5 – Aug 9, 2014. Conducted a special session

Participated in International Congress of Mathematicians held at Seoul, South Korea during Aug 13 – Aug 21, 2014.

Sinha, Nita

Participated in NORDITA scientific program, News in Neutrino Physics held at NORDITA in Stockholm, Sweden during Apr 7 – May 2, 2014.

Participated in Frontiers of New Physics: Colliders and Beyond held at ICTP, Trieste during Jun 23 – Jun 27, 2014.


Participated in International Conference on Massive Neutrinos held at Nanyang Technological University, Singapore during Feb 9 – Feb 13, 2015. Delivered an invited talk on
Participated in Workshop on Recent advances in HEP held at University of Hyderabad during Feb 26 – Feb 28, 2015. Delivered an invited lecture on ‘Flavour Physics, Standard Model and Beyond’.

Sinha, Sitabhra

Visited Indian Statistical Institute, Chennai on Apr 8, 2014. Gave invited talk on “Econophysics: Towards a physical theory of socio-economic phenomena”

Visited BITS-Pilani, Goa Campus during Apr 11 – Apr 14, 2014. Gave invited talks on (i) “Mind, Memory and Modules: Using nonlinear dynamics and complex networks to understand the brain” and (ii) “Econophysics: Towards a physical theory of socio-economic phenomena”

Participated in British Society of Immunology Meeting on Mathematical Modelling in Immunology held at Microsoft Research, Cambridge during May 19 – May 20, 2014. Gave invited talk on “Action-at-a-distance in cell signaling networks”


Visited Wolfson Wohl Cancer Research Centre, Glasgow, United Kingdom on May 27, 2014. Gave invited talk on “Module-omics: The role of mesoscopic organization of biological networks in health and disease”

Visited Institute of Biodiversity, Animal Health and Comparative Medicine, University of Glasgow, Glasgow, United Kingdom on May 27, 2014. Gave invited talk on “Modeling the dynamic patterns of epidemic propagation”


Visited Indian Institute of Technology, Gandhinagar during Sep 18 – Sep 20, 2014. Gave invited Hira7751;yagarbha lecture on “Patterns of life and death: Using physics to understand complex dynamics in human physiology”


Participated in Workshop on Mathematical Modelling and Data Analysis in Biology held at

Visited University of Allahabad, Allahabad during Nov 24 – Nov 26, 2014. Gave invited talks on (i) “Minds, Modules and Memory: Exploring networks of the nervous system” and (ii) “Why it pays to be nice to complete strangers: Co-action equilibrium in non-cooperative games”

Visited Harish-Chandra Research Institute, Allahabad during Nov 26 – Nov 28, 2014. Gave invited talk on “Patterns of life and death: Using physics to understand complex dynamics in human physiology”


Participated in ICTS-PIMS-IISER Pune Program on Advances in Mathematical Biology held at IISER Pune during Dec 7 – Dec 16, 2014. Gave invited talks on (i) “Patterns of life death: Excitable dynamics of biological cells tissue” and (ii) “Pattern formation through lateral inhibition in arrays of coupled relaxation oscillators”

Participated in Workshop on Quantitative Biology held at Institute of Life Sciences, Pune on Dec 17, 2014. Gave invited talk on “Exploring biology through networks: From the worm to the human”

Visited Bose Institute, Kolkata on Jan 30, 2015. Gave seminar talk on “Cancer “Module”-omics: Mesoscopic analysis of the network of cancer diseases and genes reveals “movers” and “shakers” of the disease”

Participated in National Workshop on Scale-Free Networks held at Cochin University of Science and Technology (CUSAT), Kochi during Feb 12 – Feb 15, 2015. Gave invited talk on “Community detection in networks”

Participated in Interdisciplinary Conference on the Science and Application of Networks held at Shiv Nadar University, Uttar Pradesh during Mar 20 – Mar 22, 2015. Gave invited talk on “Complexity of social and economic networks: The importance of community organization”

Srinivas, K.


Participated in Discussion meeting on Analytic Number Theory 2015 held at TIFR, Mumbai during Jan 5 – Jan 9, 2015. Delivered an invited talk with the title On the angles of eigen forms
Subramanian, C. R.

Visited SSN College of Engineering, OMR, Kalavakkam, Chennai - 603110 on Jun 19, 2014. Was a Resource Person in the Faculty Development Programme of Department of Mathematics. Gave a lecture on “Principle of Inclusion-Exclusion and exact algorithms for hard problems”.

Participated in *ICTCSDM-2014 (International Conference on Theoretical Computer Science and Discrete Mathematics)* held at SSN College of Engineering, Kalavakka, Chennai during Dec 8 – Dec 10, 2014. Invited Speaker

Participated in *CALDAM-2015 (First International Conference on Algorithms and Discrete Applied Mathematics)* held at IIT-Kanpur during Feb 8 – Feb 10, 2015. Invited Speaker

Sunder, V. S.

Participated in *ICLAA 2014* held at Manipal University during Dec 17 – Dec 19, 2014. Gave an invited talk on ‘Uhlmann’s theorems’ at this conference held to felicitate Prof. R.B. Bapat on his 60th birthday.

Vijayakumar Sasidevan

Participated in *Social Modeling and Simulations + Econophysics Colloquium 2014* held at Kobe, Japan during Nov 4 – Nov 6, 2014.


Vyas, Vivek M.


Visited Indian Institute of Science Education and Research Kolkata during Oct 23 – Oct 30, 2014. Gave a talk titled “A gauge theory of massive spin one particles”

Participated in *New Trends in Field Theories* held at Banaras Hindu University, Varanasi during Nov 1 – Nov 5, 2014. Gave a talk titled “Some results on topological currents in field theory”

Participated in *Mini Winter School on Ultra Cold Atoms - 2014* held at Government College

Participated in *Advances in High Energy Physics* held at School of Physics, University of Hyderabad during Feb 26 – Feb 28, 2015. Gave a talk titled “A gauge theory of massive spin one particles.”
## 5.4 Visitors from Other Institutions

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Institution/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Srijita Kundu</td>
<td>10.02.14 - 11.05.14</td>
<td>CMI, Chennai</td>
</tr>
<tr>
<td>Dileep Jatkar</td>
<td>14.02.15 - 20.02.15</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Sandeep K Goyal</td>
<td>01.03.14 - 30.05.14</td>
<td>University of KwaZulu-Natal, Durban, South Africa</td>
</tr>
<tr>
<td>Gyan Prakash</td>
<td>16.03.14 - 05.04.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Blanchard Nicolas</td>
<td>20.03.14 - 15.08.14</td>
<td>Student Civil Servant, Paris</td>
</tr>
<tr>
<td>Manoj Kumar</td>
<td>31.03.14 - 30.04.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Anamitra Mukherjee</td>
<td>01.04.14 - 04.04.14</td>
<td>University of Tennessee, Knoxville, US</td>
</tr>
<tr>
<td>Arnab Chatterjee</td>
<td>03.04.14 - 10.04.14</td>
<td>Alto University of Technology, Helsinki, Finland</td>
</tr>
<tr>
<td>Samir Kunkri</td>
<td>05.04.14 - 31.05.14</td>
<td>Mahadevananda Mahavidyalaya, Barrackpore</td>
</tr>
<tr>
<td>Probir Roy</td>
<td>06.04.14 - 11.04.14</td>
<td>Retired TIFR / Saha Institute, Kolkata</td>
</tr>
<tr>
<td>Sachin Subhash Sharma</td>
<td>12.04.14 - 27.04.14</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Punit Parmananda</td>
<td>15.04.14 - 18.04.14</td>
<td>IIT, Mumbai</td>
</tr>
<tr>
<td>Usha K. Sangale</td>
<td>20.04.14 - 29.06.14</td>
<td>SRTM University, Nanded</td>
</tr>
<tr>
<td>Name</td>
<td>Date</td>
<td>Institution</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Indranil Biswas</td>
<td>22.04.14 - 25.04.14</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Swarup Poria</td>
<td>28.04.14 - 14.05.14</td>
<td>University of Calcutta, West Bengal</td>
</tr>
<tr>
<td>Kasi Viswanadham G.</td>
<td>05.05.14 - 18.05.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Priya A.</td>
<td>05.05.14 - 04.06.14</td>
<td>Madras Christian College, Chennai</td>
</tr>
<tr>
<td>RejiKumar K.</td>
<td>05.05.14 - 30.05.14</td>
<td>NSS College, Kerala</td>
</tr>
<tr>
<td>Bipul Saurabh</td>
<td>07.05.14 - 04.07.14</td>
<td>ISI, New Delhi</td>
</tr>
<tr>
<td>Indira Chowdhuri</td>
<td>08.05.14 - 09.05.14</td>
<td>Srishti School of Arts Design Tech, Bangalore</td>
</tr>
<tr>
<td>Priyanka Seshadri</td>
<td>08.05.14 - 09.05.14</td>
<td>Srishti School of Arts Design Tech, Bangalore</td>
</tr>
<tr>
<td>Sujatha R.</td>
<td>08.05.14 - 31.07.14</td>
<td>IISER, Thiruvananthapuram</td>
</tr>
<tr>
<td>Dalawat C.S.</td>
<td>08.05.14 - 16.05.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Balachandran A.P.</td>
<td>09.05.14 - 14.05.14</td>
<td>ISI, Bangalore</td>
</tr>
<tr>
<td>Abhishek Banerjee</td>
<td>11.05.14 - 21.06.14</td>
<td>IISER, Kolkata</td>
</tr>
<tr>
<td>Suneeta Varadarajan</td>
<td>12.05.14 - 15.06.14</td>
<td>IISER, Pune</td>
</tr>
<tr>
<td>Soumya Jyoti Biswas</td>
<td>14.05.14 - 07.06.14</td>
<td>SINP, Kolkata</td>
</tr>
<tr>
<td>Selvakumar C</td>
<td>14.05.14 - 25.06.14</td>
<td>University of Madras, Chennai</td>
</tr>
<tr>
<td>Sathika V.</td>
<td>14.05.14 - 25.06.14</td>
<td>University of Madras, Chennai</td>
</tr>
<tr>
<td>Shiv Chaitanya K.V.S.</td>
<td>14.05.14 - 17.05.14</td>
<td>BITS Pilani, Hyderabad</td>
</tr>
<tr>
<td>Subhaksha</td>
<td>15.05.14 - 15.06.14</td>
<td>PSG College of Technology, Coimbatore</td>
</tr>
<tr>
<td>Nilesh Chaudhuri</td>
<td>15.05.14 - 22.07.14</td>
<td>IIT, Guwahati</td>
</tr>
<tr>
<td>Name</td>
<td>Dates</td>
<td>Institution/Location</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Lakshmi Priya C.P.</td>
<td>16.05.14 - 25.06.14</td>
<td>University of Madras, Chennai</td>
</tr>
<tr>
<td>Jayanthi M.P.</td>
<td>16.05.14 - 25.06.14</td>
<td>University of Madras, Chennai</td>
</tr>
<tr>
<td>Ramij Rahman</td>
<td>19.05.14 - 31.05.14</td>
<td>University of Allahabad, Uttar Pradesh</td>
</tr>
<tr>
<td>Sahoo P. K.</td>
<td>20.05.14 - 10.06.14</td>
<td>BITS Pilani, Hyderabad</td>
</tr>
<tr>
<td>Guruprasad</td>
<td>24.05.14 - 31.05.14</td>
<td>ISI, Kolkata</td>
</tr>
<tr>
<td>Boron D Chowdhury</td>
<td>25.05.14 - 28.05.14</td>
<td>Arizona State University, USA</td>
</tr>
<tr>
<td>Monowar Hossein S.K.</td>
<td>26.05.14 - 05.07.14</td>
<td>Aliah University, Kolkata</td>
</tr>
<tr>
<td>Gyan Prakash</td>
<td>27.05.14 - 25.06.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Paritosh Kulinpandya</td>
<td>28.05.14 - 09.06.14</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Muthusamy A.</td>
<td>28.05.14 - 09.06.14</td>
<td>PSG College og Technology, Coimbatore</td>
</tr>
<tr>
<td>Arvind Kumar</td>
<td>29.05.14 - 31.07.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Pushkar S Joglekar</td>
<td>01.06.14 - 20.06.14</td>
<td>Vishwakarma Institute of Technology, Pune</td>
</tr>
<tr>
<td>Kevin Valson Jacob</td>
<td>01.06.14 - 31.07.14</td>
<td>IIT, Kanpur</td>
</tr>
<tr>
<td>Jebarathinam C.</td>
<td>02.06.14 - 18.06.14</td>
<td>IISER, Mohali</td>
</tr>
<tr>
<td>Ajay C Ramadoss</td>
<td>02.06.14 - 30.06.14</td>
<td>Indiana University, Bloomington</td>
</tr>
<tr>
<td>Baskar A.</td>
<td>09.06.14 - 02.07.14</td>
<td>BITS Pilani, Hyderabad</td>
</tr>
<tr>
<td>Ryan Vinroot</td>
<td>13.06.14 - 25.06.14</td>
<td>University of William, US</td>
</tr>
<tr>
<td>Preena Samavad</td>
<td>13.06.14 - 20.06.14</td>
<td>BITS Pilani, Hyderabad</td>
</tr>
<tr>
<td>Name</td>
<td>Date</td>
<td>Institution</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Gopal Chandra</td>
<td>15.06.14 - 06.07.14</td>
<td>Jadavpur University, Kolkatta</td>
</tr>
<tr>
<td>Arghya Taraphder</td>
<td>15.06.14 - 21.06.14</td>
<td>IIT, Kharagpur</td>
</tr>
<tr>
<td>Tulika Maitra</td>
<td>15.06.14 - 21.06.14</td>
<td>IIT, Roorkee</td>
</tr>
<tr>
<td>Sanhita Modak</td>
<td>15.06.14 - 30.06.14</td>
<td>Netaji Subhash Engineering College, Kolkatta</td>
</tr>
<tr>
<td>Venkatesh R</td>
<td>18.06.14 - 30.06.14</td>
<td>CRM, Udem, Montreal, Canada</td>
</tr>
<tr>
<td>Manu Dixit</td>
<td>19.06.14 - 25.07.14</td>
<td>BITS Pilani, Hyderabad</td>
</tr>
<tr>
<td>Sreejit T.R</td>
<td>21.06.14 - 16.07.14</td>
<td>S.N. Bose Institute, Kolkatta</td>
</tr>
<tr>
<td>Ramlal Awasthe</td>
<td>23.06.14 - 25.06.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Sumiran Pujari</td>
<td>28.06.14 - 30.06.14</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Swatee Naik</td>
<td>29.06.14 - 05.07.14</td>
<td>University of Nevada, USA</td>
</tr>
<tr>
<td>Purabi Mukherjee</td>
<td>29.06.14 - 05.07.14</td>
<td>University of Calcutta, West Bengal</td>
</tr>
<tr>
<td>Rita Brata Munshi</td>
<td>30.06.14 - 30.06.14</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Roy Joshua</td>
<td>30.06.14 - 07.07.14</td>
<td>Ohio State University, Columbia</td>
</tr>
<tr>
<td>Soham Biswas</td>
<td>30.06.14 - 16.07.14</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Ajay Deep Kachhvah</td>
<td>01.07.14 - 30.09.14</td>
<td>IPR, Gandhinagar</td>
</tr>
<tr>
<td>Santhosh Kumar Rajanamanickam</td>
<td>01.07.14 - 30.11.14</td>
<td>PSG College of Technology, Coimbatore</td>
</tr>
<tr>
<td>Nagarajan S</td>
<td>01.07.14 - 30.11.14</td>
<td>PSG College of Technology, Coimbatore</td>
</tr>
<tr>
<td>Harish G</td>
<td>01.07.14 - 30.11.14</td>
<td>PSG College of Technology, Coimbatore</td>
</tr>
<tr>
<td>Kamal Dutta</td>
<td>02.07.14 - 30.09.14</td>
<td>IIT, Guwahati</td>
</tr>
</tbody>
</table>
Balachandran A.P. 03.07.14 - 13.07.14 IISc, Bangalore
Swagataa Acharya 06.07.14 - 25.07.14 IIT, Kharagpur
Radha Mohan 06.07.14 - 18.07.14 St. Stephen’s College, New Delhi
Tarun Kanti Ghosh 07.07.14 - 11.07.14 IIT, Kanpur
Varsha Sreenivasan 09.07.14 - 08.10.14 IIT, Madras
Veeky Baths 09.07.14 - 12.07.14 BITS, Goa
Vinod Kumarappan 09.07.14 - 11.07.14 Kansas State University, USA
Yashonidhi Pandey 09.07.14 - 16.07.14 IISER, Mohali
Yogeshwar Prasad 14.07.15 - 18.07.15 IISc, Bangalore
Michael Renardy 17.07.14 - 21.07.14 Virginia Tech, USA
Hilda A Cerdeira 25.07.14 - 03.08.14 Instituto de Fisica Teorica, Sao Paulo, Brazil
Syed Mohammad Kamil 27.07.14 - 03.08.14 Shiv Nadar University, Uttar Pradesh
Sneh Bala 28.07.14 - 30.11.14 HRI, Allahabad
Vishal Saraswat 29.07.14 - 02.08.14 University of Hyderabad
Surya Ramana D. 29.07.14 - 24.08.14 HRI, Allahabad
Snigdhayan Mahanta 29.07.14 - 02.08.14 University of Munster, Germany
<table>
<thead>
<tr>
<th>Name</th>
<th>Dates</th>
<th>Institute and Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anil Kumar C.P.</td>
<td>30.07.14 - 01.08.14</td>
<td>ISI, Bangalore</td>
</tr>
<tr>
<td>Sury B.</td>
<td>01.08.14 - 01.08.14</td>
<td>ISI, Bangalore</td>
</tr>
<tr>
<td>Parimala Raman</td>
<td>01.08.14 - 07.08.14</td>
<td>Emory University, USA</td>
</tr>
<tr>
<td>Shiv Prasad</td>
<td>04.08.14 - 14.08.14</td>
<td>IISER, Mohali</td>
</tr>
<tr>
<td>Dilpreet Kaur</td>
<td>04.08.14 - 14.08.14</td>
<td>IISER, Mohali</td>
</tr>
<tr>
<td>Kannappan Sampath</td>
<td>04.08.14 - 14.08.14</td>
<td>ISI, Bangalore</td>
</tr>
<tr>
<td>Karl Dieter Crisman</td>
<td>04.08.14 - 15.08.14</td>
<td>Gordon College, MA, USA</td>
</tr>
<tr>
<td>Siddharth Parameswaran</td>
<td>05.08.14 - 05.09.14</td>
<td>University of California, USA</td>
</tr>
<tr>
<td>Manickam M.</td>
<td>06.08.14 - 12.08.14</td>
<td>School of Mathematics, Kozhikode, Kerala</td>
</tr>
<tr>
<td>Shamik Gupta</td>
<td>06.08.14 - 09.08.14</td>
<td>University Paris-Sud, Orsay, France</td>
</tr>
<tr>
<td>Prusken A.M.M.</td>
<td>13.08.14 - 18.08.14</td>
<td>University Amsterdam, The Netherlands</td>
</tr>
<tr>
<td>Sachin Subhash Sharma</td>
<td>13.08.14 - 28.08.14</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Parthasarathy R</td>
<td>19.08.14 - 22.08.14</td>
<td>Bharathiyar University, Coimbatore</td>
</tr>
<tr>
<td>Vasudharani</td>
<td>19.08.14 - 05.09.14</td>
<td>M S University, Baroda</td>
</tr>
<tr>
<td>Parimala Raman</td>
<td>22.08.14 - 30.08.14</td>
<td>Emory University, USA</td>
</tr>
<tr>
<td>Rajesh Kumar Gupta</td>
<td>24.08.14 - 27.08.14</td>
<td>ICTP, Trieste, Italy</td>
</tr>
<tr>
<td>RejiKumar K.</td>
<td>25.08.14 - 23.09.14</td>
<td>NSS College, Kerala</td>
</tr>
<tr>
<td>Abhijit Chakraborty</td>
<td>26.08.14 - 28.08.14</td>
<td>SN Bose National Centre, Kolkata</td>
</tr>
<tr>
<td>Manchanda R.</td>
<td>31.08.14 - 03.09.14</td>
<td>IIT, Bombay</td>
</tr>
<tr>
<td>Name</td>
<td>Date</td>
<td>Institution</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Pranay Goel</td>
<td>31.08.14 - 03.09.14</td>
<td>IISER, Pune</td>
</tr>
<tr>
<td>Rabeya Basu</td>
<td>31.08.14 - 10.09.14</td>
<td>IISER, Pune</td>
</tr>
<tr>
<td>Ipsita Mandal</td>
<td>31.08.14 - 02.09.14</td>
<td>Perimeter Institute of Theoretical Physics, Ontario, Canada</td>
</tr>
<tr>
<td>Amlan Barma</td>
<td>31.08.14 - 03.09.14</td>
<td>IISER, Pune</td>
</tr>
<tr>
<td>Sumilan Banerjee</td>
<td>31.08.14 - 03.09.14</td>
<td>Ohio State University, USA</td>
</tr>
<tr>
<td>Rashmi Sharma</td>
<td>01.09.14 - 03.09.14</td>
<td>IIT, Bombay</td>
</tr>
<tr>
<td>Shailesh</td>
<td>01.09.14 - 03.09.14</td>
<td>IIT, Bombay</td>
</tr>
<tr>
<td>Nilapratim Sengupta</td>
<td>01.09.14 - 03.09.14</td>
<td>IIT, Bombay</td>
</tr>
<tr>
<td>Arun Prasath V</td>
<td>01.09.14 - 09.09.14</td>
<td>Centre for high energy physics, IISC, Bangalore</td>
</tr>
<tr>
<td>Prashant Batra</td>
<td>01.09.14 - 30.09.14</td>
<td>Technical University, Hamburg-Harburg, Germany</td>
</tr>
<tr>
<td>Daisuke Harada</td>
<td>01.09.14 - 15.10.14</td>
<td>IISc, Bangalore</td>
</tr>
<tr>
<td>Ravi S Kulkarni</td>
<td>02.09.14 - 04.09.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Adhikari S.D.</td>
<td>03.09.14 - 08.09.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Prahlad</td>
<td>11.09.14 - 12.09.14</td>
<td>IISER, Bhopal</td>
</tr>
<tr>
<td>Kumari Saloni</td>
<td>15.09.14 - 17.10.14</td>
<td>IIT, Guwahati</td>
</tr>
<tr>
<td>Prateep Chakraborty</td>
<td>16.09.14 - 20.09.14</td>
<td>ISI, Bangalore</td>
</tr>
<tr>
<td>Name</td>
<td>Dates</td>
<td>Institute/Location</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>Paritosh Pandya</td>
<td>16.09.14 - 23.09.14</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Pramod Padmanabhan</td>
<td>19.09.14 - 19.12.14</td>
<td>University of Sao Paulo, Brazil</td>
</tr>
<tr>
<td>Narendra Dixit</td>
<td>23.09.14 - 23.09.14</td>
<td>IISc, Bangalore</td>
</tr>
<tr>
<td>Tata B.V.R.</td>
<td>23.09.14 - 23.09.14</td>
<td>IGCAR, Kalpakkam</td>
</tr>
<tr>
<td>Venkatesh R.</td>
<td>25.09.14 - 05.10.14</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Naveen Gaur</td>
<td>27.09.14 - 06.10.14</td>
<td>Dyal Singh College, Delhi</td>
</tr>
<tr>
<td>Samir Kunkri</td>
<td>30.09.14 - 28.10.14</td>
<td>Mahadevananda College, Kolkata</td>
</tr>
<tr>
<td>Shanta Laishram</td>
<td>04.10.14 - 07.10.14</td>
<td>ISI, New Delhi</td>
</tr>
<tr>
<td>Balachandran A.P.</td>
<td>07.10.14 - 09.10.14</td>
<td>CHEP, IISc, Bangalore</td>
</tr>
<tr>
<td>Vishal Saraswat</td>
<td>08.10.14 - 10.10.14</td>
<td>CR Rao AIMSCS, University of Hyderabad</td>
</tr>
<tr>
<td>Siegfried Boecherer</td>
<td>08.10.14 - 12.10.14</td>
<td>University of Mannheim, Germany</td>
</tr>
<tr>
<td>Sandipan Sengupta</td>
<td>09.10.14 - 15.10.14</td>
<td>RRI, Bangalore</td>
</tr>
<tr>
<td>Bikas Chandra Paul</td>
<td>13.10.14 - 28.10.14</td>
<td>University of North Bengal, West Bengal</td>
</tr>
<tr>
<td>Manimala Mitra</td>
<td>14.10.14 - 19.10.14</td>
<td>IPPP, Durham</td>
</tr>
<tr>
<td>Ramakrishnan B.</td>
<td>20.10.14 - 05.11.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Usha K. Sangale</td>
<td>21.10.14 - 16.11.14</td>
<td>SRTM University, Nanded</td>
</tr>
<tr>
<td>Swagata Acharya</td>
<td>25.10.14 - 05.11.14</td>
<td>IIT, Kharagpur</td>
</tr>
<tr>
<td>Name</td>
<td>Dates</td>
<td>Institution</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Raghav Rangarajan</td>
<td>27.10.14 - 28.10.14</td>
<td>Physical Research Laboratory, Ahmedabad</td>
</tr>
<tr>
<td>Narayana Rana</td>
<td>01.11.14 - 31.12.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Manoj Kumar</td>
<td>01.11.14 - 31.12.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Taushif Ahmed</td>
<td>01.11.14 - 31.12.14</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Sivakumar M.</td>
<td>01.11.14 - 05.12.14</td>
<td>University of Hyderabad, Hyderabad</td>
</tr>
<tr>
<td>Patrick Scharp Feinecker</td>
<td>02.11.14 - 22.11.14</td>
<td>University of Ulm, Germany</td>
</tr>
<tr>
<td>Rajdeep Niyogi</td>
<td>02.11.14 - 14.11.14</td>
<td>IIT, Roorkee</td>
</tr>
<tr>
<td>Tridib Sadhu</td>
<td>02.11.14 - 04.11.14</td>
<td>University of Paris, France</td>
</tr>
<tr>
<td>Hidenori Sonoda</td>
<td>06.11.14 - 26.11.14</td>
<td>Kobe University, Japan</td>
</tr>
<tr>
<td>Anupam Kumar Singh</td>
<td>10.11.14 - 18.11.14</td>
<td>IISER, Pune</td>
</tr>
<tr>
<td>Bijan Saha</td>
<td>14.11.14 - 21.11.14</td>
<td>JINR, Dubna, Russia</td>
</tr>
<tr>
<td>Gaurav Narain</td>
<td>14.11.14 - 07.12.14</td>
<td>Phitsanulok University, Thailand</td>
</tr>
<tr>
<td>Kanishka Rawat</td>
<td>16.11.14 - 31.12.14</td>
<td>Punjab University, Chandigarh</td>
</tr>
<tr>
<td>Marc Bourdon</td>
<td>17.11.14 - 05.12.14</td>
<td>University of Lille, France</td>
</tr>
<tr>
<td>Mayuri Chatterjee</td>
<td>19.11.14 - 19.02.15</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Ramesh Sreekantan</td>
<td>19.11.14 - 22.11.14</td>
<td>ISI, Bangalore</td>
</tr>
<tr>
<td>Mridupawan</td>
<td>19.11.14 - 27.11.14</td>
<td>JINR, Dubna, Russia</td>
</tr>
<tr>
<td>Sujatha, R.</td>
<td>01.12.14 - 02.01.15</td>
<td>IISER, Thiruvananthapuram</td>
</tr>
<tr>
<td>Name</td>
<td>Dates</td>
<td>Institution</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Raghav Rangarajan</td>
<td>01.12.14 - 02.12.14</td>
<td>Physical Research Laboratory, Ahmedabad</td>
</tr>
<tr>
<td>Ram Murty</td>
<td>02.12.14 - 31.12.14</td>
<td>Queen’s University, Kingston, Canada</td>
</tr>
<tr>
<td>Ajit</td>
<td>05.12.14 - 08.12.14</td>
<td>ISI Delhi</td>
</tr>
<tr>
<td>Nanasiddharth</td>
<td>08.12.14 - 06.03.15</td>
<td>CMI, Chennai</td>
</tr>
<tr>
<td>Reji Kumar K.</td>
<td>08.12.14 - 08.01.15</td>
<td>NSS College, Kerala</td>
</tr>
<tr>
<td>Parimala R</td>
<td>12.12.14 - 09.01.15</td>
<td>Emory University, USA</td>
</tr>
<tr>
<td>Parudamasen</td>
<td>15.12.14 - 21.12.14</td>
<td>SN Bose Institute, Kolkatta</td>
</tr>
<tr>
<td>Nikolai Tyurin</td>
<td>15.12.14 - 31.12.14</td>
<td>JINR, Dubna, Russia</td>
</tr>
<tr>
<td>Pushkar S Joglekar</td>
<td>15.12.14 - 09.01.15</td>
<td>Vishwakarma Institute of Technology, Pune</td>
</tr>
<tr>
<td>Andreas Krebs</td>
<td>17.12.14 - 22.12.14</td>
<td>University of Tubingen, Germany</td>
</tr>
<tr>
<td>Sumantapal</td>
<td>19.12.14 - 20.12.14</td>
<td>University of Sheffield, UK</td>
</tr>
<tr>
<td>Swarup Poria</td>
<td>21.12.14 - 04.01.15</td>
<td>University of Calcutta, West Bengal</td>
</tr>
<tr>
<td>Anindita Ganguly</td>
<td>24.12.14 - 03.01.15</td>
<td>St Thomas College of Engineering Tech., Kolkata</td>
</tr>
<tr>
<td>Narayana Rana</td>
<td>01.01.15 - 08.01.15</td>
<td>HRI, Allahabad</td>
</tr>
<tr>
<td>Name</td>
<td>Dates</td>
<td>Institution</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Nang Philibert</td>
<td>02.01.15 - 26.01.15</td>
<td>Ecole Normale Superior, Gabon, Africa</td>
</tr>
<tr>
<td>Ubaid Hussain</td>
<td>05.01.15 - 31.01.15</td>
<td>Aligarh Muslim University, Uttar Pradesh</td>
</tr>
<tr>
<td>Prahladh Harsha</td>
<td>05.01.15 - 09.01.15</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Bhaduri R.K.</td>
<td>07.01.15 - 15.01.15</td>
<td>McMaster University, Canada</td>
</tr>
<tr>
<td>Olaf Beyerdorff</td>
<td>09.01.15 - 16.01.15</td>
<td>University of UC, US</td>
</tr>
<tr>
<td>Johan Bartel</td>
<td>11.01.15 - 16.01.15</td>
<td>University de Strasbourg, France</td>
</tr>
<tr>
<td>Jaban Meher</td>
<td>11.01.15 - 29.01.15</td>
<td>IISc, Bangalore</td>
</tr>
<tr>
<td>Hans Van</td>
<td>11.01.15 - 08.02.15</td>
<td>Loria, Nancy, France</td>
</tr>
<tr>
<td>Kabir Ramola</td>
<td>12.01.15 - 16.01.15</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Subinay Dasgupta</td>
<td>14.01.15 - 28.01.15</td>
<td>University of Calcutta, West Bengal</td>
</tr>
<tr>
<td>Indranil Biswas</td>
<td>16.01.15 - 25.01.15</td>
<td>TIFR, Mumbai</td>
</tr>
<tr>
<td>Haridass N. D.</td>
<td>16.01.15 - 25.01.15</td>
<td>TIFR, Hyderabad</td>
</tr>
<tr>
<td>Amitabanandi</td>
<td>18.01.15 - 21.01.15</td>
<td>MPI, Dresden, Germany</td>
</tr>
<tr>
<td>Sujit Das</td>
<td>20.01.15 - 23.01.15</td>
<td>Martin Luther University Halle-Wittenberg, Germany</td>
</tr>
<tr>
<td>Yogeshwar Prasad</td>
<td>20.01.15 - 04.02.15</td>
<td>IISc, Bangalore</td>
</tr>
<tr>
<td>Peter Hislop</td>
<td>20.01.15 - 19.02.15</td>
<td>University of Kentucky, Lexington, USA</td>
</tr>
<tr>
<td>Atul Dixit</td>
<td>22.01.15 - 23.01.15</td>
<td>Tulane University, USA</td>
</tr>
<tr>
<td>Singh J.B.</td>
<td>23.01.15 - 25.01.15</td>
<td>Punjab University, Chandigarh</td>
</tr>
<tr>
<td>Sumesh P.T.</td>
<td>28.01.15 - 30.01.15</td>
<td>Oxford University, UK</td>
</tr>
</tbody>
</table>
Anantha Narayan B. 29.01.15 - 01.02.15 IISc, Bangalore

Ram Kishore 30.01.15 - 16.02.15 INPE, Brazil

Gyan Prakash 30.01.15 - 01.02.15 HRI, Allahabad

Avinash Sonawane 30.01.15 - 01.02.15 Kitt University, Odissa

Sudipta Kumar Bera 01.02.15 - 30.04.15 IISER, Kolkatta

Arun Madhav Thalapillli 01.02.15 - 06.02.15 NHETC, Rutgers, State University of New Jersey, USA

Sanjay Puri 05.02.15 - 06.02.15 JNU, New Delhi

Nilendra Ganesh Deshpande 05.02.15 - 07.02.15 University of Oregon, USA

Dandoloff Rossen 05.02.15 - 25.02.15 University de Cergy-Pontoise, Paris, France

Sanchari 05.02.15 - 13.02.15 SN Bose National Centre Kolkata

Balaraju Battu 06.02.15 - 07.03.15 University of Allahabad, Uttar Pradesh

Arup Kumar Pal 07.02.15 - 13.02.15 ISI, Kolkata

Ashok Priyadarshan Dimri 09.02.15 - 10.02.15 JNU, New Delhi

Justin David 09.02.15 - 11.02.15 IISc, Bangalore

Satti Srinivasa Rao 10.02.15 - 20.02.15 HRI, Allahabad

Neeraj Manhas 10.02.15 - 17.02.15 Maulana Azad Institute of Technology, Bhopal

Kumar Murty V. 14.02.15 - 28.02.15 University of Toronto, Canada

Guruprasad Kar 15.02.15 - 17.02.15 ISI, Kolkata
<table>
<thead>
<tr>
<th>Name</th>
<th>Dates</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sayak Mukherjee</td>
<td>15.02.15 - 17.02.15</td>
<td>Ohio State University, US</td>
</tr>
<tr>
<td>Siddarth Barman</td>
<td>15.02.15 - 17.02.15</td>
<td>California Institute of Technology, USA</td>
</tr>
<tr>
<td>Markus Blaser</td>
<td>16.02.15 - 26.02.15</td>
<td>University of Saarland, Germany</td>
</tr>
<tr>
<td>Vasudharam Devanathan</td>
<td>16.02.15 - 27.02.15</td>
<td>M S University, Baroda</td>
</tr>
<tr>
<td>Vijay Ganesh</td>
<td>16.02.15 - 17.02.15</td>
<td>University of Waterloo, Canada</td>
</tr>
<tr>
<td>Jacobo Toran</td>
<td>18.02.15 - 05.03.15</td>
<td>University of Ulm, Germany</td>
</tr>
<tr>
<td>Yogeshwar Prasad</td>
<td>22.02.15 - 16.03.15</td>
<td>IISc, Bangalore</td>
</tr>
<tr>
<td>Aswin Joy</td>
<td>22.02.15 - 25.02.15</td>
<td>IPR, Gandhinagar</td>
</tr>
<tr>
<td>Somshubhro Bandyo Padhyay</td>
<td>23.02.15 - 28.03.15</td>
<td>Bose Institute, Kolkatta</td>
</tr>
<tr>
<td>Luigi Accardi</td>
<td>24.02.15 - 28.03.15</td>
<td>University of Rome, Italy</td>
</tr>
<tr>
<td>Yash Lodha</td>
<td>01.03.15 - 12.03.15</td>
<td>Haus Anna, Finland</td>
</tr>
<tr>
<td>Piyush P. Kurur</td>
<td>01.03.15 - 05.03.15</td>
<td>IIT, Kanpur</td>
</tr>
<tr>
<td>Pankaj Jain</td>
<td>02.03.15 - 04.03.15</td>
<td>IIT, Kanpur</td>
</tr>
<tr>
<td>Amitabh Virmani</td>
<td>03.03.15 - 06.03.15</td>
<td>IOP, Bhubaneshwar</td>
</tr>
<tr>
<td>Jurgen Hurbach</td>
<td>03.03.15 - 05.03.15</td>
<td>University of Dusseldorf, Germany</td>
</tr>
<tr>
<td>Daciberg Goncalves</td>
<td>03.03.15 - 19.03.15</td>
<td>University of Sao Paulo, Brazil</td>
</tr>
<tr>
<td>Anand Yethiraj</td>
<td>04.03.15 - 07.03.15</td>
<td>Memorial Institute, Canada</td>
</tr>
<tr>
<td>Swarnendu Tripathi</td>
<td>05.03.15 - 07.03.15</td>
<td>University of Houston, US</td>
</tr>
</tbody>
</table>
Sengupta J. 08.03.15 - 15.03.15 TIFR, Mumbai
Karen Hallberg 09.03.15 - 10.03.15 Centro Atomico Bariloche, Institute Balseiro, Argentina
Makoto Yamashita 09.03.15 - 20.03.15 Ochanomizu University, Tokyo, Japan
Farhat Habib 10.03.15 - 14.03.15 IISER, Pune
Soumya Bhattacharya 10.03.15 - 19.03.15 CIRM Trento Italy
Biswaup Mukhopadhyaya 15.03.15 - 18.03.15 HRI, Allahabad
Anantha Narayan B. 15.03.15 - 18.03.15 IISc, Bangalore
Amita Malik 16.03.15 - 17.03.15 Department of Mathematics, Illinois
Ruben Martos 16.03.15 - 30.03.15 University of Paris, France
Ayan Paul 18.03.15 - 20.03.15 Universita di Roma La Sapienza, Italy
Sinha K.B. 21.03.15 - 24.03.15 JNCASR, Kolkata
Trilochan Bagarti 21.03.15 - 31.03.15 HRI, Allahabad
Benoit Rittaud 23.03.15 - 24.03.15 University of Paris, France
Guruprasad Kar 23.03.15 - 31.03.15 ISI, Kolkata
Dharam Vir Ahluwalia 23.03.15 - 28.03.15 IIT, Kanpur
Arindam Ghosh 27.03.15 - 27.03.15 IISc, Bangalore
Pankaj Narula 01.02.15 - 01.03.15 IIT, Bombay
Chapter 6

Infrastructure

6.1 Computer Facilities

Enhancement of Computer Facility during 2014-15

Hardware facility:

- HPC Hybrid System *nandadevi* was installed. It was built using Dell R720 Rack Servers of 49 nodes and it consists of 10 TF cluster for MPI jobs, 10 Serial computing nodes using high memory, 8 GPU computing nodes, 3 Intel MIC-Phi computing nodes, Luster server with dual controller based 25 TB Parallel Storage. The total compute power is 43 TeraFlops (19TF in CPU + 24TF in GPU/PHI) and the H/Ws have provisions to add additional GPU/PHI cards on demand to increase the performances.

  The *nandadevi* ranked 27 in the top supercomputers in India list 2014.

- New Laptops of different brand/models were issued to faculty as a replacement of obsolete laptops.

- New Desktops of Dell Optiplex 9020 MT 30 nos were released to new students, Auditorium, Technical Assistants and Medical Officers’ office.

- Additional disks (Enterprise SATA) were installed in the mail server (banyan).

- Color laser printer capable of handling A3 size media, Reverse Automatic Document Feeder (RADF), Networked, Copier, Scan to mail/usb installed. Most important thing is that the facility is enabled with RFID card reader so that the users can access through their IMSc Id card instead of login. The Ricoh Aficio MFP 2003SP serves the purpose.

- MFP laser printers with ADF, networked, duplex print, copier, scan to mail/usb were provided to Directors’ Office, Engineers’ offices, Medical Officers’ office etc. The Richo Aficio SP 3510 SF serves the purpose.

- Panasonic PT-EX510 projector was installed in the Ramanujam auditorium as a replacement of obsolete Canon XEED projector.
• Internet bandwidth service contract was renewed for one more year with Airtel for 32 Mbps (1:1) through fiber loop.

• In-campus WiFi facility was revamped by using the Fortinet APs with controller enabled through the customised wifidog named as hotwifi portal.

• Setting up of Media room facility was in process.

Activities:
Dr. G. Subramoniam, Scientific Officer-F participated the Workshop on Project Management conducted by Indian Institute of Management, Ahmedabad during Feb 23-28, 2015 organised by DTI, DAE

Mr. B. Raveendra Reddy, Scientific Officer-F attended the meetings on CISAG, DAE, Mumbai during 2014
6.2 The Library

The Institute Library holds a total collection of 71602 books and bound periodicals as on March 31, 2015. This includes an addition of 1118 volumes during the current year April 2014 - March 2015. The NBHM has recognized this Institute library as the Regional Library for Mathematics. An average of about 4000 outside users in a year from colleges, universities and research institutions from different parts of the country make use of the library facilities for their academic and research information needs.

The library has a well balanced collection both print and online on the major subject areas of research such as Theoretical Physics, Mathematics and Theoretical Computer Science. The library subscribes to over 350 national and international journals.

The library has access to over 3500+ online journals from major publishers such as Elsevier, American Mathematical Society, American Physical Society, Springer Verlag, World Scientific, Institute of Physics, Wiley, etc.

Library has also access to Nature online, Science Online, ACM Digital Library, SIAM Journals Archive, Duke Mathematical Journal, and JSTOR Full digital archive. It has also perpetual online access to backfile collection of journals contents from Volume 1 from some of the major publishers like Elsevier under DAE consortium, Springer, World Scientific, Wiley, deGruyter, Cambridge University Press, Turpion, IOP Publishing and Annual Reviews Electronic Backvolume collection.

Access to online journals is restricted to members of the Institute.

Services

Apart from developing the collection, the library offers reprographic and inter library loan services. Using Libsys software on a linux platform, the library catalogue has been computerized and made available online to the readers both within and outside the Institute Campus. Online request for acquisition of books and status of borrowings have also been enabled using Libsys. Library has implemented RFID based system for self check-in and checkout of library materials. The library also provides effective 24x7 access to its resources with the help of RFID enabled access control system, perhaps the only library of this kind in the country.

Library has a website dedicated to host all the electronic information resources and to provide information about the library and its services.

Library is a member of DAE Libraries Consortium that subscribes to SCIENCE DIRECT SERVICE of Elsevier.

Library is also coordinating the MathSciNet consortium which provides online access to MathSciNet for participating institutions in the southern region.

Library is an institutional member of AMS, MALIBNET, CURRENT SCIENCE Association, and IAPT.
Acknowledgment

The Library gratefully acknowledges the donation of valuable books, journals and other reading materials received during the current year from the persons and organizations mentioned below:

Amritanshu Prasad, IMSc  
Balasubramanian, R., IMSc  
Kamal Lodaya, IMSc  
Radha Balakrishnan, IMSc  
Phawade Ramchandra Babasaheb, IMSc  
Raja, S., IMSc  
Rajesh Singh, IMSc  
Ritwik Mukherjee, IMSc  
Sudhir N. Pathak, IMSc  
Chandra Sekaran, P.  
Masuda Kayo  
Swami Suchitananda, Ramakrishna Mission

Arvind, V., IMSc  
Date, G., IMSc  
Sanoli Guin, IMSc  
Sitabhra Sinha, IMSc  
Prafulla Kumar Tale, IMSc  
Rajarshi Pal, IMSc  
Ramanathan Thinniyam Srinivasan, IMSc  
Sumit Giri, IMSc  
Delli Babu, RWTH Univ., Germany  
Patnaik Lingaraj  
DAE  
NBHM