THE INSTITUTE OF MATHEMATICAL SCIENCES

C. I. T. Campus, Taramani,

Chennai - 600 113.

REPORT ON ACADEMIC ACTIVITIES

Apr 2007 - Mar 2008

Telegram: MATSCIENCE Fax: +91-44-2254 1586
Telephone: +91-44-2254 3100/1856 , DID No : +91-44-2254 3xxx (xxx = extension)

Website : http://www.imsc.res.in/

Foreword

I am presenting the progress report of 2007-2008 this year with mixed feelings.

At the time of writing this foreword, Prof. Alladi Ramakrishnan, who founded this Institute in 1962, passed away on 7 June 2008 in Gainesville, Florida, USA. Prof. Ramakrishnan founded the Institute in 1962 and functioned as its Director till his retirement from here in 1983. In those two decades of his association with the Institute, Prof. Ramakrishnan inspired several youngsters in and around Chennai. This report contains a short biography of Prof. Ramakrishnan.

I note that five of our members were given external awards including the J C Bose medal, the Homi Bhabha Gold medal, distinguished teacher award and fellowship to the Indian Academy of Sciences.

A look at the list of publications of our members shows that this year continues to be academically productive. We organised several conferences and workshops this year. These include X workshop on High Energy Physics Phenomenology (WHEPP), ATM workshop on Algebraic Topology, Cipher-Retreat on Cryptology, a workshop on Non-commutative Geometry and Ergodic Theory and operator algebras and a workshop on Algorithms and Complexity.

The Institute also organised some off site conferences, namely, The sixth international conference on Gravitation and Cosmology, The Interface of Life, a School on Biomolecular Simulation, an international conference followed by a workshop in Statistical Physics approach to Multi-disciplinary problems and an International Conference on nano science and technology.

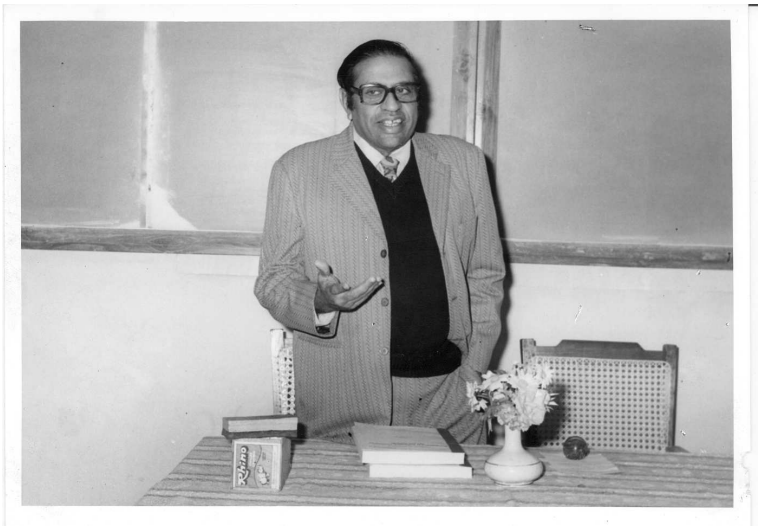
The Subashish Nag Memorial lecture was given this year by Prof Robert C. Penner of the University of Southern California.

The Institute Seminar Week has by now become a tradition here and this year too there was active and enthusiastic participation by our Research Fellows, both pre and post doctoral, and faculty. There were 30 talks in this event.

This report was compiled through the efforts of a Annual Report Committee comprising of Drs Krishna Maddaly, V Arvind, Sudeshna Sinha, Paul Pandian and Mr Parthiban. I owe my gratitude to all of them.

June, 2008 **R Balasubramanian**

Dr. Alladi Ramakrishnan, Founder-Director,
Institute of Mathematical Sciences, passes away



Alladi Ramakrishnan, the Founder-Director of the Institute of Mathematical Sciences, (also known as MATSCIENCE) Chennai, passed away on 7th June 2008 at Gainesville, Florida, USA.

Alladi Ramakrishnan was born on 9th August, 1923 in Chennai. He received his B.A.(Hon) from the University of Madras in 1943. Later he worked with Homi J. Bhabha at the Tata Institute of Fundamental Research and completed his Ph.D at University of Manchester in 1950 where he worked under the guidance of Maurice Bartlett. He returned to India and joined the Department of Physics, University of Madras, as a Reader. He founded the Institute of Mathematical Sciences, Chennai, in the year 1962, and was the Director of the Institute till his retirement in 1983. He was elected Fellow of the Indian Academy of Sciences in 1955.

He had written over a hundred research articles on many areas of theoretical and mathematical physics, including special theory of relativity, matrix analysis, elementary particles, and stochastic processes. He had been an inspiring teacher and had guided about thirty Ph.D students, most of whom became scientists working in premier research institutions and universities across India.

He is survived by his wife, Lalitha, and son Alladi Krishnaswami, a mathematician.

Contents

Chapter 1

The Institute

1.1 Board

Dr.K.Ponmudi, Hon'ble Minister for Education, Government of Tamil Nadu, Fort St. George, Chennai 600 009
(**Chairman**)

Dr. **Anil Kakodkar**, 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. **S.Ramachandran**, Vice Chancellor, University of Madras, Chennai 600 005.
(**Member**)

Prof. **C. S. Seshadri**, Director, Chennai Mathematical Institute, Information Technology Park, Padur Post, Siruseri 603 103.
(**Member**)

Prof. **S. S. Jha**, Department of Physics, Indian Institute of Technology, Bombay, Mumbai 400 076
(**Member**)

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

Prof. **Amitava Raychaudhuri,** Director, Harish Chandra Research Institute, Chhatnag Road, Jhusi, Allahabad 211 019.
(**Member**)

Shri **V.P.Raja**, I.A.S., Principal Adviser & Joint Secretery(R&D), Department of Atomic Energy, CSM Marg, Mumbai 400 001
(**Member**)

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

Shri **K.Ganesan**, I.A.S., Secretary to Government, Higher Education Department, Government of Tamil Nadu, Fort St. George, Chennai 600 009
(**Member**)

Prof. **R. Balasubramanian**, Director, The Institute of Mathematical Sciences, Chennai
(**Member Secretary**)

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**, Director, Tata Institute of Fundamental Research, Mumbai 400 005
(**Member**)

Prof.**Amitava Raychaudhuri,** Director, Harish Chandra Research Institute, Chhatnag Road, Jhusi, Allahabad 211 019
(**Member**)

Prof. **C. S. Seshadri**, Director, Chennai Mathematical Institute, Information Technology Park, Padur Post, Siruseri,603 103.
(**Member**)

Shri **V.P.Raja,** I.A.S., Principal Adviser & Joint Secretery (R&D), Department of Atomic Energy, CSM Marg, Mumbai 400 001
(**Member**)

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

Shri **K.Ganesan**, I.A.S., Secretary to Government, Higher Education Department, Government of Tamil Nadu, Fort St. George, Chennai 600 009
(**Member**)

Prof. **R. Balasubramanian**, Director, The Institute of Mathematical Sciences,Chennai
(**Member Secretary**)

1.3 Faculty

Name	*Userid*	*Tel. Ext.*
Mathematics		
Anirban Mukhopadhyay	anirban	251
Balasubramanian, R.	balu	200
Iyer, Jaya N.	jniyer	306
Kesavan, S	kesh	209
Kodiyalam, Vijay	vijay	212
Krishna, M.	krishna	309
Nagaraj, D. S.	dsn	271
Paranjape, Kapil H.	kapil	214
Partha Sarthi, Chakraborty	parthac	252
Pralay Chatterjee	pralay	305
Prasad, Amritanshu	amri	207
Raghavan, K. N.	knr	264
Sankaran, P.	sankaran	211
Srinivas, K.	srini	215
Sunder, V. S.	sunder	210
Physics		
Anishetty, R.	ramesha	321
Baskaran, G.	baskaran	303
Basu, Rahul	rahul	311
Date, G.	shyam	304
Digal, Sanatan	digal	259
Govindarajan, Thupil R.	trg	205
Indumathi, D.	indu	302
Jagannathan, R.	jagan	315
Jayaraman, T.	jayaram	312

Kaul, R.	kaul	317
Menon, Gautam I.	menon	266
Mishra, Ashok K.	mishra	323
Murthy, M. V. N.	murthy	326
Nemani, V.S.	nemani	263
Prashanth Jaikumar, R.	jaikumar	261
Rajesh, Ravindran	rrajesh	255
Rama, S. Kalyana	krama	313
Ronojoy Adhikari	rjoy	253
Ray, Purusattam	ray	319
Sathiapalan, Balachandran	bala	320
Satyavani Vemparala	vani	257
Shankar, R.	shankar	327
Sharatchandra, H. S.	sharat	254
Sibasish Ghosh,	shibais	216
Siddharthan, Rahul	rsidd	204
Simon, R.	simon	120
Sinha, Nita	nita	267
Sinha, Rahul	sinha	268
Sinha, Sitabhra	sitabhra	301
Sinha, Sudeshna	sudeshna	203
Sujay K.Ashok	sashok	265

Theoretical Computer Science

Arvind, V.	arvind	218
Lodaya, Kamal	kamal	310
Mahajan, Meena B.	meena	307
Raman, Venkatesh	vraman	220
Ramanujam, R.	jam	269
Subramanian, C.R.	crs	324

1.4 Scientific Staff

Subramoniam, G.	gsmoni	221
Ravindra, Reddy	ravi	222

1.5 Technical Staff

Paul Pandian, M.	pandian	383
Arangarajan, R.	arajan	247
Mohan, S.	mohan	300
Venkatesan, G.	gvenkat	384
Usha Devi, P.	usha	385

1.6 Project Scientists

Balakrishnan, Radha	radha	219
Mani, H.S.	hsmani	316
Rajasekaran, G.	graj	206

1.7 Project Staff

Ayan Nandy,	ayan	369
Akila	akila	167
Das Chittaranjan	crdas	226
Dhinesh Kumar, V.	dhinesh	226
Haripriya, T.V.	tvhpriya	260
Kausalya, Srinivas	kausalya	326
Mangal, Pandey	mangal	217
Raina, P.M.	raina	226
Somasundaram,	sssunder	167

Sreenivasan, N.S.	nss	381
Sridhar, S.	ssridhar	105
Srinivasan, G.	gsvasan	208

1.8 Post-Doctoral Fellows

Mathematics

Anisa Mohmad Husen Chorwadwala	anisa	102
Anupam Kumar Singh	anupamk	105
Baoulina, Ioulia	baoulina	324
Md. Manirul Ali	-	-
Nicholas Paul Gill	nick	101
Prakash,R.	prakash	256
Purusottam Rath	rath	258
Satadal Ganguly	ganguly	207
Sidhartha Sarkar	sidhu	226
Subramonian Moothathu,T.K.	tksm	327
Tamil Selvi,A.	tamilselvi	308
Veerendra Vikram, Awasthi	vvawasthi	103

Physics

Debaprasad Maity	debu	102
Prasanta Kumar Das	dasp	258
Santhosh,G.	santhosh	322
Shreecharan,T.	shreet	108
Zahera Jabeen	zahera	308

Theoretical Computer Science

Madhu Kallingalthodi	kmadhu	256
Majumdar, Kaushik	kaushik	328
Tribikram Gupta	tgupta	103

1.9 Ph.D. Students

Name	*Userid*	*Tel. Ext.*
Mathematics		
Aaloka, Kanhere	aaloka	114
Anoop,T.V.	tvanoop	371
Ajay Singh Thakur	thakur	382
Chattopadhyay Pratyusha	pratyusha	376
Dubey Umesh Venkatesh	dubey	382
George Scaria	george	287
Gupta, Ved Prakash	vpgupta	224
Krishna, K.S.	krishna	223
Krishnan, Rajkumar	rkrishnan	239
Madhushree Basu	madhu	114
Mubeena, T.	mubeena	241
Pal Sarbeswar	spal	376
Pampa Paul	pampa	241
Pooja Singla	pooja	223
Prem Prakash Pandey	premsmg	223
Samuel Preena	preena	376
Sarkar Swagata	swagata	294
Sundar, S.	ssundar	382
Tupurani Srikanth	tsrikanth	242
Physics		
Anoop Varghese,	ganoop	223
Amit Kumar, Bhattacharjee	amit	348
Banerjee, Kinjal	kinjal	209
Belliappa, A.B.	belliappa	241

Bhowmick, Samrat	samr	373
Chakravarty, Gaurav	gaurav	373
Gopala Krishna, K.	gkrishna	294
Karthik,I.	karthik	111
Krishnakumar Sabapathy	kkkumar	223
Kumar, Alok	alok	272
Laddha, Alok	alokl	294
Lukose, Vinu	vinu	344
Misra, Basudha	basudha	294
Mitra, Mithun Kumar	mithun	211
Neeraj Kumar, Kamal	neeraj	237
Pan, Raj Kumar	rajkp	211
Pradeep Kanth, J. Maruthi	maruthi	299
Rajeev Singh,	rajeev	223
Rashmi Behera,	-	-
Saket, Abhinav	abhinav	373
Sandeep K., Goyal	goyal	374
Sandipan Sengupta,	sandi	371
Saptarishi, Mondal	saptarshi	344
Sharma, Chandradev	sharma	344
Sircar, Nilanjan	nilanjan	373
Solomon, Ivan J.	solomon	289
Somdeb Ghose,	somdeb	223
Soumyajit, Pramanik	soumyajit	241
Sourish Kumar, Maitra	sourish	237
Syed Mohammed Kamil	kamil	223
Tanumoy, Mandal	tanumoy	241
Vallan Bruno Cruz, A.	bruno	223

Theoretical Computer Science

Aravind N.R.	nraravind	299

Amaldev	amal	373
Das, Bireswar	bireswar	211
Easaw Simon, Sunil	ssimon	224
Geevarghese Philip,	philip	371
Kunal, Dutta	kdutta	237
Limaye P., Nutan	nutan	294
Mukhopadhyay, Partha	partham	299
Muthu, Rahul	rahulm	272
Narayanan, N.	narayan	259
Neeldhara, Mishra	neeldhara	119
Phawade, Ramachandra Babasaheb	ramachandra	299
Prajakta, Nimbhorkar	prajakta	240
Praveen,M.	praveen	371
Rao B.V., Raghavendra	bvrr	299
Saumya, Paul	saumya	373
Sharma, Jayalal	jayalal	112
Sheerazuddin, S.	sheeraz	223
Shripad Joglekar, Pushkar	pushkar	299
Sikdar, Somnath	somnath	272
Sreejith, A.V	sreejith	237
Srikanth, Srinivasan	srikanth	348
Vijayaraghavan, T.C	tcvijay	259

1.10 Administrative Staff

Name	*Userid*	*Tel. Ext.*
Saraswathi Ramaraj *Registrar*	sarasram	150
VishnuPrasad, S. *Admn. Officer*	svishnu	151
Palani, V. *Accounts Officer*	palani	152

Amulraj, D.
Ashfack Ahmed
Babu, B.
Balakrishnan, J.
Elumalai, G.
Ganapathi, R.
Gayatri, E.
Geetha, M.
Gopinath, S.
Indra, R.
Janakiraman, J.
Jayanthi, S.
Johnson, P.
Moorthy, E.
Munuswamy, M.
Munuswamy, N.
Muthukrishnan, M.
Nityanandam, G.
Padmanabhan, T.
Parijatham, S.M.
Parthiban, V.
Prema, P.
Radhakrishnan, M. G.
Rajasekaran, N.
Rajendran, C.
Ramesh, M.
Ravichandran, N.
Ravindran, A.
Rizwan Shariff, H.
Sankaran, K.P.
Selvaraj, M.
Tamil Mani, M.
Usha, Otheeswaran
Varadaraj, M.
Vasudevan, T.V.
Venugopal, T.

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

Chapter 2

Research and Teaching

2.1 Mathematics

2.1.1 Research Summary

Algebra

Some work was done [**Ko1**] studying determinantal and Pfaffian ideals of symmetric, skew-symmetric and alternating matrices over general commutative rings. Some of the results obtained include proofs of evenness of the McCoy rank, an extension of the principal minor theorem and a general expansion formula for the Pfaffian of an alternating matrix.

A classification of centralizer algebras of matrices into finite, tame, or wild representation types is being attempted, using methods from the representation theory of quivers.

The similarity classes of 3×3 matrices over a local principal ideal ring were analyzed in [**Pr2**]. When the residue field is finite, and explicit formula, as well as a generating function for the number of such classes was obtained. Similar results were obtained for conjugacy classes in the general linear group.

Lie Groups, Algebraic groups, Dynamical systems on homogeneous spaces

Research has been done in various areas of finite and infinite group theory, as described below.

Linear spaces: two papers have been published in the last twelve months contributing to the classification of finite linear spaces which admit a line-transitive automorphism group. One of these works was sole author, the author with Alan R. Camina and Alexandre E. Zalesski. A talk was given in IMSc outlining some of the implications of this work. [**G2**, **G5**]

Projective planes: two papers on this subject are relevant. They are both sole author - one has been published, the other has appeared as a pre-print. Together they consitute a very significant contribution to a proof of the following conjecture: "a projective plane admitting a point-transitive automorphism group is Desarguesian". A talk was given in TIFR, Mumbai,

on this subject. [**G1**, **G4**]

Reversibility and conjugacy: work has been undertaken with Ian Short and Anthony G. O'Farrell. Results have been produced which classify reversibility in various groups of homeomorphisms of the line and the circle. In addition a new classification of conjugacy in Thompson's group F has been announced. In association with Ian Short, a new classification of conjugacy in Thompson's group T has also been written down, although we are yet to announce this formally. A talk was given as part of IMSC's seminar week on this subject. [**G6**, **G7**, **G8**]

Real conjugacy classes: work has commenced (with Anupam Singh) on a classification of real conjugacy classes in various finite groups of Lie type. Complete results have been obtained for several infinite families of classical groups as well as some low-rank exceptional groups. No results have been announced to this point - this is likely to occur some time in the next couple of months. Anupam Singh gave a talk on this subject as part of IMSc's seminar week.

Work is in progress on (strongly) real conjugacy classes in the Groups of Lie type with Nick Gill. A formula for some groups like GL_n, SL_n, U_n and G_2 was successfully written down. The representation theory side of this problem is also being considered.

It is shown that the proof by Mehta and Parameswaran that Wahl's conjecture holds in odd characteristics for Grassmannians works also for symplectic and orthogonal Grassmannians [**S**].

Computed the initial ideals, with respect to certain conveniently chosen term orders, of ideals of tangent cones at torus fixed points to Schubert varieties in orthogonal Grassmannians. These turn out to be square-free monomial ideals and therefore Stanley-Reisner face rings of simplicial complexes. These complexes are described. The maximal faces of these complexes encode certain sets of non-intersecting lattice paths [**R3**].

Algebraic Geometry

The group of n-by-n special linear matrices over an algebraically closed field of characteristic $p > 2$ acts naturally on the direct sum of several copies of the space k-vectors and covectors. It was shown in [**L**] that the resulting quotient variety is Frobenius split provided the number of copies the space of k-vectors and covectors are at least n each. Similar result has been obtained for the group of special orthogonal group.

Varieties defined over number fields

In recent work of Ravi Vakil (of Stanford University) it has been shown that moduli spaces of smooth projective surfaces can be "arbitrary". By combining his ideas and those in an earlier paper we are aiming to show that *any* finite type affine scheme over the integers is a connected component of the moduli space of smooth projective surfaces.

The Double-Six

The Shläfli double-six is a sextuple of pairs of skew lines in space which has been known for about 150 years. It arises in the study of the lines on a cubic surface over complex numbers. Representations of these configurations in ordinary (3-dimensional) space are rather hard

to come by. An exposition of how such configurations can be constructed has been written and this procedure demonstrated was demonstrated by means of a programme and a short animated film.

Resolving group quotients

In earlier collaborative work with D. Ramakrishnan, the question of minimally resolving the quotient of n-space by the alternating group on $n+1$ symbols has come up. In joint work with Sarbeshwar Pal we are studying the problem of completing such a resolution in the case $n = 4$. So far we have completed the resolution outside the origin.

Combinatorial Algebraic Topology

Earlier work of Daniel Kan indicates that one can construct a completely combinatorial description of the homotopy theory of simplicial complexes. However, the proofs that these give the same answers as the "usual" ones seems to involve non-algebraic techniques. By studying the work of Kan and more recent work we have (in collaboration with Umesh Dubey) found a combinatorial proof.

Finitistic constructions of derived categories

In collaboration with Umesh Dubey, the work of Beilinson and Kapranov, which gives an elementary description of the derived category of coherent sheaves on complex projective homogeneous spaces is being studied. This is a subject that has recently seen a spurt in interest following the work of Orlov, Bondal and Bridgelund.

Lie Groups

It was shown that Heisenberg Lie groups are in canonical one to one correspondence with abelian Lie groups with finitely many connected components, generalising the classification result of [**Pr3**] from finite groups to Lie groups. This results from a decomposition of the phase space into the product of an abelian Lie group and its Pontryagin dual. Efforts are underway to identify other interesting classes of Heisenberg groups for which this property holds.

Analytic Number Theory

G.H. Hardy was the first to show that the classical Riemann zeta-function has infinitely many zeros on the critical line. A. Selberg developed the notion of Selberg Class: a class of Dirichlet Series having analytical properties analogous to the Riemann zeta-function. It has been shown that a function of *degree* two in the Selberg Class has infinitely many zeros on the critical line [**Kot2**].

Let G be a finite abelian group , written additively . A set A is said to be sumfree if the equation $x + y = z$ has no solution in A . Now assume that all the prime divisors of $|G|$ are of the form $3k + 1$ (the other cases already dealt with by Ben Green and Ruzsa) In [**B3**] , a charecterisation of sumfree sets with maximal cardinality and also (in a few cases) count the number of the sumfree sets are discussed.

In [**B2**] , it is observed that , under schinzel's Hypothesis one can produce many examples

of a sequence of k consecutive integers such that the total number of prime factors of the product is substantially less than the number of primes upto $2k$.

For a finite abelian group written additevely , what is the largest cardinality of a subset$A$ such that no subsum of elements of A add upto zero . This number is called Davenport's constant . In [**Rb2**], it is proved that the number is $|G|/5$ withfinitely many exceptions and the exceptions are explicitely given In the same vein , given a subset B of integers ,one can ask for the largest subset A such that no linear combination of the elements of A with coeffients from B vanishes . This is the subject matter of [**B1**] and [**Rb3**].

Work is in progress regarding infinitute of zeros of a general L-function in Selberg class of degree 2. An infinite family of number fields is constructed whose class numbers has many prime factors. This improves and generalises an earlier result of the authors. some study is being done on questions regarding number of factorisations of intergers.

Operator Algebras

Some time was spent on reading up some work by Feldman and Moore on the one hand and by Damien Gaboriau on the other, on 'orbit equivalence', and preparing the ground-work for a workshop that was organised on this theme in February.

Some time was also spent with Vijay Kodiyalam on trying to obtain an independent approach to the result obtained by Guionnet-Jones-Shlyakhtenko to prove that every 'subfactor planar algebra' indeed arose from a subfactor, which was based entirely on planar algebraic arguments, and bypassed any reference to random marices or free probability theory.

Some time back on quantum SU(2) we constructed a spectral triple. This has been studied in great detail. We show that this spectral triple does not satisfy Poincare duality. But classically as a manifold SU(2) is same as the three sphere and this property continues in the quantum arena. More precisely quantum SU(2) is a special case of odd dimensional quantum spheres. So, more generally we obtain an explicit KK-equivalence between od dimensional quantum spheres and circle. This in turn allows us to construct equivariant spectral triples for odd dimensional quantum spheres satisfying Poincare duality.

Representation Theory

In [**Pr1**], a new notion of cuspidality for representations of GL_n over a finite quotient O_k of the ring of integers O of a non-Archimedean local field F using geometric and infinitesimal induction functors, which involve automorphism groups G_λ of torsion O-modules is defined. When n is a prime, it is shown that this notion of cuspidality is equivalent to strong cuspidality, which arises in the construction of supercuspidal representations of $GL_n(F)$. Strongly cuspidal representations share many features of cuspidal representations of finite general linear groups. In the function field case, it is shown that the construction of the representations theory of $GL_n(O_k)$ for $k \geq 2$ for all n is equivalent to the construction of the representations of all the groups G_λ. A functional equation for zeta functions for representations of $GL_n(O_k)$ is established for representations which are not contained in an infinitesimally induced representation. All cuspidal representations for $GL_4(O_2)$ are constructed. Not all these representations are strongly cuspidal.

A characterization of the maximal abelian sub-algebras of matrix algebras that are normalized by the canonical representation of a finite Heisenberg group was given. Further, a classification of finite Heisenberg groups was obtained and used to construct a rich class of examples [**Pr3**].

Topology

An action of a group on a Hausdorff topological space is said to be chaotic if the set of points having finite orbits is dense and the action is topologically transitive. A characterization of all groups which can act chaotically on the space of rationals has been obtained. The class of all such groups is shown to have some remarkable closure properties. As a corollary, it is proved that there exist continuously many distinct conjugacy classes of chaotic homeomorphisms of the rationals.

It has been shown that there are no degree one maps between two complex Grassmann manifolds $G_k(\mathbb{C}^n), G_l(\mathbb{C}^m)$ of the same dimension unless the map is a homotopy equivalence. In fact, fixing the integers $k, l > 1, \neq l$, for all but finitely many n, the degree of any continuous map was shown to be zero.

The K-rings of torus manifolds with locally standard action and whose quotients are homology polytope had been described in terms of generators and relations. This class of spaces contains as a special case the smooth compact complex toric varieties.

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.

[**B1**]
Sukumar Das Adhikari***, R. Balasubramanian, F. Pappalardi*****, and P. Rath**.
Some zero sum constants with weights.
Proceedings of the Indian academy of Sciences, **118(2)**, 183–188, 2008.

[**B2**]
R. Balasubramanian, S. Laishram***, N Shorey*** **T, and R. Thangdurai***.
The number of prime divisors of a product of consecutive integers.
2007.

[**B3**]
R. Balasubramanian, Gyan Prakash***, and D.S Ramana***.
Sumfree sets of finite abelian groups of type iii.
2007.
(Preprint: ArXiv 0711.4317).

[C]
Partha Sarathi Chakraborty and Arupkumar Pal*.
Equivariant spectral triples and poincaré duality for $su_q(2)$.
2007.

[**Ch1**]
Pralay Chatterjee.
On the power maps, orders and exponentiality of p-adic algebraic groups.
Journal fur die reine und angewandte Mathematik (Crelle's Journal), 2008.
(To be published).

[**Ch2**]
Pralay Chatterjee.
Automorphism invariant cartan subgroups and power maps of disconnected groups.
2008.
(Submitted).

[**Ch3**]
Pralay Chatterjee.
Surjectivity of the power maps of real algebraic groups.
2008.

[**G1**]
Nick Gill.
Transitive projective planes.
Advances in Geometry, **7**, 475, 2007.

[**G2**]
Nick Gill.
$PSL(3, q)$ and line-transitive linear spaces.
Beiträge zur Algebra und Geometrie, **48**, 591, 2007.

[**G3**]
Nick Gill.
Polar spaces and embeddings of classical groups.
New Zealand Journal of Mathematics, 2007.
(To be published).

[**G4**]
Nick Gill.
Transitive projective planes and 2-rank.
2007.
(Preprint: 0711.4459).

[**G5**]
Nick Gill, Alan R. Camina***, and Alexandre E. Zalesski***.
Large dimensional classical groups and linear spaces.

Bulletin of the Belgian Mathematical Society - Simon Stevin, 2008.
(To be published).

[**G6**]
Nick Gill, Anthony G. O'Farrell*, and Ian Short*.
Reversibility in the group of homeomorphisms of the circle.
2008.
(Submitted).

[**G7**]
Nick Gill and Ian Short*.
Conjugacy in Thompson's group.
2007.
(Preprint: 0709.1987).

[**G8**]
Nick Gill and Ian Short*.
Reversible maps and composites of involutions in groups of piecewise linear homeomorphisms of the real lines.
Aequationes Mathematicae, 2008.
(To be published).

[**I1**]
Indranil Biswas* and Jaya N. Iyer.
Vanishing of the chern classes of de rham bundles for some families of moduli spaces.
Communications in Algebra., **35(5)**, 1525, 2007.

[**I2**]
Jaya N. Iyer.
Chern invariants of some flat bundles in the arithmetic deligne cohomology.
Math. Zeitschrift (published online)., DOI 10.1007/s00209-007-0261-x, 2008.
(To be published).

[**I3**]
Jaya N. Iyer.
Murre's conjectures and explicit chow–kuenneth projectors for varieties with a nef tangent bundle.
Transactions of Amer.Math.Soc, 2008.
arXiv math.AG/07061566 (To be published).

[**I4**]
Jaya N. Iyer.
Murre's conjecture for rational homogeneous bundles over a variety.
2008.
(Submitted).

[**I5**]
Jaya N. Iyer and Indranil Biswas*.
Holomorphic connections on some complex manifolds.
C. R. Math. Acad. Sci. Paris, **344(9)**, 577, 2007.

[**I6**]
Jaya N. Iyer and Uma N. Iyer*.
Chern-simons classes of flat connections on supermanifolds.
2007.
arXiv math.AG/07072321 (Submitted).

[**I7**]
Jaya N. Iyer and Stefan Mueller-Stach*.
Chow–kuenneth decomposition for some moduli spaces.
2007.
arXiv math.AG/07104002 (Submitted).

[**I8**]
Jaya N. Iyer and Carlos T. Simpson*.
A relation between the parabolic chern characters of the de rham bundles.
Math. Annalen., **338(2)**, 347, 2007.

[**I9**]
Jaya N. Iyer and Carlos T. Simpson*.
Regulators of canonical extensions are torsion; the smooth divisor case.
arXiv math.AG/07070372 (not for publication)., 2007.
(Preprint: arXiv math.AG/07070372).

[**I10**]
Jaya N. Iyer and Carlos T. Simpson*.
The chern character of a parabolic bundle, and a parabolic reznikov theorem in the case of finite order at infinity.
'Geometry and Dynamics of groups and spaces', in memory of A.Reznikov, Progress in Maths, Vol.265, Kapranov,M;Kolyada,S;Manin,Y.I;Moree,P;Potyagaillo,L (Eds), **Vol 265**, 439, 2008.

[**K**]
S. Kesavan and T. Muthukumar.
Low cost control problems on perforated and non-perforated domains.
Proceedings of the Indian Academy of Sciences (Mathematical Sciences), **118(1)**, 133, 2008.

[**Ko1**]
Vijay Kodiyalam, T.Y. Lam*, **and R.G. Swan***.
Determinantal ideals, Pfaffian ideals and the prinicpal minor theorem.
In S.K.Jain and S.Parvathi, editors, *Noncommutative rings,group rings, diagram algebras and their applications*, page 35. AMS, 2007.
(To be published).

[**Ko2**]
Vijay Kodiyalam and V. S. Sunder.
Graphs, planar algebras and Kuperberg's invariant.
Journal of Operator Theory, 2007.
(To be published).

[**Ko3**]
Vijay Kodiyalam and V. S. Sunder.
Temperley-lieb and non-crossing partition planar algebras.
Proceedigs of Conference on Non-commutative ring theory and Diagram algebras, to be published in Contemporary Math., 456, 2008.
(To be published).

[**Kot1**]
Srinivas Kotyada and Anirban Mukhopadhayay.
A zero-density estimate for the selberg class.
International Journal of Number Theory, **3(2)**, 263, 2007.

[**Kot2**]
Srinivas Kotyada, Anirban Mukhopadhyay, and Rajkumar Krishnan.
On the zeros of functions in the selberg class.
ArXiv, 2008.
(Preprint: 0804.0715).

[**Kr**]
Debasish Bose*, **C.P.Anil Kumar***, **R. Krishnan, and Shobha Madan***.
On Fugledés conjecture for three intervals.
In *arXiv.org*. 2008.
(Preprint: arxiv:0308.0049).

[**L**]
V. Lakshmibai, K. N. Raghavan, and P. Sankaran.
Frobenius splitting of certain rings of invariants.
Michigan Mathematical Journal, 2007.
(To be published).

[**M1**]
Kalyan Chakraborty*, **Florian Luca***, **and Anirban Mukhopadhyay**.
Class numbers with many prime factors.
2008.
(Submitted).

[**M2**]
Anirban Mukhopadhyay and Kotyada Srinivas.
A zero density estimate for the selberg class.
International journal of number theory, **3(2)**, 263, 2007.

[**P1**]
Kapil H. Paranjape.
Debian on a slug: Or how a slug made friends with a gnu and a penguin.
Linux Gazette, **138(138)**, 01, 2007.

[**P2**]
Kapil H. Paranjape.
Setting up an encrypted debian system.
Linux Gazette, **140(140)**, 01, 2007.

[**P3**]
Kapil H. Paranjape.
Who is using your network?
Linux Gazette, **141(141)**, 01, 2007.

[**P4**]
Kapil H. Paranjape.
Virtualizing without virtualizing.
Linux Gazette, **150(150)**, 01, 2008.

[**Pr1**]
Anne-Marie Aubert***, Uri Onn*****, and Amritanshu Prasad**.
On cuspidal representations of general linear groups over discrete valuation rings.
2007.
(Submitted).

[**Pr2**]
Nir Avni***, Uri Onn*****, Amritanshu Prasad, and Leonid Vaserstein***.
Similarity classes of 3×3 matrices over local principal ideal rings.
Communications in Algebra, 2007.
(To be published).

[**Pr3**]
Amritanshu Prasad and M. K. Vemuri*.
Inductive algebras for finite Heisenberg groups.
2007.
(Submitted).

[**R1**]
V. Lakshmibai***, K. N. Raghavan, and P. Sankaran**.
Frobenius splitting of certain rings of invariants.
Michigan Mathematics Journal, 2007.
(To be published).

[**R2**]
K. N. Raghavan and Shyamashree Upadhyay*.
Hilbert functions of points on Schubert varieties in Orthogonal Grassmannians.

2007.
math.CO.07040542 (Submitted).

[**R3**]
K. N. Raghavan and Shyamashree Upadhyay*.
Initial ideals of tangent cones to Schubert varieties in orthogonal Grassmannians.
2007.
arXiv:0710.2950 (Submitted).

[**Rb1**]
Balasubramanian R and Ramachandra K*.
Some problems of analytic number theory -v.
In N.Saradha, editor, *Diophantine equations*, page 49. narosa Publishing house, Nov 2007.

[**Rb2**]
Balasubramanian R and Bhowmik gautami*.
Upper bounds for davenport constant.
In *Combinatorial Number theory*, page 61. De Gruyter , Berlin, Nov 2007.

[**Rb3**]
Adhikari S.D*, **Balasubramanian R, and Rath P***.
Some combinatorial group invariants and their generalisations with weights.
CRM Proc lecture notes, **43**, 327, 2007.

[**S**]
V. Lakshmibai*, **P. Sankaran, and K. N. Raghavan**.
Wahl's conjecture holds in odd characteristics for symplectic and orthogonal Grassmannians.
2007.
arXiv:0710.3470 (Submitted).

[**Si**]
Anupam Singh.
Real elements in spin groups.
2007.
(Submitted).

[**Sn**]
Balaji V*, **Biswas I***, **Gabber O***, **and Nagaraj D. S**.
Brauer obstruction for a universal vector bundle.
C. R. Math. Acad. Sci. Paris, **345(5)**, 265, 2007.

[**V**]

Books/Monographs Authored/Edited

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

[**K**]
S. Kesavan.
Functional Analysis.
Texts and Readings in Mathematics (TRIM). Hindustan Book Agency, New Delhi, India., 2007.
(To be published).

[**R**]
Venkatramani Lakshmibai* **and Komaranapuram N. Raghavan**.
Standard Monomial Theory–Invariant Theoretic Approach, volume 137 of *Encyclopaedia of Mathematical Sciences*.
Springer, Berlin Heidelberg, 2008.

[**S**]
Siva Athreya* **and V. S. Sunder**.
Measure and Probaility.
Universities Press, 160 Anna Salai,Chennai 600002, 2008.

2.2 Physics

2.2.1 Research Summary

Astroparticle Physics

Recent observations confirming the existence of heavy neutron stars around 2 solar masses pose a challenge to existing equations of state that describe neutron stars with quark cores (hybrid stars). An equation of state based on the topological Skyrme model of hadrons was investigated and found to yield neutron star masses and radii that are consistent with present observational constraints [**Ja1**].

The fact that neutrinos have mass and that their flavors oscillate implies that lepton flavor-violating (LFV) processes can occur even in the Standard model and not only in its extensions such as supersymmetry. We pointed out that LFV through electron to muon conversion can occur even without invoking neutrino oscillations, as in electron-nucleon/nucleus scattering. We computed the tree-level differential cross-section for electron to muon conversion in low-energy elastic electron-nucleon/nucleus scattering via single photon exchange for this standard model process. We also included the possibility of creating muons from the decay of photoproduced pions. We found that the cross-section of these processes is much larger than LFV processes induced by neutrino oscillations and comparable to that obtained in extensions of the standard model. Our results serve as a caution on the interpretation of future LFV experiments, and can also be used to check the running of the Weinberg angle at small momentum transfer [**Ja3**].

The production of heavy nuclei in an r-process situated in decompressing neutron matter at the surface of a neutron star was studied . The low entropy and small electron fraction of cold neutron matter leads to efficient production of heavy elements through the actinides. Substantial sensitivity of the final abundance pattern of heavy elements to heating from nuclear reactions and expansion timescale of the ejecta was evident in the decompression scenario. The frequency of decompression events in the galaxy was estimated and found to be significantly smaller than that of type II supernovae but comparable to binary neutron star mergers[**Ja2**].

Biological Physics

The electrostatic contribution to the elastic moduli of a driven cell or artificial membrane in an electrolyte has been calculated in recent work, in collaboration with D. Lacoste (ESPCI, Paris), J.-F. Joanny (Curie Inst., Paris) and Martin Bazant (MIT). The membrane is submitted to a DC electric field, which cause ions currents across the membrane, through specific channels, pumps or natural pores. A steady state and fluctuations about it are considered. In the steady state, charges accumulate in the Debye layers close to the membrane and as a result modify the elastic moduli of the membrane. Charge and membrane fluctuations are accounted for to first order in the membrane height field and in the channel concentration field. The electrostatic contribution to the bending modulus is shown to increase with the salt concentration, whereas the contribution to the surface tension decreases. The calculation also confirms the importance of capacitative effects, which are responsible for a negative contribution to the surface tension.

In certain situations (e.g., in people suffering from an ischemic heart), the normal periodic activity of the heart can be hampered by arrhythmias, i.e., disturbances in the natural rhythmic activity of the heart. A fatal arrhythmia occurring in the ventricles is Ventricular Fibrillation (VT), during which there is no coherent activation of the muscle cells so that the heart stops beating. Death follows within minutes, unless large electrical shocks are applied to "reset" the heart to its normal rhythm. The problem with such treatment is that not only is it painful, but it also causes damage to the heart tissue, creating scars which can act as substrate for future arrhythmias. The underlying cause for VF is the onset of spatiotemporal chaos, through the spontaneous formation and subsequent breakup of electrical spiral waves. For this reason, physicists have tried to devise control methods (based on the principles of nonlinear dynamics) that use electrical pulses of extremely low magnitude. We have ourselves proposed multiple methods that defibrillate with low-amplitude electrical stimuli, and in a recent review [**Sinh5**] have compared all the various control methods that have been proposed to date. We have recently also suggested a novel method of controlling such spatially extended chaos by stimulation along an array of points [**Sr**]. By generating a simulated wave of control that is constantly replenished by external stimulation, even when it is temporarily annihilated by collision with chaotic fragments, the method is successful in removing chaotic behavior with only a single application of very low-amplitude pulse.

Regulatory genomics (prediction of cis-regulatory modules and binding sites of transcription factors), developmental and evolutionary biology, statistics of DNA and relation to chromatin structure and features, multiple sequence alignment, sequence signatures in centromere formation.

A variety of experiments suggest that membrane proteins are important targets of anesthetic molecules, and that ion channels interact differently with anesthetics in their open and closed conformations. All-atom molecular dynamics simulations supplemented by normal mode analysis have been employed to probe the interactions of the inhalational anesthetic halothane with both an open and closed conformer of KirBac1.1, a potassium ion channel, embedded in a lipid bilayer. Normal mode analysis on the closed and open channel, in the presence and absence of halothane, reveals that the anesthetic modulates the global as well as the local dynamics of both conformations differently. In the case of the open channel the observed reduction of flexibility of residues in the inner helices, suggests a functional modification action of anesthetics on ion channels. In this context, preferential quenching of the aromatic residue motion and modulation of global dynamics by halothane may be seen as steps towards potentiating or favoring open state conformations. The present molecular dynamics simulations provide the first insights into possible specific interactions between anesthetic molecules and ion channels in different conformations.[**V4**]

The chemical-physical basis for K+ permeation and selectivity in K+ channels has been the focus of attention of many theoretical and computational studies since the first crystal structure was obtained by the Mackinnon lab in 1998. Most of the previous studies reported focused on atomic descriptions of permeation events in the selectivity filter of K+ channels in their closed conformation. A comparative analysis of permeation events in the KirBac1.1 K+ channel in a closed- and an open-state model was carried out using all-atom molecular dynamics simulations. As previously suggested by many studies of this and other K+ channels, when the channel is closed the ion conduction involves transitions between two main sites of the selectivity filter, with two K+ ions each coordinated by eight carbonyl oxygens of the protein and separated by a water molecule. In contrast, in our open-state model, three to four K+ ions move in a concerted motion during the permeation process. The selectivity filter, though maintaining a certain degree of flexibility to cope with these cooperative events, appears to be more symmetrical and robust in the simulations of the open-state channel when it is occupied by an average of three ions. Therefore, it appears as if the occupation of the pore depends upon the global conformation of the channel. Due to the complexity of these systems, only single conduction events have been described by means of molecular dynamics trajectories. To complement these results and describe the energetics of ion permeation and ionic fluxes, continuum approaches (Poisson-Boltzmann and Poisson-Nernst-Planck theory) have been also employed.[**V1**]

Infectious diseases and antibiotic resistance are now considered the most imperative global healthcare problem. In the search for new treatments, host defense, or antimicrobial, peptides have attracted considerable attention due to their various unique properties; however, attempts to develop in vivo therapies have been severely limited. Efforts to develop synthetic mimics of antimicrobial peptides (SMAMPs) have increased significantly in the last decade, and the work focused primarily on the structural evolution of SMAMPs and their membrane activity. In discussions regarding the membrane interaction of SMAMPs, close attention has been paid to the lipid composition of the bilayer. Despite many years of study, the exact conformational aspects responsible for the high selectivity of these AMPs and SMAMPs toward bacterial cells over mammalian cells are still not fully understood. The ability to design SMAMPs that are potently antimicrobial, yet nontoxic to mammalian cells has been demonstrated with a variety of molecular scaffolds. Initial animal studies show very good tissue distribution along with more than a 4-log reduction in bacterial counts. The results on SMAMPs are not only extremely promising for novel antibiotics, but also provide an

optimistic picture for the greater challenge of general proteomimetics.[**V3**]

Classical and Quantum Gravity, Black Holes, Cosmology

It is a long standing belief that a quantum theory gravity will "resolve" the singularities of classical gravity. That this does happen in the loop quantized homogeneous cosmological models has been established to an extent. These models however are "too simple" - there are no field degrees of freedom for example. The next class of models in increasing order of complexity are the inhomogeneous models, one of the simplest and yet non trivial example of these is the so-called *Polarized Gowdy model on* T^3. A program of loop quantization of this model and subsequent analysis has been initiated. The classical reformulation correcting earlier guesses in the literature has been completed in [**Ba1**]. The first steps which discuss the choice of the kinematical Hilbert space as well as quantization of the basic constraints have been carried out. There are many ambiguities which are yet to be addressed. These are discussed in [**Ba2**].

Condensed Matter Physics

Collections of non-Brownian particles suspended in a viscous fluid and subjected to oscillatory shear at very low Reynolds number have recently been shown to exhibit a remarkable dynamical phase transition separating reversible from irreversible behaviour as the strain amplitude or volume fraction are increased. A simple model for this phenomenon has been proposed in collaboration with Sriram Ramaswamy (IISc, Bangalore), based on which it is argued that this transition lies in the universality class of the conserved DP models or, equivalently, the Manna model. This leads to predictions for the scaling behaviour of a large number of experimental observables. It is thus proposed that non-Brownian suspensions under oscillatory shear may thus constitute the first experimental realization of an inactive-active phase transition which is not in the universality class of conventional directed percolation[**Me2**].

Ground state of systems of trapped neutral fermionic atoms at ultra-low temperatures, with the attractive interaction tuned to Feshbach resonance, are analysed by mapping them to a system of particles obeying exclusion statistics. The energies and the spatial densities of the few-body systems, using a generalisation of the extended Thomas-Fermi (ETF) method, are calculated at unitarity. The results are compared to the many-body Monte-Carlo calculations given by Chang and Bertsch (Phys. Rev. A**76**,021603(R) (2007)). The semiclassical FES results are consistent with the Monte-Carlo calculations of the above authors, but can hardly be distinguished from the over all scaling of the ETF result at unitarity.[**Mu1**]. These results support the earlier results obtained at finite temperature that indeed the fermions at unitarity may be described as an exclusion statistics system.

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

The production of the lightest neutralinos was studied in the radiative process $e^+e^- \to \tilde{\chi}_1^0\tilde{\chi}_1^0\gamma$ in low energy supersymmetric models for the International Linear Collider energies. This includes the minimal supersymmetric standard model as well as its extension with an additional chiral Higgs singlet superfield, the nonminimal supersymmetric standard model. The

dependence of the signal cross section on the parameters of the neutralino sector of the minimal and nonminimal supersymmetric standard model was compared and contrasted. The background to this process coming from the Standard Model process $e^+e^- \to \nu\bar{\nu}\gamma$, as well as from the radiative production of the scalar partners of the neutrinos (sneutrinos) $e^+e^- \to \tilde{\nu}\tilde{\nu}^*\gamma$, which can be a background to the radiative neutralino production when the sneutrinos decay invisibly was also considered. In low energy supersymmetric models radiative production of the lightest neutralinos may be the only channel to study supersymmetric partners of the Standard Model particles at the first stage of a linear collider, since heavier neutralinos, charginos and sleptons may be too heavy to be pair-produced at a e^+e^- machine with $\sqrt{s} = 500GeV$.[**Bas2**]

The dynamics of fermionic unparticles was developed from first principles. It was shown that any unparticle, whether fermionic or bosonic, can be recast in terms of a canonically quantized field, but with non-local interaction terms. A possible gauge theory was developed for fermionic unparticles. Computing the consequent contribution of un-fermions to the β function of the theory, it was shown that this can be viewed as the sum of two contributions, one fermion-like and the other scalar-like. However, if full conformal invariance is imposed, the latter vanishes identically. The consequences thereof as well as some general phenomenological issues are discussed.[**Bas1**]

It is argued that the quantum gravity attractions dynamically generate tiny degenerate Majorana masses for the neutrinos. The unequal masses of the charged leptons then induce a computable neutrino mass matrix with splittings and mixings through the electroweak interactions. In this way the Standard Model including quantum gravity can accommodate and predict the neutrino masses and mixings. Some consequences are pointed out.

Standard Model of HEP is extended to include a second scalar doublet, which is odd under an exact Z_2 discrete symmetry. Its lightest neutral member H^0 can be one component for the dark matter of the Universe.The general phenomenology of the four particles of this doublet is discussed without assuming that H^0 is the dominant component of the dark matter.The possibility of observing this dark scalar doublet at LHC and the impact of the dark scalar doublet on the observability of the standard model Higgs boson at colliders are studied.[**R3**]

A new method was proposed to determine the mass and width differences of the two D meson mass-eigenstates as well as the CP violating parameters associated with $D^0 - \bar{D}^0$ mixing. It was shown that an accurate measurement of all the mixing parameters is possible for an arbitrary CP violating phase, by combining observables from a time dependent study of D decays to a doubly Cabibbo suppressed mode with information from a CP eigenstate. As an example, $D^0 \to K^{*0}\pi^0$ decays where the K^{*0} is reconstructed in both $K^+\pi^-$ and $K_S\pi^0$ was considered. It was also shown that decays to the CP eigenstate $D \to K^+K^-$ together with $D \to K^+\pi^-$ decays can be used to extract all the mixing parameters. A combined analysis using $D^0 \to K^{*0}\pi^0$ and $D \to K^+K^-$ can also be used to reduce the ambiguity in the determination of parameters. [**Sin**]

Foundations of Quantum Mechanics

A hidden variable theoretical description of successive measurements of non-commuting spin

observables on an input spin-s state was considered[**Di**]. Although these spin observables are non-commuting, they act on different states, and so, the joint probabilities for the outputs of successive measurements are well-defined. We have shown that, in this scenario, hidden variable theory leads to Bell-type inequalities for the correlation between outputs of successive measurements. The maximum violation of these inequalities by quantum correlations (i.e., the correlations of successive measurements on a quantum state) by varying the spin value and the number of measurements was accounted for. Our approach can be used to obtain a measure of the deviation of Quantum Mechanics from the theory obeying realism and time-locality, in terms of the amount of classical communication needed to be transferred between successive measurements in order to simulate the above-mentioned correlations in successive measurements.

Non-perturbative QCD, Lattice Gauge Theory, QGP

The finite temperature phase transitions of a scalar field on a fuzzy sphere using Monte-Carlo techniques were studied. Our results agree with conventional calculations. The role of metastable states and the order of transition are argued[**D**]. Our analysis to many scalar fields was continued and spontaneous breakdown of global symmetry contrary to expectations from Coleman-Mermin-Wagner theorem[**Dig**] was established.

Nonlinear Dynamics, Solitons and Chaos

Using the Kirchhoff model, nonlinear dynamics of a thin elastic tube is analyzed to find its conformations. For constant torsion, the possible curvatures are shown to be Jacobi elliptic functions. A helical conformation arises as a special case.[**B1**] Such curvatures induce corresponding quantum effective periodic potentials for an electron in the tube, causing its delocalization.[**B2**, **B3**]

A general scheme for mapping the sine-Gordon equation to moving space curves is presented, and new classes of curves in addition to the existing ones are found. The variety of space curves that correspond to one-soliton , breather and two-soliton solutions of the various classes are displayed. [**B4**]

A local map capable of describing the full variety of dynamical states, ranging from regular to chaotic, obtained when a nematic liquid crystal is subjected to a steady shear flow, has been proposed and studied. The map is formulated in terms of a quaternion parametrization of rotations of the local frame described by the axes of the nematic director, subdirector and the joint normal to these, with two additional scalars describing the strength of ordering. The model yields kayaking, wagging, tumbling, aligned and coexistence states, in agreement with previous formulations based on coupled ordinary differential equations. Such a map can serve as a building block for the construction of lattice models of the complex spatio-temporal states predicted for sheared nematics[**K**]. Some progress on the construction of such coupled map lattices has been made.

Complex networks occur all around us, especially in the biological context, ranging from the protein contact network at the level of molecules to food webs at the level of ecological communities. Over the past few years, we have been addressing the issue of how network

structure affects the dynamics that such a system is capable of, and in turn, how does any constraint on dynamics affect the kind of structure that the network will have. To address the first question, we recently analysed the effect of small-world connection topology on excitable media dynamics and revealed a hitherto unsuspected transition between two varieties of patterns - one dominated by spatial patterns such as spiral waves, the other characterised by extremely regular temporal oscillations - when the number of long-range connections in a system is increases [**Sinh4**]. This result has ramifications across many biological systems, in particular in the brain, where neurons and glia form a similar excitable media with small-world topology. To address the second question, on how dynamics affects structure, we have recently shown that the issue of stability against dynamical perturbations can often force networks in nature to have modular structure [**P1**, **P4**]. This reveals a new mechanism of how networks that we see around us could have evolved as a result of multi-constraint optimization.

Biological neural networks were recently analyzed in detail in order to understand whether the constraint of efficient information processing imposes certain structural constraints on the network. For this purpose we have chosen the C. elegans nematode, as the entire connectivity pattern of all its 302 neurons have been carefully mapped out. Doing a k-core analysis of the network, we find that it is hierarchically organized and that the inner cores have an assortative nature. As assortativity implies that nodes with large number of connections (hubs) are strongly inter-connected, this implies a functional significance in fast transmission of activity [**Sinh2**]. We also note that the core neurons obtained from our analysis have a strong overlap with the set of neurons implicated in various functional circuits through laser ablation studies. We are in the process of building a full dynamical model of the network of 280 non-pharyngeal neurons to investigate the network dynamics underlying information processing in C. elegans.

The spatiotemporal dynamics of a network of coupled nonlinear oscillators, modeled by sine circle maps, with varying degrees of randomness in coupling connections was investigated [**J2**]. It was shown that that the change in the basin of attraction of the spatiotemporal fixed point due to varying fraction of random links p, is crucially related to the nature of the local dynamics. Even the *qualitative* dependence of spatiotemporal regularity on p changes drastically as the angular frequency of the oscillators change, ranging from monotonic increase or monotonic decrease, to non-monotonic variation. Thus it is evident here that the influence of random coupling connections on spatiotemporal order is highly non-universal, and depends very strongly on the nodal dynamics.

QFT, Topological QFT, Conformal Field Thoery

Explicit solution of a Green function in a non-renormalizable toy model demonstrates that Green functions of the interacting theory fall off much faster than at the tree level at large momenta. This suggests a method of calculations in quantum field theory which is free of divergences.

The noncommutative extension of the standard model is studied using the Seiberg-Witten maps to lowest order in the space-time noncommutativity parameter. It is applied to the calculation of Moller and Bhabha scattering including both photon and the Z-boson exchanges. The deviations in angular distributions for the noncommutativity parameter in the

TeV scale are explored.[**Ra**]

A formalism to construct a twisted standard model in moyal space-time is developed. This requires a clear understanding of the spontaneous symmetry breakdown[**T**] in such a space. The issue of statitics for identical particles in kappa Minkowski space is considered. It was shown for special class of realisations the flip operator is independent of ordering[**Rg**]

QFT's on noncommutative spaces have been studied from various perspectives recently. The phase structure of fields on such a space reveals a new phase known as strip phase. Using Monte Carlo simulations we have studied the finite temperature phase transition of neutral scalar field on a fuzzy sphere. We work with the zero mode in the temporal directions, while the effects of the higher modes are taken care by the temperature dependence of r. In the numerical calculations we use "pseudo-heatbath" method which reduces the auto-correlation considerably. Our results agree with the conventional calculations. We report some new results which show the presence of meta-stable states and also suggest that for suitable choice of parameters the symmetry breaking transition is of first order.[**D**].

To investigate further the non-trivial aspects of non-commutative space we study and analyse the questions regarding breakdown of global symmetry on noncommutative sphere. We do this by considering a complex scalar field on a fuzzy sphere which has the continuous U(1) symmetry. Due to nonlocal interaction non-uniform condensates arise as ground state configurations, which help stabilize the condensate against the Goldstone mode fluctuations [**Dig**].

Quantum Computations

A classical protocol to simulate the quantum correlations $\langle\Psi_s^-|\vec{a}.\vec{S}\otimes\vec{b}.\vec{S}|\Psi_s^-\rangle$ corresponding to the spin-s singlet state $|\Psi_s^-\rangle$ of two spin-s particles, using the measurements of the spin observables $\vec{a}.\vec{S}$, $\vec{b}.\vec{S}$ separately on the two spin-s systems was given [**G2**]. In any local hidden variable theoretic model for quantum correlations, not only we reproduce the marginal probabilities of having the outcomes $\vec{a}.\vec{S}=j$, $\vec{b}.\vec{S}=k$ (where $j,k=-s,-s+1,\ldots,s-1,s$) for the shared state $|\Psi_s^-\rangle$ but we also reproduce the joint probability of having the joint outcome $\vec{a}.\vec{S}=j$ and $\vec{b}.\vec{S}=k$ for the same shared state (and thereby, we reproduce the correlation $\langle\Psi_s^-|\vec{a}.\vec{S}\otimes\vec{b}.\vec{S}|\Psi_s^-\rangle$). In the folklore of classical simulation of quantum correlations, we generally put forward the apparently weaker task of reproducing the marginal probabilities as well as the the above-mentioned correlation, not necessarily the above-mentioned joint probabilities. Even in this weaker setting, one would require, in general, to have classical communications (on the top of local hidden variable theory) to get the simulation done. When $s=2$, it turns out that there is no difference between the stronger simulation scenario versus the weaker one so far as the required amount of classical communication is concerned. In the weaker version of simulation, we have shown that, in the worst case scenario, $\lceil\log_2(s+1)\rceil$ bits of communication will do the simulation job where $\lceil x\rceil$ is the least integer greater than or equal to x. The simulation scheme we followed here is based on the binary representation of the Hilbert space dimension $2s+1$ of individual systems. To check the optimality of this simulation scheme, we have compared this scheme with another simulation scheme where $2s+1$ is equal to n-th power of an integer. Although in the finite regime, these two schemes required, in general, different amount of classical communications, in the asymptotic case (*i.e.*, for large s limit), the don't differ. We have also focused on the

stronger version of the simulation method.

Statistical Mechanics

Fluid vesicles obtained via the self-assembly of amphiphilic molecules exhibit a variety of shapes in thermal equilibrium. Such shapes can be understood in terms of the energy minimising configurations of a curvature Hamiltonian, under the constraints of fixed enclosed volume and surface area. A model for the equilibrium statistical mechanics of a pressurised semiflexible polymer ring, as a simplified version of the vesicle problem, has been studied in two dimensions. The Hamiltonian has a term which couples to the algebraic or signed area of the ring and a term which accounts for bending (semiflexibility). The model allows for self-intersections. Using a combination of Monte Carlo simulations, Flory-type scaling theory, mean-field approximations and lattice enumeration techniques, a phase diagram is obtained in which collapsed and inflated phases are separated by a continuous transition. The scaling properties of the averaged area as a function of the number of units of the ring are derived. For large pressures, the asymptotic behaviour of the area is calculated for both continuum and lattice versions of the model. For small pressures, the area is obtained through a known mapping onto the quantum mechanical problem of an electron moving in a magnetic field. The simulation data agree well with the analytic and mean-field results[**Mit1**, **Mit2**].

It has been shown that the competition between structural phase transitions in a pure system as modified by disorder, coupled to the non-equilibrium effects of an external drive, results in a variety of novel complex phases. A relationship between this system and the physics of the disordering of the XY model in an external symmetry breaking field has also been conjectured. The ubiquity of structural phase transitions in the vortex state of a large number of superconductors which have been studied recently, as well as the relative ease with which the vortex state can be driven, suggests experimental situations in which the ideas here should find application. Such experiments would help to clarify the interplay between disorder and an underlying equilibrium phase transition, as monitored through dynamical quantities, a physical situation which has been argued to be relevant to the longstanding problem of the peak effect in superconductors[**Me1**].

In recent times there has been a surge of interest in applying statistical mechanics to understand socio-economic phenomena. The aim is to seek out patterns in the aggregate behavior of interacting agents, which can be individuals or groups or companies or nations. One such pattern is of social inequality, i.e., the distribution of resources across all societies. A well-known scaling relation in economics known as Pareto Law has asserted that the distribution of income (as well as wealth) across different societies has a power-law tail with a characteristic exponent α;according to the stricter version of this law, $\alpha = 1.5$ for all societies. This has recently come under attack, as a large number of empirical studies have observed various values of α for different national economies. Also, some groups (including us) have tried to present models that seek to explain how this distribution comes about through simple asset-exchange type mechanisms. We have reviewed such models in a recent paper, along with the empirical data which mostly suggests that income distribution has a power law tail but that its bulk follows a log-normal or Gibbs distribution form [**Sinh1**].

A prominent feature of modern economic life is the existence of financial markets. The availability of large quantities of electronic data recording transactions in such markets has

meant that physicists interested in looking for universalities in economics have found such data irresistible. Based on the study of price fluctuations, it had been suggested that the corresponding distribution has a power law with exponent -3. However, the universality of this "inverse cubic law" has recently come under attack, with certain groups claiming that it is violated in developing economies. We have carried out a exhaustive analysis of price fluctuations in the Indian market to demonstrate that it follows the inverse cubic law, a result that is independent of the exact market that is being analyzed (i.e., BSE or NSE) or the actual period under study [**P3**]. We have also looked at the cross-correlation behavior of the prices of different stocks and found them to be much less affected by intra-sector influences than in the developed markets of the west. This implies that unlike the price fluctuation distribution, the network of interactions between stocks as inferred from the cross-correlation may be a better indication of the maturity of a market[**Sinh3**, **P2**].

Flowing granular media exhibit varied physical phenomena. Analytical progress in the subject is difficult. Therefore, it makes sense to study simple models that capture the essence of granular system. One such model is that of a freely cooling inelastic gas. The coarsening properties of this system are studied. The coarsening process is shown to violate the Porod law, which is a robust law that is seen in most coarsening systems. All existing theories of granular systems predict Porod law for the freely cooling gas. Hence, the new result shows the need to look for the correct theory [**Raj2**].

The problem of a polymer in the presence of an external force has been of recent interest, both theoretical and experimental. The model that is most commonly studied is the worm like chain model, wherein the polymer is allowed to intersect itself. The effects of force on a polymer with self avoidance is less understood. Also, many polymers are anisotropic in nature. The effects of anisotropy is also not well understood. In this work, an anisotropic self-attracting, self-avoiding polymer being extended by a force is studied. For some special cases, exact solution is obtained. For the generic case, the problem is studied through exact enumeration [**Raj1**].

String Theory

It is shown that the loop variable technique can be used to obtain a gauge invariant exact renormalization group equation (ERG). This is an application of Wilson's technique in position space rather than in momentum space. Using loop variable representation of the action enables one to make these equations gauge invariant. These are thus exact equations of motion for the backgrounds of the open bosonic string. An interesting feature is that if a smooth regulator is used, one can take the infrared cutoff length to infinity. The resulting equations do not contain the UV cutoff parameter a. Thus the theory is scale invariant even though we have a finite (UV) cutoff! This is possible because we have an infinite number of operators. This is thus a "perfect action" in the RG sense, that has been discussed in the context of lattice gauge theory.[**S1**]

All the work on loop variables thus far has concentrated on getting equations of motion for various bosonic string theories (open, with Chan-Paton factors, closed). The issue of an Action is being addressed now. A proposal for a gauge invariant action is given. The basic idea is to first construct a quantity that reproduces for the on-shell physical modes, the kinetic term and interaction terms. This is written as the operator $\frac{d}{dlna}$ acting on some

quantity. This quantity is in fact the partition function with an infinite normalization factor viz the on shell integrated two point function. This removes a Mobius infinity. Then we switch to loop variables and replace this operator with the gauge covariant version $\frac{d}{d\Sigma}$. The result is gauge invariant off shell also. This is the proposal. It is shown to reproduce the tachyon potential that has been obtained in other approaches. [**S2**]

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.

[**B1**]
Radha Balakrishnan and Rossen Dandoloff*.
Nonlinear dynamics of an elastic nanotube and electron delocalization.
In M. Daniel and S. Rajasekar, editors, *Recent Developments in Nonlinear dynamics*, Feb 2008.
(To be published).

[**B2**]
Radha Balakrishnan and Rossen Dandoloff*.
Effect of conformations on charge transport in a thin elastic tube.
Nonlinearity, **21**, 1, 2008.

[**B3**]
Rossen Dandoloff* **and Radha Balakrishnan**.
Charge transport in a thin elastic tube: Role of curvature.
Meetings in Physics at University of Sofia, **8**, 5, 2007.

[**B4**]
Rick Mukherjee* **and Radha Balakrishnan**.
Moving curves of the sine-Gordon equation: New links.
2008.
(Preprint: IMSc/2008/03/02).

[**Ba1**]
Kinjal Banerjee and Ghanashyam Date.
Loop quantization of polarized gowdy model on T^3: Classical theory.
2007.
IMSc/2007/12/15, arxiv:0712.0683 (Submitted).

[**Ba2**]
Kinjal Banerjee and Ghanashyam Date.
Loop quantization of polarized gowdy model on T^3: Quantum theory.

2007.
IMSc/2007/12/16, arXiv:0712.0687 (Submitted).

[**Bas1**]
Rahul Basu, Debajyoti Choudhury*, and H. S. Mani.
Fermionic un-particles, gauge interactions and the β function.
Physics Letters B, 2008.
IMSc/2008/03/03, arXiv:0803.4110 (Submitted).

[**Bas2**]
Rahul Basu, P. N. Pandita*, and Chandradew Sharma.
Radiative neutralino production in low energy supersymmetric models.
Physical Review D, 2007.
IMSc/2007/11/14, arXiv:0711.2121 (To be published).

[**D**]
C. R D. Das, S. D. Digal, and T. R. P. Govindarajan.
Finite temperature phase transition of a single scalar field on a fuzzy sphere.
Modern Physics Letters A, 2007.
arXiv:0706.0695 (To be published).

[**Di**]
Ali Ahanj*, Pramod S. Joag*, and Sibasish Ghosh*.
Quantum correlations in successive spin measurements.
International J. Quantum Information, **5(6)**, 885, 2007.

[**Dig**]
Chittaranjan Das*, Sanatan Digal, and Govindarajan T R.
Spontaneous symmetry breakdown in fuzzy spheres.
2008.
0802.1576 (Submitted).

[**G1**]
Ali Ahanj*, Pramod S. Joag*, and Sibasish Ghosh.
Classical simulation of two spin-s singlet state correlations involving spin measurements.
Physics Letters A, **368(1-2)**, 34, 2007.

[**G2**]
Ali Ahanj*, Pramod S. Joag*, and Sibasish Ghosh.
Simulation of two spin-s singlet correlation for all s involving spin measurements.
2007.
(Preprint: quant-ph/0706.2287).

[**G3**]
Somshubhro Bandyopadhyay*, Sibasish Ghosh, and Vwani P. Roychowdhury*.
Robustness of entangled states that are positive under partial transposition.
Physical Review A, **77(3)**, 032318–1, 2008.

[**G4**]
Lieven Clarisse*, **Sibasish Ghosh, Simone Severini***, **and Anthony Sudbery***.
The disentangling power of unitaries.
Physics Letters A, **365(5-6)**, 400, 2007.

[**G5**]
Samir Kunkri*, **Guruprasad Kar***, **Sibasish Ghosh, and Anirban Roy***.
Winning strategies for pseudo-telepathy games using non-local box.
Quantum Information and Computation, **7(4)**, 319, 2007.

[**J1**]
Zahera Jabeen and Neelima Gupte*.
Probabilistic signatures of spatiotemporal intermittency in the coupled sine circle map lattice.
2008.
arXiv:0803.1353 [nlin.CD] (Submitted).

[**J2**]
Zahera Jabeen and Sudeshna Sinha.
Non-universal dependence of spatiotemporal regularity on randomness in coupling connections.
2008.
arXiv:0804.0469 [nlin.CD] (Submitted).

[**Ja1**]
Prashanth Jaikumar, Manjari Bagchi*, **and Rachid Ouyed***.
High-density Skyrmion matter and Neutron stars.
The Astrophysical Journal, 2008.
arXiv:0708.3436 (To be published).

[**Ja2**]
Prashanth Jaikumar, Bradley S. Meyer*, **Kaori Otsuki***, **and Rachid Ouyed***.
Nucleosynthesis in neutron-rich ejecta from Quark-Novae.
Astronomy and Astrophysics, **471(1)**, 227, 2007.

[**Ja3**]
Prashanth Jaikumar, Daniel R. Phillips*, **Lucas Platter***, **and Madappa Prakash***.
Muon production in low-energy electron-nucleon and electron-nucleus scattering.
Physical Review D, **76**, 115001, 2007.

[**Jam**]
Maruthi Pradeep Kanth Jampa, Satyavani Vemparala, and Ramesh Anishetty.
Long distance orientational correlations in liquid water and shape dependant hydrophobic force.
2008.
(Submitted).

[**K**]
S. M. Kamil, Sudeshna Sinha, and Gautam I. Menon.
Regular and Chaotic States in a Local Map Description of Sheared Nematic Liquid Crystals.
Physical Review E, 2008.
0801.3876 (Submitted).

[**M1**]
S. L. Lee*, **G. I. Menon, A. J. Drew***, **J. Mesot***, **E. Morenzoni***, **H. Luetkens***, **S. Langridge***, **D. G. Heron***, **C. Marrows***, **and E. M. Forgan***.
Using Muons and Neutrons to study Vortex Systems in Bulk and Thin Film Superconductors.
In *XIV International Conference on Hyperfine Interactions and XVIII International Symposium on Nuclear Quadrupole Interactions*. Springer-Verlag, Aug 2007.
(To be published).

[**M2**]
A. de Col*, **G. I. Menon, V. Geshkenbein***, **and G. Blatter***.
Surface Melting of the Vortex Lattice in Layered Superconductors: Density Functional Theory.
Phys. Rev. B, **75**, 184532, 2007.

[**Me1**]
Ankush Sengupta*, **Surajit Sengupta***, **and Gautam I. Menon**.
Non-equilibrium States of Driven Disordered Polymorphic Solids.
In P. Sen and P.K. Mohanty, editors, *Proceedings of Statphys-Kolkata VI: An International Conference on Statistical Physics*, page 384. Physica A, Aug 2007.

[**Me2**]
Gautam I. Menon and Sriram Ramaswamy.
Universality Class of the Reversible-Irreversible Transition in Sheared Suspensions.
Physical Review Letters, 2008.
0801.3881 (Submitted).

[**Me3**]
A. Sengupta*, **Surajit Sengupta***, **and Gautam I. Menon**.
Driven Disordered Periodic Media with an Underlying Structural Phase Transition.
Phys. Rev. B (Rapid Comm.), **75**, 180201(R), 2007.

[**Mi1**]
Ram Kishore* **and Ashok K. Mishra**.
On the solutions of the infinite u hubbard model through orthofermions.
Physics Letters A, **369**, 226, 2007.

[**Mi2**]
Ram Kishore* **and Ashok K. Mishra**.
Orthofermion approach to the infinite u hubbard model.
Physica B, **403**, 1344, 2008.

[**Mi3**]
Ram Kishore* **and Ashok K. Mishra**.
Representation of orthofermion spin operators.
Physica A, **387**, 2225, 2008.

[**Mit1**]
Mithun K. Mitra, Gautam I. Menon, and R. Rajesh.
Phase transitions in pressurised semiflexible polymer rings.
Physical Review E, 2007.
arXiv:0708.3318 (To be published).

[**Mit2**]
Mithun K. Mitra, Gautam I. Menon, and R. Rajesh.
Asymptotic behavior of inflated lattice polygons.
J. Stat. Phys., 2007.
arXiv:0710.1509 (To be published).

[**Mu1**]
R. Bhaduri*, **M. Murthy, and M. Brack***.
Fermionic ground state at unitarity and haldane exclusion statistics.
Submitted to J. Phys. B. Atomic and Molecular Physics, 2008.
cond-mat/arXiv:0803.1215 (Submitted).

[**Mu2**]
M. Brack*, **P. Winkler***, **and M. Murthy**.
Coupling of surface and volume dipole oscillations in c_{60}*molecules*.
$Int.J.Mod.PhysE, \mathbf{17(1)}, 138, 2008.$

[**P1**]
Raj K. Pan and Sitabhra Sinha.
Modular networks emerge from multiconstraint optimization.
Physical Review E, **76(4)**, 045103(R), 2007.

[**P2**]
Raj K. Pan and Sitabhra Sinha.
Collective behavior of stock price movements in an emerging market.
Physical Review E, **76(4)**, 046116, 2007.

[**P3**]
Raj K. Pan and Sitabhra Sinha.
Inverse-cubic law of index fluctuation distribution in indian markets.
Physica A, **387(8-9)**, 2055, 2008.

[**P4**]
Raj K. Pan and Sitabhra Sinha.
Modular networks with hierarchical organization: The dynamical implications of complex structure.

Pramana, 2008.
(To be published).

[**R1**]
G. Rajasekaran.
Are Neutrinos Majorana Particles?
In Vandana Nanal and R G Pillay, editors, *Proceedings of Workshop on Neutrinoless Double Beta Decay (NDBD07)*. TIFR, Mumbai, Oct 2007.
Keynote Address : arXiv:0803.4387 (To be published).

[**R2**]
G. Rajasekaran.
A Historical Panorama of HEP and a Roadmap for the Future.
In P K Raina and S P Khastgir, editors, *Proceedings of the XVII DAE-BRNS High Energy Physics Symposium*, page xviii. IIT, Kharagpur, Oct 2007.

[**R3**]
Quing-Hong Cao*, Ernest Ma*, and G. Rajasekaran.
Observing the dark scalar doublet and its impact on the standard model higgs boson at colliders.
Physical Review D, **76**, 095011, 2007.

[**R4**]
M. S. Raghunathan* and G. Rajasekaran.
Subaltern Science in the South.
In Prof Uma Dasgupta, editor, *Science and Modern India:An Institutional History, c.1784-1947 (A Volume of the Project of History of Indian Science, Philosophy and Culture)*. Centre for Studies in Civilisations, New Delhi and Kolkata, 2007.
(To be published).

[**R5**]
G. Rajasekaran.
Is Neutrino a Majorana Particle? (foreword).
In V K B Kota and U Sarkar, editors, *Neutrinoless Double Beta Decay*, page xi. Narosa Publishing House, 2007.

[**Ra**]
P. K. Das*, N. G. Deshpande*, and G. Rajasekaran.
Moller and Bhabha scattering in the noncommutative standard model.
Physical Review D, **77**, 035010, 2007.

[**Raj1**]
R. Rajesh, I. Giri*, S. Jensen*, and R. Kumar*.
Role of pulling direction in understanding the energy landscape of proteins.
2008.
(Submitted).

[**Raj2**]
M. Shinde*, D. Das*, and R. Rajesh.
Violation of porod law in a freely cooling granular gas in one dimension.
Physical Review Letters, **99**, 234505, 2007.

[**Rg**]
Govindarajan T. R, Kumar S. Gupta*, Harikumar E*, Meljanac S*, and Meljanac D*.
Twisted statistics in kappa minkowski space-time.
Phys. Rev D, 2008.
(To be published).

[**S1**]
Balachandran Sathiapalan.
Gauge invariant exact renormalization group and perfect actions in the open bosonic string theory.
Mod.Phys.Lett.A, **22**, 1701, 2007.

[**S2**]
Balachandran Sathiapalan.
Gauge invariant action for the open bosonic string.
International J. of Mod. Physics A, 2007.
IMSc/2007/12/07 arXiv:0712.1650 [hep-th] (To be published).

[**Sh1**]
H.S. Sharatchandra.
Are neutrino masses dynamically generated by quantum gravity attractions?
2007.
IMSc/2007/10/13 (Submitted).

[**Sh2**]
H.S. Sharatchandra.
Evading divergences in quantum field theory.
2007.
IMSc/2007/07/08 (Submitted).

[**Sha**]
Maxime Imbeault*, David London*, Chandradew Sharma, Nita Sinha, and Rahul Sinha.
Patterns of new physics in B decays.
Physics Letters B, **653**, 254, 2007.

[**Si1**]
Sreedevi Padmanabhan*, Jitendra Thakur*, Rahul Siddharthan, and Kaustuv Sanyal*.
Accelerated evolution of cse4p-associated centromeric dna sequences in closely-related pathogenic yeasts, candida albicans and candida dubliniensis.

2008.
(Submitted).

[**Si2**]
Rahul Siddharthan.
Parsing regulatory dna: general tasks, techniques, and the phylogibbs approach (review article).
Journal of Biosciences, **32(5)**, 863, 2007.

[**Si3**]
Rahul Siddharthan.
Phylogibbs-mp: Module prediction and differential motif finding by gibbs sampling.
2008.
(Submitted).

[**Si4**]
Rahul Siddharthan and Erik van Nimwegen*.
Detecting regulatory sites using phylogibbs (review article).
In Nicholas H. Bergman, editor, *Comprehensive Genomics (Methods in Molecular Biology vol. 395)*, page 381. Humana Press, 2007.

[**Sim1**]
S. Chaturvedi*, **E. Ercolessi***, **G. Morandi***, **G. Marmo***, **N. Mukunda***, **and R. Simon**.
Ray space 'Riccati' evolution and geometric phases for N-level quantum systems.
Pramana, **69(3)**, 317, 2007.

[**Sim2**]
S. Chaturvedi*, **G. Marmo***, **N. Mukunda***, **and R. Simon**.
Schwinger representation for the symmetric group: Two explicit constructions for the carrier space.
2007.
(Preprint: quant-ph/07113729).

[**Sin**]
Nita Sinha, Rahul Sinha, T. E. Browder*, **N. G. Deshpande***, **and Sandip Pakvasa***.
Method for determining the $D^0 - \bar{D}^0$ mixing parameters.
Physical Review Letters, **99**, 262002, 2007.

[**Sinh1**]
Arnab Chatterjee*, **Sitabhra Sinha, and Bikas K. Chakrabarti***.
Economic inequality: Is it natural ?
Current Science, **92(10)**, 1383, 2007.

[**Sinh2**]
Nivedita Chatterjee* **and Sitabhra Sinha**.
Understanding the mind of a worm: Hierarchical network structure underlying nervous system

function in c. elegans.
Progress in Brain Research, **168**, 145, 2007.

[**Sinh3**]
Sitabhra Sinha and Raj K. Pan.
Uncovering the internal structure of the indian financial market: Large cross-correlation behavior in the nse.
In A. Chatterjee and B.K. Chakrabarti, editors, *Econophysics of Markets and Business Networks*, page 3. Springer, 2007.

[**Sinh4**]
Sitabhra Sinha, Jari Saramaki*, and Kimmo Kaski*.
Emergence of self-sustained patterns in small-world excitable media.
Physical Review E, **76(1)**, 015101(R), 2007.

[**Sinh5**]
Sitabhra Sinha and S. Sridhar.
Controlling spatiotemporal chaos and spiral turbulence in excitable media.
In E. Scholl and H-G. Schuster, editors, *Handbook of Chaos Control (2nd edition)*, page 703. Wiley-VCH, 2008.

[**Sinh6**]
Sitabhra Sinha and Nisheeth Srivastava*.
Is inequality inevitable in society ? income distribution as a consequence of resource flow in hierarchical organizations.
In A. Chatterjee and B.K. Chakrabarti, editors, *Econophysics of Markets and Business Networks*, page 215. Springer, 2007.

[**Sinha1**]
W. L. Ditto*, K. Murali*, and Sudeshna Sinha.
Construction of a chaotic computer chip.
In *Proceedings of* ICAND. Springer Verlag Complexity Series.
(To be published).

[**Sinha2**]
W. L. Ditto*, K. Murali*, and Sudeshna Sinha.
Chaos computing : ideas and implementation.
In *Proceedings of* Experimental Chaos Conference *(ECC9), Brazil (2006) published in* Philosophical Transactions of the Royal Society of London *(Series A)*.
(To be published).

[**Sinha3**]
M. Shrimali*, G. He*, Sudeshna Sinha, and K. Aihara*.
Synchronization of threshold coupled chaotic neurons.
In *Proceedings of* International Conference on Artificial Neural Networks *(ICANN 2007), Porto, Portugal*. Springer-Verlag (Lecture Notes in Computer Science).
(To be published).

[**Sinha4**]
P. M. Gade*, D. V. Senthilkumar*, S. Barve*, and Sudeshna Sinha.
Power-law scaling of persistence characterizes travelling waves in coupled circle maps.
Physical Review E, **75**, 066208, 2007.

[**Sinha5**]
M. R. Jahed-Motlagh*, B. Kia*, W. L. Ditto*, and Sudeshna Sinha.
Fault tolerance and detection in chaotic computers.
International Journal of Bifurcation and Chaos, **17**, 1955, 2007.

[**Sinha6**]
Manish D. Shrimali*, Sudeshna Sinha, and Kazuyuki Aihara*.
Asynchronous updating induces order in threshold coupled systems.
Physical Review E, **76**, 046212, 2007.

[**Sinha7**]
Sudeshna Sinha.
Clipping chaos to cycles.
In M.A.F. SanJuan and C. Grebogi, editors, *Recent Progress in Controlling Chaos*.
(To be published).

[**Sr**]
S. Sridhar and Sitabhra Sinha.
Controlling spatiotemporal chaos in excitable media using an array of control points.
Europhysics Letters, **81(5)**, 50002, 2008.

[**Su**]
J. Lu*, K. Murali*, Sudeshna Sinha, H. Leung*, and M. A. Aziz-Alaoui*.
Generating multi-scroll chaotic attractors by thresholding.
Physics Letters A, **372**, 3234, 2008.

[**T**]
Govindarajan T R.
Towards a twisted standard model in moyal space-time.
In *Proceedings of Balkan Workshop 2007*. Fortschr. Phys, Sep 2007.
(To be published).

[**V1**]
Carmen Domene*, Satyavani Vemparala, Simone Furini*, Kim Sharp*, and Michael L. Klein*.
The role of conformation in ion permeation in a k+ channel.
Journal of American Chemical Society, **130**, 3389, 2008.

[**V2**]
Ekta Khurana*, Matteo Dal Peraro*, Russell Devane*, Satyavani Vemparala, William F. DeGrado*, and Michael L. Klein*.
Gating mechanism of the m2 proton channel from influenza a virus: A new perspective from

molecular dynamics calculations.
2008.
(Submitted).

[**V3**]
Abhigyan Som*, **Satyavani Vemparala, Ivaylo Ivanov***, **and Gregory Tew***.
Synthetic mimics of antimicrobial peptides (review).
Biopolymers (Peptide Science), **90(2)**, 83–93, 2008.

[**V4**]
Satyavani Vemparala, Carmen Domene*, **and Michael L. Klein***.
Interaction of anesthetics with open and closed conformations of a potassium channel studied via molecular dynamics and normal mode analysis.
Biophysical Journal, **94**, 1, 2008.

2.3 Theoretical Computer Science

2.3.1 Research Summary

Algorithms and Data Structures

Given a bipartite graph $G = (X \dot\cup D, E \subseteq X \times D)$, an *$X$-perfect matching* is a matching in G that covers every node in X. The following generalisation of the X-perfect matching problem has applications in constraint programming: Given a bipartite graph as above and a collection $\mathcal{F} \subseteq \mathcal{P}(X)$ of k subsets of X, find a subset $M \subseteq E$ of the edges such that for each $C \in \mathcal{F}$, the edge set $M \cap (C \times D)$ is a C-perfect matching in G (or report that no such set exists). In [**M2**] it is shown that the decision problem is NP-complete and that the corresponding optimisation problem is in APX when $k = O(1)$ and even APX-complete already for $k = 2$. On the positive side, it is shown that a $2/(k+1)$-approximation can be found in $\text{poly}(k, |X \cup D|)$ time. It is also shown that such an approximation M can be found in time $(k + \binom{k}{2}2^{k-2})\text{poly}(|X \cup D|)$, with the further restriction that each vertex in D has degree at most 2 in M.
(This work appears in [**M2**].)

Given a permutation π, the BLOCK SORTING problem is to find a shortest series of block moves which, when applied in succession, sorts π. Here a block is a maximal substring of successive integers in order, and a block move is the displacement of a block to a location where it merges with another block. BLOCK SORTING is an NP-hard optimization problem and has a factor 2 approximation algorithm. In [**M4**], a combinatorial characterization of optimal solutions of BLOCK SORTING is presented, and is used to prove various computationally important properties of the problem. In particular, certain block moves that are provably optimal are identified. The equivalence of block sorting and a combinatorial puzzle is also established. Further, several polynomial-time heuristics for BLOCK SORTING, that are inspired either by the above-mentioned combinatorial characterization, or by the approach of earlier work that was based on the BLOCK MERGING problem, or both, are considered. Although these heuristics seem to be promising candidates for improving the approximation

ratio (their approximation ratios are provably at most 2), it is shown that none of them leads to a better approximation ratio than 2.
(This work appears in [**M4**].)

Improved Parameterized algorithms for MAXCUT and MAXDAG are obtained.MAXCUT of a graph is a maximum set of edges forming a bipartite subgraph of the given graph. On the other hand, MAXDAG of a directed graph is a set of arcs of maximum size such that the graph induced on these arcs is acyclic. Our algorithms are obtained through new kernelization and efficient exact algorithms for the optimization versions of the problems [**Ra3**]

The parameterized version of the Unique Coverage problem is considered. Here one is given a family of sets and a parameter k, and the question is whether there exists a subfamily that covers at least k elements exactly once. This NP-complete problem has applications in wireless networks and radio broadcasting and is also a natural generalization of the well-known Max Cut problem. It is shown that this problem is fixed-parameter tractable with respect to the parameter k, and a 4^k kernel is given for the problem.

In the weighted version of the problem where the sets have weights and the elements have profits, and one is interested in minimizing the total weight of the sets picked and maximizing the profit of the elements to be covered, the problem becomes harder. It is shown that in the most general setting, assuming real costs and profits,the problem is not fixed-parameter tractable unless P = NP. Assuming integer costs and profits it is shown that the problem is W[1]-hard with respect to B as parameter and is fixed parameter tractable under some reasonable restriction, with respect to both B and k as parameters [**Ra1**].

A graph is a König-Egervary graph if and only if the size of its maximum matching equals the size of its minimum vertex cover. It is shown that finding a minimum number of vertices or edges to be removed to make a given graph into a König graph is NP-hard. It is also shown that the parameterized complexity of the vertex deletion problem reduces to the problem of deciding whether a given graph has a vertex cover whose size is at most k more than the size of its maximum matching. Since the latter problem is fixed parameter tractable (as it reduces to the FPT problem of checking whether at most k clauses can be deleted to make a given 2CNF formula satisfiable), this makes the problem fixed parameter tractable [**Ra2**]. Both the vertex and edge deletion problems were also studied for their approximation complexity.

The parameterized complexity of the following problem is considered: Given a hereditary property $\mathcal{P}$ on digraphs, an input digraph D and a positive integer k, does D have an induced subdigraph on k vertices with property $\mathcal{P}$? The hereditary properties for which this induced subgraph problem is $W[1]$-complete are completely characterized for two classes of directed graphs: general directed graphs and oriented graphs. Those properties for which the induced subgraph problem is $W[1]$-complete for general directed graphs but fixed parameter tractable for oriented graphs are also completely characterized. These results are among the very few parameterized complexity results on directed graphs [**Ra5**].

Automata, Logic and Concurrency

A survey of how temporal and tense logics have been extended to timed logics which refer

to the duration between points —and more generally, measurement logics— in both the point and interval frameworks, has been completed [**Lo2**]. In the course of the survey, a completeness proof for a metric temporal logic and a decidability proof for a new dynamic measurement logic extending it have been sketched.

A sublogic of interval temporal logic (alternatively, a subclass of starfree expressions) has been defined by replacing the chop operator with "deterministically marked" chops. This allows unique parsing of a word matching a formula, with the consequence that membership is in LogDCFL, and satisfiability is in Pspace (and NP-complete for a fixed alphabet). A quadratic model-preserving reduction to partially ordered two-way deterministic finite automata and an exponential converse reduction from the automata to the logic are the main results. The latter result also shows that the syntax defined, which uses deterministic and co-deterministic products over the piecewise testable languages of Simon (1975), matches the expressiveness of unambiguous products á là Schützenberger (1976) over these languages, and hence of first-order logic with two variables, an open problem concurrently and independently solved by Kufleitner and Weil using completely different techniques [**Lo1**].

Infinite duration zero-sum games with *regular* objectives on finite graphs are known to be determined, and winning strategies for either player can be computed effectively. For non-zero-sum games, consideration of a player's best response to the opponent's strategies is problematic, even for bounded memory strategies, since a player has only partial knowledge of the other's strategies during play. In [**R2**], we suggest a "programming language" for specifying strategies and provide algorithms for best response synthesis for games with Muller objectives.

An important requirement of electronic voting protocols is that of *receipt freeness*: no voter should be able to prove, after the election, that (s)he voted for a particular candidate; otherwise coercion is possible. In [**R1**], we show that such properties are naturally specified in a Hintikka-style logic of knowledge, and provide an algorithm for verifying whether an e-voting protocol is receipt free, when the number of voters is bounded. It has been known that the FOO protocol (based on blind signatures) admits receipts; we prove this in the formal model.

Computational Complexity

In [**M1**], the well-studied linear algebraic problem of computing the rank and determinant of matrices is re-visited in order to obtain completeness results for small complexity classes. In particular, computing the rank of a class of diagonally dominant matrices is shown to be complete for Log, and computing the permanent and determinant of tridiagonal matrices over $\mathbb{Z}$ is shown to be in $\mathsf{Gap}\,\mathsf{NC}^1$ and hard for NC^1. The study of computing the rigidity of a matrix – the number of entries that need to be changed in order to bring the rank of a matrix below a given value – is initiated. It is NP-hard over $\mathbb{F}_2$ and some restricted versions are shown to characterize small complexity classes. A variant of rigidity is also considered where there is a bound on the amount of change allowed. Using ideas from the linear interval equations literature, this problem is shown to be NP-hard over $\mathbb{Q}$ and a certain restricted version is shown to be NP-complete. Restricting the problem further, variations which can be computed in PL and are hard for $\mathsf{C}_{=}\mathsf{L}$ are obtained.
(This work appears in [**M1**].)

For the all-ones lower triangular matrices, the upper and lower bounds on rigidity are known to match. In [**M3**], these techniques are applied to the all-ones extended lower triangular matrices, to obtain upper and lower bounds with a small gap between the two; it is shown that the rigidity is $\theta(\frac{n^2}{r})$.
(This work appears in [**M3**].)

In [**L1**], the restrictiveness of planarity on the complexity of computing the determinant and the permanent is explored, and it is shown that both problems remain as hard as in the general case, i.e. GapL and #P complete. On the other hand, both bipartite planarity and bimodal planarity bring the complexity of permanents down (but no further) to that of determinants. The permanent or the determinant modulo 2 is complete for $\oplus$L, and it is shown that that parity of paths in a layered grid graph (which is bimodal planar) is also complete for this class. The complexity of grid graph reachability is also related to that of testing existence / uniqueness of a perfect matching in a planar bipartite graph.
(This work appears in [**L1**].)

The P-complete Circuit Value Problem CVP, when restricted to monotone planar circuits MPCVP, is known to be in NC^3, and for the special case of upward stratified circuits, it is known to be in LogDCFL. In [**L3**], the complexity of MPCVP is re-examined, with special attention to circuits with cylindrical embeddings. The topological condition of cylindricality, which is stronger than planarity but strictly generalizes upward planarity, is characterized, and the characterization is made partially constructive. This construction, and four key reduction lemmas, are used to obtain several improvements. It is shown that stratified cylindrical monotone circuits can be evaluated in LogDCFL, and arbitrary cylindrical monotone circuits can be evaluated in AC^1(LogDCFL), while monotone circuits with one-input-face planar embeddings can be evaluated in LogCFL. For monotone circuits with focused embeddings, an upper bound of AC^1(LogDCFL) is shown. The NC^3 algorithm for general MPCVP is re-examined, and shown to be in $AC^1(\text{LogCFL}) = SAC^2$. Finally, extensions beyond MPCVP are considered. It is shown that monotone circuits with toroidal embeddings can, given such an embedding, be evaluated in NC. Some special kinds of arbitrary genus circuits can also be evaluated in NC. Further, planar non-monotone circuits with polylogarithmic negation-height can be evaluated in NC.
(This work appears in [**L3**].)

In [**A2**] we explore connections between the algorithmic complexity of ideal membership and the polynomial identity testing problem. In [**A5**] we give new deterministic and randomized algorithms for different cases of polynomial identity testing for noncommutative circuits.

In [**A3**] we show that canonization and isomorphism testing for full k-trees can be done in the complexity class L^{UL}.

In [**A4**] we study distinguishing number for planar graphs. A vertex k-labeling of graph G is distinguishing if the only automorphism that preserves the labels of G is the identity map. The distinguishing number of G, D(G), is the smallest integer k for which G has a distinguishing k-labeling. We apply the inclusion-exclusion principle to develop recursive formulas for counting inequivalent distinguishing k-labelings of a graph. Along the way, we prove that the distinguishing number of planar graphs are polynomial-time computable.

Graph Theory and Combinatorics

It is shown in [**Mu3**] that the acyclic chromatic index of any partial 2-tree is at most $\Delta + 1$. Here, Δ refers to the maximum degree of the partial 2-tree. In particular, this is true for the class of series-parallel graphs. These bounds are also shown to be tight. Also, these bounds are constructive leading to efficient deterministic algorithms for obtaining acyclic edge colorings using $\Delta + 1$ colors.

A new notion of colouring is introduced and studied in [**Mu4**]. A proper edge colouring of a graph G is called a k-intersection colouring if each pair of adjacent vertices do not share more than k colours in common. We derive tight upper bounds on the minimum number of colours sufficient to obtain such a colouring.

We show that the acyclic chromatic index of a graph is bounded by $2\Delta + 29$, if the graph is planar or if it has an edge decomposition into 3 forests. We also show that $\Delta + 6$ colours are enough if the graph is planar as well as triangle free.

We obtain upper and lower bounds for the oriented chromatic number of a number of classes of graphs.

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**]
V. Arvind, Johannes Koebler*, and Wolfgang Lindner*.
Parameterized learnability of k-juntas and related problems.
In Eiji Takimoto Marcus Hutter, Rocco A. Servedio, editor, *The 18th International Conference on Algorithmic Learning Theory. LNAI, Springer Verlag.*, page 120. Springer, Oct 2007.

[**A2**]
V. Arvind and Partha Mukhopadhyay.
The monomial ideal membership problem and polynomial identity testing.
In Takeshi Tokuyama (Ed.), editor, *18th International Symposium, ISAAC 2007, Sendai, Japan, December 17-19, 2007, Proceedings. Lecture Notes in Computer Science 4835.*, page 800. Springer, Dec 2007.

[**A3**]
V. Arvind, Bireswar Das, and Johannes Koebler*.
The space complexity of k -tree isomorphism.
In Takeshi Tokuyama (Ed.), editor, *18th International Symposium, ISAAC 2007, Sendai, Japan, December 17-19, 2007, Proceedings. Lecture Notes in Computer Science 4835*, page 822. Springer, Dec 2007.

[**A4**]
V. Arvind, Christine Cheng*, and Nikhil Devanur*.
On computing the distinguishing numbers of planar graphs and beyond: a counting approach.
SIAM Journal of Discrete Mathematics, 2008.
(To be published).

[**A5**]
V. Arvind, Partha Mukhopadhyay, and Srikanth Srinivasan.
New results on noncommutative and commutative polynomial identity testing.
2008.
(Preprint: CoRR abs/0801.0514).

[**L1**]
Samir Datta*, Raghav Kulkarni*, Nutan Limaye, and Meena Mahajan.
Planarity, determinants, permanents, and (unique) perfect matchings.
In Volker Diekert, Mikhail Volkov, and Andrei Voronkov, editors, *Proceedings of 2nd International Computer Science Symposium in Russia CSR, Ekaterinburg. LNCS Vol. 4649.*, pages 115–126. Springer, Sep 2007.

[**L2**]
Nutan Limaye, Meena Mahajan, and Antoine Meyer*.
On the complexity of membership and counting in height-deterministic pushdown automata.
In Edward Hirsch, Alexander Razborov, A Semenov, and Anatol Slissenko, editors, *Proceedings of 3nd International Computer Science Symposium in Russia CSR, LNCS vol. 5010.* Springer, Jun 2008.
(To be published).

[**L3**]
Nutan Limaye, Meena Mahajan, and Jayalal Sarma M. N.
Improved upper bounds in NC for monotone planar circuit value and some restrictions and generalizations.
Computational Complexity, 2007.
(To be published).

[**Lo1**]
Kamal Lodaya, Paritosh K. Pandya*, and Simoni S. Shah*.
Marking the chops: an unambiguous temporal logic.
In *Theoretical computer science*. IFIP, 2008.
(To be published).

[**Lo2**]
Kamal Lodaya.
Marking time.
In Madhabendra Nath Mitra Sundar Sarukkai Mihir K. Chakraborty, Benedikt Löwe, editor, *Logic, navya-nyāya and applications*. College Publications (London), 2008.
(To be published).

[**M1**]
Meena Mahajan and Jayalal Sarma M N.
On the complexity of matrix rank and rigidity.
In Volker Diekert, Mikhail Volkov, and Andrei Voronkov, editors, *Proceedings of 2nd International Computer Science Symposium in Russia CSR, Ekaterinburg. LNCS vol. 4649.*, pages 269–280. Springer, Sep 2007.

[**M2**]
Martin Kutz*, **Khaled Elbassioni***, **Irit Katriel***, **and Meena Mahajan**.
Simultaneous matchings: Hardness and approximation.
Journal of Computer and System Sciences, 2008.
doi:10.1016/j.jcss.2008.02.001 (To be published).

[**M3**]
Meena Mahajan and Jayalal Sarma M N.
Rigidity of a simple extended lower triangular matrix.
Information Processing Letters, 2008.
10.1016/j.ipl.2008.02.010 (To be published).

[**M4**]
Meena Mahajan, R. Rama*, **and S. Vijayakumar***.
Block sorting: A characterization and some heuristics.
Nordic Journal of Computing, 2008.
(To be published).

[**Ma**]
Kaushik K. Majumdar.
Behavioral response to strong aversive stimuli: A neurodynamical model.
Brain and Cognition (Elsevier), 2007.
(Submitted).

[**Maj**]
Kaushik K. Majumdar and Dwijesh Duttta Majumder*.
Fuzzy knowledge-based and model-based systems.
J. Int. Fuzzy Systems (Jphn Wiley/IOS Press), 2007.
(To be published).

[**Mu1**]
Rahul Muthu, N. Narayanan, and C. R. Subramanian.
Acyclic edge colouring of outerplanar graphs.
In Ming-Yang Kao and Xiang-Yang Li, editors, *Proceedings of the Third International Conference on Algorithmic Aspects in Information and Management, AAIM-2007,*, pages LNCS Vol. 4508/2007, 144–152. Springer Berlin/Heidelberg, Jun 2007.

[**Mu2**]
Rahul Muthu, N. Narayanan, and C. R. Subramanian.

Improved bounds on acyclic edge colouring.
Discrete Mathematics, **307(23)**, 3063–3069, 2007.

[**Mu3**]
Rahul Muthu, N. Narayanan, and C. R. Subramanian.
Acyclic edge colouring of partial 2-trees.
2007.
(Submitted).

[**Mu4**]
Rahul Muthu, N. Narayanan, and C. R. Subramanian.
k-intersection colouring.
2007.
(Submitted).

[**N**]
Narayanan Narayanan, Anna Fiedorowicz*, and Mariusz Hałuszczak*.
On acyclic edge colouring planar graphs.
2008.
(Submitted).

[**R1**]
A. Baskar*, R. Ramanujam, and S. P. Suresh*.
Knowledge-based modelling of voting protocols.
In Dov Samet, editor, *Theoretical Aspects of Rationality and Knowledge*, page 62. Morgan Kaufmann, Jun 2007.

[**R2**]
R. Ramanujam and Sunil Simon.
Structured strategies in games on graphs.
In T. Wilke J. Flum, E. Grädel, editor, *Logic and Automata, in the series* Texts in Logic and Games, page 553. Amsterdam University Press, 2007.

[**Ra1**]
Hannes Moser*, Venkatesh Raman, and Somnath Sikdar.
The parameterized complexity of the unique coverage problem.
In Takeshi Tokuyama, editor, *Proceedings of the 18th International Symposium on Algorithms and Computation (ISAAC)*, page 621. Springer - Verlag (LNCS) volume 4835, Dec 2007.

[**Ra2**]
Sounaka Mishra*, Venkatesh Raman, Saket Saurabh, Somnath Sikdar, and C. R. Subramanian.
The complexity of finding subgraphs whose matching number equals the vertex cover number.
In Takeshi Tokuyama, editor, *Proceedings of the 18th International Symposium on Algorithms and Computation (ISAAC 2007)*, page 268. Springer-Verlag (LNCS) volume 4835, Dec 2007.

[**Ra3**]
Venkatesh Raman and Saket Saurabh.
Improved fpt algorithms for two edge problems: Maxcut and maxdag.
Information Processing Letters, **104(2)**, 65, 2007.

[**Ra4**]
Venkatesh Raman, Saket Saurabh, and Somnath Sikdar.
Efficient exact algorithms through enumerating maximal independent sets and other techniques.
Theory of Computing Systems, **41**, 563, 2007.

[**Ra5**]
Venkatesh Raman and Somnath Sikdar.
Parameterized complexity of the induced subgraph problem in directed graphs.
Information Processing Letters, **104(3)**, 79, 2007.

[**S1**]
Hannes Moser* **and Somnath Sikdar**.
The parameterized complexity of the induced matching problem.
In *Proceedings of the International Frontiers of Algorithmics Workshop (FAW), 2007.*, page 325. Springer, Aug 2007.

[**S2**]
Micheal Dom* **and Somnath Sikdar**.
The parameterized complexity of the rectangle stabbing problem.
In *The Proceedings of the 2nd International Frontiers of Algorithmics Workshop (FAW 2008).* Springer, Jun 2008.
(To be published).

[**S3**]
Hannes Moser* **and Somnath Sikdar**.
The parameterized complexity of the induced matching problem.
Discrete Applied Mathematics, 2008.
(To be published).

Books/Monographs Authored/Edited

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

[**A**]
V. Arvind and Sanjiva Prasad, editors.
Proceedings of Foundations of Software Technology and Theoretical Computer Science, 27th International Conference, volume 4855 of *Lecture Notes in Computer Science*.
Springer Verlag, 2007.

2.4 Student Programmes

2.4.1 Degrees Awarded

Doctoral Degrees Awarded during 2007 – 2008

Mathematics

Name: **Muthukumar, T.**
Thesis Title: Asymptotic behaviour of some optimal control problems
Thesis Advisor: Kesavan, S.
University: University of Madras

Doctoral Theses Submitted during 2007 – 2008

Mathematics

Name: **Jijo, S.**
Thesis Title: Planar algebra associated to the Asymptotic inclusion of a Kac algebra subfactor
Thesis Advisor: Sunder, V. S.
University: Chennai Mathematical Institute

Name: **Gupta, Ved P.**
Thesis Title: Planar algebra of the subgroup-subfactor
Thesis Advisor: Sunder, V. S.
University: Homi Bhabha National Institute

Theoretical Computer Science

Name: **Saurabh, Saket**
Thesis Title: Exact Algorithms for Optimization and Parameterized versions of some graph problems
Thesis Advisor: Raman, Venkatesh
University: HBNI

Masters Theses during 2007 – 2008

Theoretical Computer Science

Name: **Manuel, Amaldev**
Thesis Title: Automata for words with data

Thesis Advisor: Ramanujam, R.
University: HBNI

Name: **Paul, Soumya**
Thesis Title: Model checking games for logics with concurrency
Thesis Advisor: Ramanujam, R.
University: HBNI

Name: **Srinivasan, Srikanth**
Thesis Title: Markov Chains and Sampling Algorithms
Thesis Advisor: Subramanian, C. R.
University: Homi Bhabha National Institute

2.4.2 Lecture Courses During 2007 – 2008.

The following **lecture courses** were offered during 2007 – 2008.

Course Title	Period	Lecturer
Mathematics		
Noncommutative Geometry	Jan-Apr 2007	Chakraborty, Partha S.
Number Theory	Jan-Apr 2007	Srinivas, K.
Algebra	Aug-Dec 2007	Kodiyalam, Vijay
Classical Groups - Examples of Lie groups and Algebraic Groups	Aug-Nov 2007	Singh, Anupam
Representations of Algebraic Groups–I	Aug-Nov 2007	Raghavan, K. N.
Topology I	Aug-Nov 2007	Chatterjee, Pralay D.
Measure Theory	Sep-Dec 2007	Mukhopadhyay, Anirban
Three lectures on "The Twisted Groups"	Nov-Nov 2007	Gill, Nick
Complex Analysis	Jan-Apr 2008	Chakraborty, Partha S.
Ergodic Theory (course with teaching shared by Krishna Maddaly)	Jan-Apr 2008	Sunder, V. S.
Functional Analysis	Jan-Apr 2008	Prasad, Amritanshu
Representations of Algebraic Groups–II	Jan-Apr 2008	Raghavan, K. N.
Topology II	Jan-Apr 2008	K. H. Paranjape
Physics		
Condensed Matter Physics	Jan-May 2007	Vemparala, Satyavani
Introduction to Particle Physics	Jan-May 2007	Murthy, M.V.N.
Quantum Field Theory	Jan-Apr 2007	Sathiapalan, Balachandran

Statistical Mechanics	Jan-May 2007	Digal, Sanatan D.
Advance particle physics	Aug-Nov 2007	Mani, Harihara S.
Advanced Statistical Mechanics	Aug-Dec 2007	Rajesh, R.
Advanced Statistical Physics	Aug-Nov 2007	Ray, Purusattam
Classical Mechanics	Aug-Nov 2007	Siddharthan, Rahul
General Relativity	Aug-Dec 2007	Date, G.
Quantum field Theory II (Reading Course)	Aug-Dec 2007	Sathiapalan, Balachandran
Nonlinear Dynamics	Aug-Dec 2007	Sinha, Sudeshna
Quantum Mechanics	Aug-Dec 2007	Ghosh, Sibasish
Particle Physics	Jan-Apr 2008	Sinha, Nita
Physics of Information and Computation (Quantum part)	Jan-May 2008	Ghosh, Sibasish
Physics of Information and Computing	Jan-Apr 2008	Sinha, Sitabhra
Statistical Mechanics	Jan-Apr 2008	Rajesh, R.

Theoretical Computer Science

Computational Complexity	Jan-Apr 2007	Mahajan, Meena B.
Mathematical Logic	Jan-Apr 2007	Ramanujam, R.
Timed and hybrid systems (Seminar course with Madhavan Mukund)	Jan-Apr 2007	Lodaya, Kamal
Automata and computability	Aug-Dec 2007	Lodaya, Kamal
Computational Complexity II	Aug-Nov 2007	Mahajan, Meena B.
Concurrency theory	Aug-Dec 2007	Lodaya, Kamal
Design and Analysis of Algorithms	Aug-Dec 2007	Raman, Venkatesh
Discrete Mathematics	Aug-Dec 2007	Subramanian, C. R.
Parameterized Complexity	Aug-Dec 2007	Raman, Venkatesh
Programming Language Theory	Aug-Dec 2007	Ramanujam, R.
Algebraic automata theory	Jan-Apr 2008	Lodaya, Kamal
Mathematical Logic	Jan-Apr 2008	Ramanujam, R.
Randomized Approximation Algorithms	Jan-Apr 2008	Subramanian, C. R.

In addition, the following **lecture courses** were offered during 2007 – 2008 by IMSC faculty in the National Undergraduate programme of the Chennai Mathematical Institute.

Course Title	Period	Lecturer

Mathematics

Lie theoretic methods in Analysis	Mar-May 2007	Prasad, Amritanshu
Analysis I	Aug-Nov 2007	Kesavan, S.
Sobolev Spaces	Dec-Dec 2007	Kesavan, S.
Functional Analysis	Jan-Mar 2008	Kesavan, S.

Physics

undergraduate laboratory	Aug-Mar 2007	Mani, Harihara S.
Electromagnetism I	Jan-Apr 2007	Govindarajan, T. R.
Overview of Physics	Aug-Dec 2007	Rajasekaran, G.
Quantum mechanics I	Aug-Nov 2007	Mani, Harihara S.
Particle Physics	Jan-Apr 2008	Rajasekaran, G.
Quantum mechanics II	Jan-Apr 2008	Mani, Harihara S.

2.4.3 Summer Students

Every summer, a small number of students from various institutes/universities come to our instituteand 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, 2007 - Mar, 2008.

Student	Faculty
Mathematics	
Sanoop, BITS, Goa	Sankaran, Parameswaran
Khemani, Shreya, St Xavier's College, Mumbai	Sankaran, Parameswaran
Philip, M. G., Department of Physics, Univ. of Hyderabad	Ghosh, Sibasish
Venkataraman, Vijay S., Indian Institute of Technology, Madras	Ghosh, Sibasish
Banerjee, Shiladitya, CMI, Chennai	Menon, Gautam I.
Varun, K. A., School of Photonics, CUSAT, Kochi	Menon, Gautam I.
Sircar, Pronoy , Indian Institute of Technology, Kanpur	Murthy, M.V.N.
Titum, Paraj, IIT Kanpur	Rajesh, R.
Acharya, Sukadeb, IIT Kharagpur	Siddharthan, Rahul
Rajagopalan, Deepthi, SASTRA, Thanjavur	Siddharthan, Rahul
Dasgupta, Moumita, St Xaviers College, Mumbai	Sinha, Sitabhra
Sreenivasan, Varun, St Xaviers College, Mumbai	Sinha, Sitabhra
Theoretical Computer Science	
Tilak, Hrushikesh, Chennai Mathematical Institute	Mahajan, Meena B.
Vasudev, Yadu, National Institute of Technology, Calicut	Raman, Venkatesh
Tewari, Vasu V., National Institute of Technology, Tiruchi	Raman, Venkatesh
Rajaraman, Archana, Pondicherry University	Ramanujam, R.
Cyriac, Aiswarya, NIT, Calicut	Ramanujam, R.

2.4.4 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, 2007 - Mar, 2008.

Student	Faculty
Mazumdar, Arindam, Indian Institute of Technology, Delhi	Murthy, M.V.N.
Janani, P., Department of Physics, University of Madras, Chennai	Murthy, M.V.N.
Chandra, Anjan, Norwegian Institute of Science and Technology, Trondheim, Norway	Ray, Purusattam
Chakrabarti, Samrat, University of Pune, Pune	Sinha, Sitabhra
Narayanan, Siddharth, IIIT, Allahabad	Ramanujam, R.

2.5 Honours and Awards

Balasubramanian, R. was awarded J.C.Bose fellowship, for 2007, by the DST. for five years

Jaikumar, Prashanth was awarded Visiting Scientist Position, for 2008, by the Argonne National Laboratory, USA.

Kesavan, S. was awarded Elected Fellow, for 2008, by the Indian Academy of Sciences, Bangalore.

Mani, Harihara S. was awarded Distinguished Teacher award 2007, for 2007, by the Indian Institute of Technology, Kanpur for For distinguished teaching over several years.

Rajasekaran, G. was awarded Homi Bhabha Gold Medal, for 2007, by the Prime Minister Dr Manmohan Singh for First Rank in the First Batch of the BARC Training School (50 years ago!).

Chapter 3

Other Professional Activities

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

Balasubramanian, R.

Chairman of Sectional committee for Mathematics of indian academy of Sciences during Jan – Dec, 2007.

Vice president of Malibnet during Mar 2007 – Mar 2008.

Member of Scientific committee of Indo-French Institute of Mathematics (IFIM)

Member (2007-2010) of Science & Engineering Research Council (SERC)of DST

Member of Governing Council, HRI, Allahabad

Member of the Advisory Board of Indian Jour of Pure and applied Mathematics

Convener of National Organising Committee for ATM school onNumber theory held at H .R.I Allahabad during Dec 4 – Dec 23, 2007.

Basu, Rahul

Member of National Organising Committee of Quark Matter 2008 during Mar 2007 – Feb 2008.

Convener of National Organising Committee for Xth Workshop in High Energy Physics Phenomenology (WHEPP X) held at IMSc during Jan 2 – Jan 13, 2008.

Chakraborty, Partha S.

Convener of Local Organising Committee for Workshop in Noncommutative Geometry, Op-

erator Algebras, Ergodic Theory held at IMSc during Feb 11 – Feb 22, 2008.

Date, G.

Secretary of The Indian Association for General Relativity and Gravitation

Convener of International Organising Committee for The Sixth International Conference on Gravitation and Cosmology held at IUCAA, Pune during Dec 17 – Dec 21, 2007.

Member of Local Organising Committee for Institute Seminar Week (ISW-2008) held at IMSc during Mar 3 – Mar 7, 2008.

Jaikumar, Prashanth

Organizer, National Science Day at Institute of Mathematical Sciences, Chennai on Feb 29, 2008.

Kesavan, S.

Reviewer of Mathematical Reviews

Member of Editorial Board, Journal of the Kerala Mathematical Association

Member of Board of Studies in Mathematics, Homi Bhabha National Institute

Member of Board of Studies in Engineering Sciences, Homi Bhabha National Institute

Visitor's Nominee of Selection Committee, School of Sciences, Indira Gandhi National Open University (IGNOU), New Delhi.

Member of Executive Committee, ICM, 2010

Member of Board of Studies in Mathematics (Postgraduate), University of Madras

Convenor and Dean of Studies of Academic Council, Chennai Mathematical Institute

Member of Board of Studies, Ramanujan School of Mathematics and Computer Science, Pondicherry University during Jan – Mar, 2008.

Lodaya, Kamal

Member of Programme Committee, 2nd Indian Winter School on Logic, Kanpur, 2008 during Apr 2007 – Jan 2008.

Member of Programme committee, 25th STACS conference, Bordeaux, 2008 during Apr 2007

– Feb 2008.

Krishna, M

Member, FIST committe for Mathematics, DST.

Mahajan, Meena B.

Member of Local Organising Committee for Workshop on Algorithms and Complexity held at IMSc during Mar 10 – Mar 12, 2008.

Menon, Gautam I.

Associate Member of Centre for Computational Materials Science, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore during Feb 2007 – Feb 2008.

Member of Local Organising Committee for The Interface of Life held at IIT, Madras during Jan 7 – Jan 18, 2008.

Associate Member of Advanced Materials Research Unit, S.N. Bose National Centre for Basic Sciences, Kolkata during Jan – Jan, 2008.

Member of Local Organising Committee for International Conference on Nanoscience and Technology (ICONSAT-2008) held at Convention Centre, Chennai Trade Centre, Chennai during Feb 27 – Feb 29, 2008.

Murthy, M.V.N.

Member of Editorial Board, PRAMANA- Journal of physics

Member of Program Management Committee, India-Based Neutrino Observatory (INO).

Paranjape, Kapil H.

Associate Editor of Editorial Board, Proceedings of Indian Academy of Sciences (Mathematical Sciences) during Apr 2006 – Mar 2008.

Member of Editorial Board, Journal of the Ramanujan Mathematical Sciences during Apr 2006 – Mar 2008.

Member of Advisory Board of arXiv.org during Apr 2006 – Mar 2008.

Convener of National Organising Committee for NBHM Summer Programme held at IMSc during Jun 15 – Jul 15, 2007.

Debian Developer of The Debian Project during Aug 2007 – Mar 2008.

Prasad, Amritanshu

Member of the KVPY scholarship interview committee during Jan – Jan, 2008.

Raghavan, K. N.

Treasurer of The Ramanujan Mathematical Society during Apr 2006 – Mar 2008.

Treasurer of Ramanujan Mathematical Society

Rajasekaran, G.

Member of Scientific Steering Committee of INO

Member of Academic Council of CMI

Chairman of Board of Studies for Physics, CMI

Raman, Venkatesh

Member of Steering Committee of the International Workshop on Parameterized and Exact Computation during Jul 2005 – Mar 2008.

Ramanujam, R.

Convener, Steering committee of Association for Logic in India. during Jan 2007 – Mar 2008.

Member, Program committee of Computing: The Australasian Theory Symposium, Wollongong, Australia, January 22-25, 2008. during Feb 2007 – Jan 2008.

Member, Program Committee. of 9th International Conference on Distributed Computing and Networking, January 5-8, 2008, Kolkata. during Mar 2007 – Jan 2008.

Member, Program Committee. of International Conference on Distributed Computing and Internet Technology, Dec 17-20, 2007, Bhubaneswar. during Apr – Dec, 2007.

Member, Program Committee. of 12th Asian Computing Conference, Carnegie Mellon University, Qatar, December 9-11, 2007. during Apr – Dec, 2007.

Member, Executive Council of Indian Association for Research in Computing Science

Convener, Steering committee of Association for Logic in India

Ray, Purusattam

Member of National Organising Committee for Statistical Physics Approaches to Multi-disciplinary Problems held at Indian Institute of Technology, Guwahati during Jan 7 – Jan 13, 2008.

Sankaran, Parameswaran

Convener of Local Organising Committee for ATM Workshop on Algebraic Topology held at IMSc during Jun 4 – Jun 9, 2007.

Convener of Local Organising Committee for Subhashis Nag Memorial Endowment Lecture held at IMSc on Jan 2, 2008.

Simon, R.

Member of Syndicate of Manonmaniam Sundaranar University, Tirunelveli.

Sinha, Nita

Member of National and Local Organising Committee for X Workshop on High Energy Phenomenology held at IMSc during Jan 2 – Jan 13, 2008.

Sinha, Sudeshna

Editor of American Institute of Physics Journal "Chaos"

Board Member of International Physics and Control Society (IPACS) during Sep 2007 – Mar 2008.

Srinivas, K.

Co-organizer at Institute of Mathematics and Its Applications, Bhubaneswar on Jun 13, 2007. A four week Mathematics Training Camp was organized together with Professor Swadheen Pattanayak. The aim of this program was to find out students from rural background and encourage them to take up mathematics with love and dedication.

Member of NICER Interview Board, Bhubaneswar during Aug – Aug, 2007.

Invited speaker at Science City Auditorium, Planetarium Campus, Chennai on Aug 20, 2007. Science City, which is an autonomous organization established by the Govt. of Tamil Nadu organized a three days programme entitled "An insight into the world of Science for the students of corporation schools in Chennai" for 11th standard students.

Invited speaker at Science City Auditorium, Planetarium Campus, Chennai on Oct 3, 2007. Interacted with students of standard IX from four corporation schools from Chennai. The

aim of the talk was to inculcate interest for mathematics.

Invited speaker at J. Karodia Higher Secondary School, Perambur on Oct 9, 2007. Gave a talk to XI and XII standard students. The focus was to derive some mathematical formulas by themselves rather than mugging them.

Convener of Local Organising Committee for Cipher Retreat 2007 held at IMSc during Dec 27 – Dec 28, 2007.

Member of KVPY Interview committee, Chennai during Jan – Jan, 2008.

Mathematics coordinator at Science City, Birla Planetarium Campus, Kotturpuram, Chennai on Feb 6, 2008. Science City organized a 5 day event called Science Festival-2008 from Feb 6- Feb 10, 2008. Professors David Mumford, S. R. S. Varadhan, Anurag Mittal (IIT Chenai), R. Ramanujan delivered a popular lectures. Some mathematical exhibits were also displayed.

Subramanian, C. R.

Member of Program Committee of the 27th Annual International Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS-2007). during Apr – Dec, 2007.

Member of Local Organising Committee for Workshop on Algorithms and Complexity held at IMSc during Mar 10 – Mar 12, 2008.

Sunder, V. S.

Member of Editorial Board of the Proceedings of the Indian Academy of Sciences (Math. Sci.). during Aug 2001 – Mar 2008.

Member of Editorial Board of the 'Texts and Readings in Mathematics' (or the TRIM) series published by the Hindustan Book Agency. during Aug 2001 – Mar 2008.

Convener of Board of Studies for Mathmatical Sciences, Homi Bhabha National Instituye during Sep 2006 – Mar 2008.

Gave lecture at Children's Club in Mylapore, Chennai on Jul 8, 2007. Lectrured on 'Braids, Groups, and braid-groups' to some school children

Convener of Local Organising Committee for Workshop on Non-commutative Geometry, Ergodic Theory and operator algebras held at IMSc during Feb 11 – Feb 21, 2008.

Vemparala, Satyavani

Member of National Organising Committee for School on Biomolecular Simulations held

at Jawaharlal Nehru Center for Advanced Scientific Research (JNCASR), Bangalore, India during Nov 6 – Nov 16, 2007.

Member of Local Organising Committee for The Interface of Life held at Indian Institute of Technology Madras, Chennai, India during Jan 7 – Jan 18, 2008.

Chapter 4

Colloquia

4.1 Conferences/Workshops Held at IMSc

4.1.1 ATM Workshop on Algebraic Topology

As part of the Advanced Training in Mathematics Schools supported by the National Board for Higher Mathematics, the Workshop on Algebraic Topology was held at IMSc. The Workshop was a sequel to the Advanced Instructional School in algebraic and differential topology held in December 2005 at ISI Kolkata. There were about 20 participants from all over the country. The following three mini-courses were given:
(1) Group actions on manifolds (by Goutam Mukherjee, ISI Kolkata)
(2) Rational homotopy theory (by P. Sankaran, IMSc.)
(3) Computations in algebraic topology (by A. R. Shastri, IIT Bombay).

Besides these there were also talks by participants.

A flute concert by Prof. A. R. Shastri, who was one of the resource persons, was organized on the occasion of the Workshop.

4.1.2 NBHM Summer Programme

This is a summer workshop for gifted undergraduate students. Lectures were given by numerous mathematicians from IMSc, IIT/M and visitors.

4.1.3 Cipher Retreat 2007

A two-day long workshop called *Cipher-Retreat* was organised at IMSc during the period 27-28 Dec, 2007 under the XI Plan project no. 11-R & D - IMS - 5.01 - 0200 .

The aim of this event was to bring together Indian Cryptanalysts in an attempt to break/get a lead on recently developed fast stream ciphers.

The focus was on the following ciphers:

1. RCR 64
2. RCR 32
3. TPy-6A
4. TPy-6B

The organizing committee consisted of Prof. Kapil Paranjape from IMSc, Dr. K. Srinivas and Mr. Gautham Sekhar from Leuven, Belgium. About 14 people participated in this exercise (discounting those who attended the first session only). The participants were from IMSc, SAG , IIT (Roorkee), ABB (Bangalore), Microsoft Research (Bangalore), AU-KBC Center (Chennai).

There were four sessions. In the first session Gautham Sekhar gave a detailed analysis of all the above mentioned stream ciphers. Subsequently the participants were divided into two groups: group A and Group B. Group A studied the stream ciphers (3) and (4), whereas group B was given the other two ciphers to analyse.

At the end of two days many interesting observations were discovered. It is hoped that the findings in this event will be pursued further in due course of time and we are sure that this will lead to some important collaborative research.

4.1.4 Subhashis Nag Memorial Endowment Lecture

The Subhashis Nag Memorial Endowment Lecture for the year 2007-08 was delivered by Professor Robert C. Penner, University of Southern California, Los Angeles, on 'From punctured surfaces to punctured solenoid'. This was followed by a series of three seminar talks by Prof. Penner, on the same theme.

4.1.5 Xth Workshop in High Energy Physics Phenomenology (WHEPP)

The WHEPP series of workshops brings together phenomenologists from all over India and abroad to meet and set up working groups that would identify and work on important and relevant problems in High Energy Physics Phenomenology.

At the end of the two week period, the coordinators of the various working groups present a report of the activities of each of the working groups. The work mentioned in these reports (which are reproduced in the proceedings, along with the plenary talks) eventually appear as published papers in standard journals.

WHEPP X completes a cycle of 10 workshops and was held at IMSc for the third time. There were 110 outside participants, (about 20 of them were foreigners) and there were about 12 plenary talks and 10 Working Group (non overlapping) talks. WHEPP X was particularly important since it was the last meeting before the start of the Large Hadron Collider at CERN. Therefore there was significant amount of time devoted to discussing issues in LHC physics.

The main themes of this meeting were Neutrinos, Astroparticle Physics and Cosmology, QCD and QGP , Beyond Standard Model Physics and Collider and Flavour Physics. The details of the organising committees and talks can be seen at http://www.whepp.in/

The proceeding of this meeting are expected to appear in a special issue of Pramana before the end of the year.

In view of the large number of participants, and the non-availability of Guest House rooms in other neighbouring institute, many participants were housed in Esthell hotel in Adyar and many serviced apartments in the Adyar area.

4.1.6 Workshop on Non-commutative Geometry, Ergodic Theory and operator algebras

The workshop basically consisted of two series of lectures: (a) *Orbit equivalence, Geometric group theory, and von Neumann algebras*, and (b) *Elliptic differential operators on non-commutative space*. These were delivered by Damien Gaboriau (ENS-Lyons) and Michel Hilsum (CNRS, Paris), with a few preparatory lectures given by M.G. Nadkarni, V.P. Gupta and V.S. Sunder.

4.1.7 Institute Seminar Week (ISW-2008)

The **Institute Seminar Week** was held from March 3 to 7, 2008, from 10 AM to 1 PM on each day. The seminar coordinators were Anirban Mukhopadhyay (Mathematics), Ghanashyam Date (Theoretical Physics) and Kamal Lodaya (Theoretical Computer Science). There were 30 talks, of 25 minutes duration each. Speakers presented their work and described problems of current research interest.

List of Seminars at ISW 2008

- **Nick Gill**

  The Thompson groups

- **R Ramanujam**

  Free and fair e-elections

- **Arunagiri**

  Zitterbewegung in Graphene

- **Parameswaran Sankaran**

  Coarse geometry of groups

- **Praveen M**

  Reachability problem in Petri nets

- **Raj Kumar Pan**

  The Small-world of Modular Networks

- **Amritanshu Prasad**

  Invariant subspaces for groups of discrete Fourier transform type operators

- **S Sheerazuddin**

  Modelling and verification of web services

- **Nilanjan**

  What do we get by "boiling" strings?

- **Rahul Sinha**

  Anomalies in B meson decays: Can they be signals of New Physics?

- **Partha Mukhopadhyay**

  Noncommutative Polynomial Identity Testing

- **Rajkumar Krishnan**

  Irrationality of Zeta(3)

- **Venkatesh Raman**

  Vertex Cover: Parameterizing Above the Matching Number

- **Sridhar**

  Local Control of Global Chaos in Excitable Media.

- **Veerendra Vickram Awasthi**

  Homology of Generalized Hawaiian Earring

- **Gautam Menon**

  Cell division as a pattern formation problem

- **Anupam Kumar Singh**

  Real Elements in Algebraic Groups

- **Soumya Paul**

  Potential Games

- **Kapil Paranjape**

  What is Reciprocity?

- **Sitabhra Sinha**

  Understanding the Mind of a Worm

- **Sunil Simon**

  Games for distributed systems

- **Sujay Ashok**

  D-branes as Matrix Factorizations

- **Amaldev M**

  Unbounded Data

- **Nita Sinha**

  Determination of neutral D meson mixing parameters

- **Venkata Suryanarayana Nemani**

  Counting Giants

- **N Narayanan**

  The Discharging Method

- **Rahul Siddharthan**

  How DNA evolves, and how to trace its ancestry

- **Amit Kumar Bhattacharjee**

  Statics and Kinetics of Nematic liquid crystals

- **Kapil Paranajape**

  The Shlafly Double-Six

- **G Baskaran**

  Birth of Topological Qubits, a triplet, made visible

4.1.8 Workshop on Algorithms and Complexity

This workshop was organised by the theoretical computer science group. It was planned as an update meeting: an informal meeting where some participants talk about recent stuff that they have done / that has recently interested them.

The workshop had 60 participants, with more than half being from Chennai itself. Outstation participants came from the IITs, TIFR, IISc, the NITs, IISER and VIT.

The program consisted of eighteen talks ranging from wide-ranging surveys to detailed technical expositions.

4.2 Other Conferences/Workshops Organized by IMSc

4.2.1 School on Biomolecular Simulations

The scope of the school was to introduce methods and tools in setting up molecular simulations in context of biomolecules. Using molecular dynamics methodology as the central concept, the school aimed at providing a systematic way to setup the systems, simulating them, analysis techniques to extract and visually represent some of the interesting properties of biological systems. Some of the biological systems that were explored included DNA, ion channels, lipid membranes etc.

4.2.2 The Sixth International Conference on Gravitation and Cosmology

The **Sixth International Conference on Gravitation and Cosmology** was held from December 17 – 21, 2007 at IUCAA, Pune. From IMSc, Ghanashyam Date chaired the Scientific Organizing Committee while Tarun Souradeep, IUCAA chaired the Local Organizing Committee. The confernce was funded with support from ISRO, HRI (Allahabad), IIA (Bangalore), IMSc (Chennai), RRI (Bangalore), SINP (Kolkata) and IUCAA, Pune.

There were 17 plenary talks of 60 minute duration and 4 plenary talks of 30 minute duration. The talks covered topics from cosmology, gravitational waves, numerical relativity, black holes, quantum gravity including a talk on the Gravity Probe B experiment designed to measure spin precession effects. There were 3 parallel workshops on: (i) Classical General Relativity and Gravitational Waves (ii) Cosmology and (iii) Quantum Gravity.

The conference was attended by about 150 participants. Details of the academic program as well as talks may be accessed from http://www.iucaa.ernet.in/ icgc07 . The proceedings are slated to be published by *Journal of Physics: Conference Series* by mid 2008.

4.2.3 The Interface of Life

There are several good reasons for a researcher to enter the area of membrane biophysics. The first and most important is to be able to address questions of great relevance to frontier themes in biology. But there is also the motivation of understanding biomembranes as examples of remarkable physical systems in their own right. On the bio-medical side, the development of synthetic membranes which can aid in the encapsulation and delivery of drugs is a significant challenge. The purpose of this international school was to provide an introduction to the general field of membrane biophysics. The school covered basic as well as advanced material in this field, including the areas mentioned above. The lectures centered around biologically relevant questions - the effect of anesthetics on membrane properties and the structure of rafts in lipid membranes are two illustrative examples - and used these questions to illustrate how different biophysical tools could be developed and used to study them. It also emphasized the role of theoretical analysis in the understanding and modelling of experimental data.

4.2.4 Statistical Physics Approaches to Multi-disciplinary Problems

It was an International workshop followed by a conference on the active and fast developing field of 'Statistical Physics Approaches to Multi-disciplinary Problems'. The topics of the meeting include complex networks, biology inspired physics, soft condensed matter, statistical physics in materials science etc. The total number of speakers was 30 out of which 10 were International speakers and 4 IMSC speakers.

4.2.5 International Conference on Nanoscience and Technology (ICONSAT-2008)

This Conference, sponsored by the National Initiative on Nano Science and Technology of the Department of Science and Technology, Govt. of India, was the third in the series following ICONSAT-2003 held in December 2003 at Kolkata, and ICONSAT-2006 held in March 2006 at New Delhi. The following areas were discussed: (a) Novel Synthesis Routes, (b) Functionality & Properties at Nanoscale, (c) New Applications & Nanodevices (d) Computational Nanoscience and (e) Nanobiology.

4.3 Seminars

Date	Speaker Affiliation	Title
02-04-2007	Thomas Vidick ENS	Quantum Interactive Proof Systems
03-04-2007	S Ramanan	Riemann-Roch Theorem
05-04-2007	S Ramanan	Riemann-Roch Theorem
10-04-2007	S Ramanan	Riemann-Roch Theorem
12-04-2007	S Ramanan	Riemann-Roch Theorem
16-04-2007	Dilip Banhatti Madurai Kamaraj University	Disk galaxy rotation curves and dark matter distribution
19-04-2007	Partha Mukhopadhyay DAMTP, Cambridge University, UK	A universality in pp-waves and D-branes
23-04-2007	J.Maharana Inst of Physics, Bhubaneswar	Novel Stringy Symmetries
24-04-2007	R. Rajesh IMSc	Climate Change: A summary of the IPCC Fourth Assessment Report
25-04-2007	Anindya Sinha National Institute of Advanced Studies, Bangalore, Nature Conservation Foundation, Mysore	Social Cognition in Primates: From Mental Representation to Distributed Cognition
03-05-2007	Diptiman Sen CHEP, IISc, Bangalore	Quantum charge pumping
09-05-2007	P.B. Sunil Kumar IIT, Madras	Domain Growth in Fluid Membranes with Asymmetric Transbilayer Lipid Distribution

16-05-2007	Vinobalan Durairaj University of Kentucky, USA	Synergistic 4d-3d electron coupling in Cr substituted Ruthenates
17-05-2007	Shiva Athreya	A Glimpse into the work of S. R. S. Varadhan
25-05-2007	Gautam Menon IMSc	de Gennes: A Life in Science
06-06-2007	Rajamani Narayanan Florida International University, Miami, USA	Large Nc gauge theories on a continuum torus in the t́ Hooft limit
07-06-2007	David Lacoste ESPCI, Paris	Out-of-equilibrium fluctuations of a processive molecular motor
13-06-2007	R. Shankar IMSc	Ganga, Aayo Kahan Se ? Gaumukh, Jao Kahan Re ? (*Ganga, where do you come from ? Gaumukh, where are you going ?*)
14-06-2007	R. Balasubramanian IMSc	Euler: the master of us all
19-06-2007	Kaneenika Sinha University of Toronto	Sato-Tate Conjecture
20-06-2007	Soumya Paul IMSc	Games for model checking logics with concurrency
20-06-2007	Pomita Ghoshal HRI, Allahabad	Matter effects and mass hierarchy determination with atmospheric neutrinos
21-06-2007	Ajay K Sood IISc, Bangalore	Fascinating Flow Behaviour of Soft Matter: Spatio-Temporal Rheochaos
21-06-2007	K R Parthasarathy Indian Statistical Institute, New Delhi	Varadhanś work in Probability Theory
26-06-2007	P. S. Thiagarajan National University of Singapore	A parameter estimation Technique for Pathway Models

27-06-2007	Animesh Datta Department of Physics & Astronomy, Univeristy of New Mexico, Albuquerque	Entanglement and Beyond – A Discord-ant Story
03-07-2007	R. Shankar Yale University, USA	Dots for Dummies
04-07-2007	S. G. Rajeev University of Rochester, USA	NonCommutative Contact Geometry in Quantum Thermodynamics
06-07-2007	T.E.S. Raghavan University of Illinois	Algorithms for Structured Cooperative Games
06-07-2007	H.S.Sharatchandra IMSc	Evading infinities in quantum field theory
20-07-2007	Eleonora DellÁquila Rutgers University, USA	Childrenś drawings from Seiberg-Witten curves
24-07-2007	Sumedha ISI Foundation, Torino, Italy	Evolution of population on neutral networks
24-07-2007	Krishna Athreya IMI, IISc, Bangalore	On growth rate for random graphs
25-07-2007	H. C. Nainwal Dept. of Geology, H.N.B. Garhwal University, Srinagar (Garhwal), Uttarakhand	Receding Glaciers in Uttarakhand Himalaya: An overview
25-07-2007	C. Gowdigere ICTP, Trieste	Toric Kahler metrics and Ring-like co-ordinates for AdS_5
26-07-2007	K. V. Subrahmanyam CMI	Invariant theory of n*n matrices
31-07-2007	N. V. Suryanarayana IMSc	Black hole charges from the near horizon geometry
02-08-2007	Lata Narayanan Concordia University,Canada	Mechanisms to induce random choice

02-08-2007	Prof S.G. Dani School of Maths, TIFR, Mumbai	Values of quadratic forms at integral points near proper subspaces.
03-08-2007	Kumar S. Raman University of Illinois, Urbana-Champaign, USA	On the construction of microscopic models with exotic phases
06-08-2007	Prof G. Misra Indian Institute of Science	Homogeneous Bundles
06-08-2007	Sourav Chakraborty Univ of Chicago, USA	Property Testing
07-08-2007	C.Balaji IIT Madras	Retrieval of Geophysical Parameters from Satellite Microwave Radiances
08-08-2007	S Kalyana Rama IMSc	Consequences of U dualities in M theory for Cosmology
10-08-2007	Swagata Sarkar IMSc	Degrees of maps between Grassmannians.
10-08-2007	R. Kittappa Millersville University, USA	The enumeration of rectangular kolam configurations
13-08-2007	Shamindra Kumar Ghosh Vanderbilt University	Planar Algebras - A Category Theoretic Point of View
14-08-2007	Paramita Das Vanderbilt University	The planar algebra of group-type subfactors
16-08-2007	Florian Luca Mathematical Institute, UNAM,Mexico	Diophantine quadruples
22-08-2007	Amit Deshpande MIT, USA	Sampling-Based Algorithms for Dimension Reduction
24-08-2007	Rejish Nath University of Hannover, Germany	Physics of solitons and vortices in dipolar Bose Einstein Condensates
28-08-2007	Govind Krishnaswami Utrecht University, The Netherlands	Rigid Body in Classical Mechanics

31-08-2007	A. S. Unnikrishnan National Institute of Oceanography, Goa	Observed sea-level rise in the past century
05-09-2007	Naresh Dadhich IUCAA, Pune	Black Hole from AdS Space-time
07-09-2007	Shiva Prasad Kasiviswanathan Penn State Univ, USA	Approximately Counting Embeddings into Random Graphs
07-09-2007	Subhasis Sinha SNBCBS, Kolkata	Correlated bosons in optical lattice
11-09-2007	Ved Prakash Gupta IMSc	Seminar on Planar algebras
12-09-2007	N. D. Hari Dass IISc, Bangalore	Nature of QCD Strings
13-09-2007	Anisa Mohmad Husen Chorwadwala IMSc	Extremum of the First Eigenvalue of the Laplacian over a family of domains in space forms
14-09-2007	Amit Deshpande MIT, USA	Spectral Graph Partitioning
19-09-2007	Benoit Famaey Inst. of Astronomy and Astrophysics, ULB, Brussels, Belgium	The bullet galaxy cluster and its implications for the existence of dark matter
20-09-2007	Deepak Parashar University of Warwick / MPIM Bonn	Coloured quantum groups, Yang-Baxter operators and Yang-Baxter systems.
21-09-2007	G. Rajasekaran IMSc	My inward bound journey and how I achieved enlightenment
25-09-2007	Nick Gill IMSc	Line-transitivity and finite linear spaces

26-09-2007	Roberto A. Kraenkel Institute for Theoretical Physics, State University of Sao Paulo,Brazil	Title: Dynamical Stabilization in BEC
08-10-2007	K. R. Parthasarathy ISI, Delhi	Neyman-Preason philosophy in Quantum Information Theory.
09-10-2007	Aparna Baskaran Syracuse University	Applying non-equilibrium statistical mechanics to understand systems of self propelled particles
10-10-2007	Anirban Basu IAS, Princeton	The D^4R^4 term in type IIB string theory on T^2 and U-duality
11-10-2007	Kumar Gupta SINP, Kolkata	Noncommutative Gravity and Black Holes
16-10-2007	Xavier Bressaud Institut de Mathmatiques de Luminy, France	A new normal form for braids
16-10-2007	Sajeev John Univ. of Toronto	Photonic Band Gap Materials: Semiconductors of Light
17-10-2007	M. Sakthi Balan Univ of Western Ontario, London, Canada	Peptide computing: a brief survey and some open problems
17-10-2007	Sajeev John Dept. of Physics, Univ. of Toronto, Canada	Photonic Band Gap Materials: Engineering Light-Matter Interactions
18-10-2007	Kalyan Sinha JNCASR, Bangalore	A Theory of Dissipative Processes
19-10-2007	Michael Dom University of Jena	Approximation and Fixed-Parameter Algorithms for Consecutive Ones Submatrix Problems
19-10-2007	Raghu Raghavan Therataxis, Baltimore	Classical mechanics and brain disease

22-10-2007	Kaustuv Sanyal (JNCASR, Bangalore)	Centromeres perform a highly conserved function of chromosome segregation using rapidly evolving DNA
26-10-2007	Sujata Ghosh Viswabharati University	Modelling Simultaneous Games with Concurrent Dynamic Logic
29-10-2007	S. Ramanan CMI, Chennai	Interaction between Geometry and Topology through the years.
31-10-2007	G Baskaran	BCS 50: a Super Story
31-10-2007	Professor Jesus Juyumaya University of Valparaiso, Valparaiso, Chile	Title : On an unipotent Hecke algebra.
01-11-2007	R. Srinivasan CMI, Chennai	Type III factors as invariants of type III E_0-semigroups
02-11-2007	Blaise Genest IRISA, Rennes, France	Constructing exponential-size deterministic Zielonka automata
02-11-2007	Govind Swarup FRS	Frontiers of Radio Astronomy: Key questions today
05-11-2007	Bharat Kumar Sharma Institute of Physics (IOP), Bhubaneswar	Equation of state and properties of neutron stars
13-11-2007	Iravatham Mahadevan	The structure of the Indus script
14-11-2007	M N Vahia Department of Astronomy and Astrophysics, Tata Institute of Fundamental Research, Mumbai	Archaeoastronomy in Indian Context
15-11-2007	M N Vahia Department of Astronomy and Astrophysics, Institute of Fundamental Research, Mumbai	Indus culture and its abstract sciences
16-11-2007	Sunil Mukhi TIFR, Mumbai	Blackhole Breakup and Dyon Decay

21-11-2007	Deepak Dhar Tata Institute of Fundamental Research, Mumbai	Exact entropy of dimer coverings for a class of lattices in two or more dimensions
22-11-2007	B.V. Rajarama Bhat ISI, Bengaluru	Completely positive maps leaving a maximal commutative algebra invariant.
22-11-2007	Tapash Chakravarty University of Manitoba, Canada	Finding Physics in DNA
28-11-2007	Shradha Mishra Dept. of Physics, IISc, Bangalore	Coarsening, clumping and cuspy correlations in active nematics: microscopic and coarse-grained approaches
28-11-2007	Ricardo Baeza-Yates Yahoo! Research, Barcelona, Spain	Mining web queries
29-11-2007	Amritanshu Prasad. IMSc	Inductive algebras for finite Heisenberg groups.
05-12-2007	Speaker:Aruna Rajan Theoretical and Computational Biophysics Group, Beckman Institute, University of Illinois at Urbana-Champaign	Length Dependent Optical Effects in Single Walled Carbon Nanotubes
06-12-2007	Rahul Santhanam University of Toronto/University of Edinburgh	Infeasibility of instance compressibility and succinct PCPs for NP
17-12-2007	V. S. Sunder IMSc	Von Neumann algebras and ergodic theory
18-12-2007	B. Siva Selvan NIT Trichy	Efficient algorithms for video association mining
19-12-2007	Nabamita Banerjee HRI, Allahabad	Adding Charges to N=4 Dyons
19-12-2007	Subroto Mukerjee Univ. of California, Berkeley	Spinor condensates: Phase transitions and vortex lattices

20-12-2007	B.V. Rao ISI, Kolkata	On Lusinś theorem
20-12-2007	B. Normand ETH, Zurich, Switzerland	Quantum Magnets under Pressure
21-12-2007	Zoran Skoda Ruder Boskovic Inst, Zagreb	Noncommutative space-times of Lie algebra type
24-12-2007	A P Balachandran Syracuse University	Quantum Fields on the Moyal Plane
27-12-2007	Parampreet Singh Perimeter Institute, Canada	Big Bang and Loop Quantum Cosmology
27-12-2007	B. Normand ETH, Zurich, Switzerland	High-dimensional fractionalisation and spinon deconfinement in pyrochlore antiferromagnets
28-12-2007	Bruce Normand University of Fribourg, Switzerland	Mountaineering in the Himalaya and Karakoram
31-12-2007	Sudhakar Panda HRI	Moduli stabilization via Inflation
02-01-2008	Professor Robert C. Penner University of Southern California, Los Angeles	Nag Memorial Lecture : From punctured surfaces to punctured solenoid
03-01-2008	Robert C. Penner University of Southern California, Los Angeles	Short course on decorated Teichmueller theory
03-01-2008	Gilles Pisier Paris and Austin, Texas	Operator spaces and Grothendieck's inequality
04-01-2008	Prof. Gilles Pisier Texas A & M University and Paris VI	Operator spaces and Grothendieck's inequality
07-01-2008	Vinodchandran Variyam University of Nebraska, Lincoln	On the space complexity of the directed planar reachability problem

07-01-2008	Professor Robert C. Penner University of Southern California, Los Angeles	Short course on decorated Teichmueller theory
07-01-2008	Bobby Ezhuthachan TIFR, Mumbai	Thesis Viva
08-01-2008	Professor Robert C. Penner University of Southern California, Los Angeles	Short course on decorated Teichmueller theory
08-01-2008	Vinodchandran Variyam University of Nebraska, Lincoln	On the space complexity of the directed planar reachability problem
10-01-2008	Prof. George Willis University of Newcastle, Australia	Totally disconnected locally compact groups
10-01-2008	Emiliano Imeroni ULB, Brussels	Giants in beta-deformed theories
11-01-2008	V P Nair City College of the CUNY, New York	Yang-Mills in 2+1 dimensions: Basics and Update
11-01-2008	Vincent Pilloni Paris Nord, University of Paris - 13	p-adic modular forms and classical modular forms (using a functional equation ?)
14-01-2008	Gerald B Folland University of Washington	Curvelets, Image Processing, and Wave Propagation
14-01-2008	Manoj Gopalakrishnan Univ of Southern California	Event-systems: A generalization of chemical kinetics
16-01-2008	Ramarathnam Venkatesan Microsoft Research	Non-abelian analogs of Lattice Rounding
16-01-2008	Kimmo Kaski Laboratory of Computational Engineering Helsinki University of Technology, Espoo, Finland	Weighted Social Network: An Empirical Structure Study and Modelling the Emergence of Communities
17-01-2008	R Venkatesan Microsoft Research	Cryptography meets Programming Language Research

17-01-2008	G Santosh IMSc	Anomalous Thermal Conduction in One Dimension
18-01-2008	Chinmay Das Dept of Physics and Astronomy, University of Leeds, UK	Simulation of fully hydrated Stratum Corneum lipid bilayer
21-01-2008	Raja Sridharan TIFR	A Few Historical Remarks on Complete Intersection Questions
21-01-2008	Manjari Bagchi TIFR, Mumbai	Properties of Strange Quark Matter in connection to astrophysics
21-01-2008	Michael F Schatz School of Physics, Georgia Tech, Atlanta	Topological Characterization of Spatiotemporal Patterns
22-01-2008	Anirban Banerjee Max Planck Institute for Molecular Genetics, Berlin, Germany	Graph spectra: A tool for analyzing structure and evolution of a network
23-01-2008	Indu Satija Dept. of Physics, George Mason University, USA	Phase transitions, Entanglement and Quantum Noise Interferometry
23-01-2008	Raja Sridharan TIFR	A Few Historical Remarks on Complete Intersection Questions
24-01-2008	Pankaj S Joshi TIFR , Mumbai	Current perspectives on collapse of massive stars
25-01-2008	Saket Saurabh UIB Bergen	Parameterized Low-distortion Embeddings - Graph metrics into lines
28-01-2008	Hamsa Balakrishnan M I T, USA	Challenges in Next Generation Air Transportation Systems
29-01-2008	Kapil Hari Paranjape IMSc	Hilbert Schemes and Moduli Problems
29-01-2008	Kinkar Chandra Das SungKyunKwan Univ., Korea	Recent results on Laplacian eigenvalues of graphs

30-01-2008	Debaprasad Maity IMSc	Cosmological Constant, Brane Tension and hierarchy problem
30-01-2008	S. S. C. Shenoi National Institute of Oceanography, Goa	Why is the Bay of Bengal warmer than the Arabian Sea: The role of ocean dynamics
31-01-2008	Jean-Yves Beziau University of Neuchatel, Switzerland	Universal Logic: Towards a general theory of logics
01-02-2008	Paritosh K. Pandya TIFR, Mumbai	On a Nyquist-like sampling analysis for a continuous-time logic with durations
06-02-2008	Samir Datta Chennai Mathematical Institute	Deterministically Isolating a Perfect Matching in Bipartite Planar Graphs
06-02-2008	R Rajesh IMSc	Statistics of Driven Dissipative Systems: Kolmogorov laws
11-02-2008	Prof. K. Varadarajan University of Calgary, Calgary, Canada	Analogues of IBN and related properties for modules.
11-02-2008	Punit Parmananda UAEM, Cuernavaca, Mexico	Noise induced order in an excitable system
12-02-2008	Goutam Mukherjee ISI, Kolkata	Leibniz algebra and deformations
13-02-2008	Prof. K. Varadarajan University of Calgary, Calgary, Canada	Analogues of IBN and related properties for modules.
13-02-2008	R. Sujatha TIFR, Mumbai	A course of lectures on 'Catalan's Conjecture'
14-02-2008	Alice Fialowski Eötvös Loránd University, Budapest	Global deformations and geometry
15-02-2008	Aniruddha C. Naolekar Indian Statistical Institute, Bangalore	Quasi-isometric embeddings of lamplighter groups

18-02-2008	Frits Staal University of California, Berkeley	Language and Method in Indian Science
18-02-2008	R. Sujatha TIFR, Mumbai	A course of lectures on 'Catalan's Conjecture'
20-02-2008	R. Sujatha TIFR, Mumbai	A course of lectures on 'Catalan's Conjecture'
20-02-2008	Theodore Tomaras Univ of Crete, Greece	Accelerating Universe and Centauros in TeV-scale gravity with large extra dimensions
21-02-2008	Siddhartha Bhattacharya TIFR, Mumbai	Measurable rigidity of algebraic Z^d-actions
21-02-2008	Subhashish Banerjee Raman Research Institute, Bengaluru	Phase Distributions in Open Quantum Systems
22-02-2008	Theodore Tomaras Univ of Crete, Greece	On n-point amplitudes in N=4 SYM
22-02-2008	Peter Zvengrowski University of Calgary, Calgary	Cohomology of finite fundamental groups of 3-manifolds
25-02-2008	Raja Paul Department of Neurobiology, Physiology and Behavior, University of California, Davis, USA.	Mechanical regulation of cell contractility and spontaneous cell patterning
25-02-2008	Subhendu Rakshit Dortmund University, Germany	Ice Fishing for Neutrinos
25-02-2008	R. Sujatha TIFR, Mumbai	A course of lectures on Catalan's Conjecture
27-02-2008	Alain Pumir University of Nice, Nice, France	Multisite pacing and chaos control in the heart
28-02-2008	Peter Zvengrowski University of Calgary	Applications of homotopy theory to graph colourings

28-02-2008	Samrat Bhowmick IMSc	Description of Rotating Multicharged Black Hole in Terms of Branes and Antibranes
29-02-2008	Josef Gruska Masaryk University, Brno, Czech Republic	Challenges of quantum complexity theory for quantum physics
03-03-2008	John Cardy Rudolph Peierls Centre for Theoretical Physics, Oxford, UK	Random Planar Curves and Stochastic Loewner Evolution
06-03-2008	Bhupendra Nath Tiwari IIT Kanpur	Thermodynamic Geometry of Black Holes in String Theory
06-03-2008	Nils-Peter Skoruppa University of Siegen, Germany	Theta Blocks: Factorization of theta functions and lattices
10-03-2008	Uma Divakaran IIT Kanpur	Crossover from Non-universal to Universal behavior in a RFBM with mixed uniform distribution
11-03-2008	Vickram Soni National Physical Laboratory, New Delhi	Darwin, Diversity and Lifetime of an evolving network
11-03-2008	Shobha Madan IIT Kanpur	On Fuglede's Conjecture for three intervals.
12-03-2008	Ajit Kembhavi IUCAA, Pune	SuperMassive Black Holes - Here, There and Everywhere
13-03-2008	Ajit Kembhavi IUCAA, Pune	The Physics of Warm Absorbers in Active Galaxies
17-03-2008	R. Sujatha TIFR	A course of lectures on 'Catalan's Conjecture'
18-03-2008	S. Anantha Ramakrishna Physics Dept, IIT Kanpur	Negative refractive index materials
18-03-2008	S. Anantha Ramakrishna Physics Dept, IIT Kanpur	Designing metamaterials and negative refractive index materials

19-03-2008	R. Sujatha TIFR	A course of lectures on 'Catalan's Conjecture'
19-03-2008	S. Anantha Ramakrishna Physics Dept, IIT Kanpur	"Perfect Lenses" made of negative index materials overcome diffraction
20-03-2008	S. Anantha Ramakrishna Physics Dept, IIT Kanpur	Designing Super-lenses for manipulating the optical near-field
20-03-2008	K.T Arasu Wright State University	Sequences with good correlation properties
24-03-2008	Mark Mandelkern University of California at Irvine	Antihydrogen
25-03-2008	Anushya Chandran Dept of Electrical Engineering, IIT Madras	Regional Versus Global Entanglement in Resonating-Valence-Bond States
26-03-2008	Prashanth Jaikumar IMSc	The Astrophysics of Quark Matter
27-03-2008	Harald Helfgott University of Bristol	A course on Arithmetic combinatorics
27-03-2008	Ahpisit Ungkitchanukit Chulalongkorn University, Bangkok, Thailand	Dark Energy
28-03-2008	Harald Helfgott University of Bristol	A brief course in arithmetic combinatorics

Chapter 5

External Interactions

5.1 Collaborative Projects with Other Institutions

5.1.1 Biology of CD40 signaling in uninfected and Leishmania-infected macrophages

A collaborative project with Bhaskar Saha (NCCS, Pune), Gautam Menon (IMSc), Sitabhra Sinha (IMSc) and Parag Sadhale (MCBL, IISc, Bangalore). The project is intended to build on previous work by Saha et al that CD40 signalling via p38MAP kinase or ERK-1/2 results respectively in inflammatory or anti-inflammatory responses. The mechanism of such reciprocal signalling is to be studied in this project, at the level of the membrane and receptors, the signalling network, and the transcriptional response. This is a three-year project funded by the Department of Biotechnology until 2010.

5.1.2 DST CP-STIO, Program for people of Indian Origin

Study of noncommutative geometry and particle physics by T.R.Govindarajan.

5.1.3 DST Indo Croatian project on Calogero-Sutherland model, Integrable models and Noncommutative geometry by T.R. Govindarajan

We study integrable models, Calogero models and noncommutative geometry with the motivation to understand near horizon structure blackholes

5.1.4 India-based Neutrino Observatory (INO)

The INO proposal has been granted in-principle approval and statutory clearances are awaited. INO group at IMSc is an active participant in the collaboration. The INO group at IMSc consists of D. Indumathi, H.S. Mani, M.V.N. Murthy, G. Rajasekaran and Nita Sinha. In addition a full time project member N.S. Sreenivasan is involved in the INO group activities at IMSc especially with the INO site and engineering related activities.

The activities of the Engineering Task Force (ETF) were coordinated through IMSc by the INO group. The Engineering Task Force (ETF), chaired by S. Ramanujam, Associate Director, ESG, BARC, and co-chaired by Y.C. Manjunatha,Director, ESG, IGCAR, has completed the site related Detailed Project Report (DPR) entrusted to TNEB. Simultaneously an Environmental Impact Assessment (EIA) was prepared and submitted by the Salim Ali Centre for Ornithology and Natural History(SACON). A detailed Environmental Management Plan (EMP) is nearing completion and IMSC group is coordinating the completion of EMP by CARE-EARTH organisation in Chennai.

The IMSc group continues to be associated with the physics analysis and simulations relevant to the Magnetised Iron Calorimeter (ICAL) detector at INO. Apart from the physics results that can be studied with atmospheric neutrinos and neutrinos from long base-line neutrino beams, the group is also engaged in studies such as track recognition and reconstruction using ICAL detector.

The members of the group continue to take active part in INO outreach activities, such as giving popular lectures at various universitities and other such institutions with the long term goal of creating awareness and interest in INO as well as generate human resources necessary for such a large project at a future time.

5.1.5 Physical Properties Relevant to Nanoscale Devices and Biological Motors in the Brownian Regime

Joint project with Gautam Menon from IMSc and A.M. Jayannavar (IOP, Bhubaneswar) and Surajit Sengupta (SNBNCBS, Kolkata), funded by the Nanoscience and Nanotechnology Initiative of the DST, India. Our general goal in this project is posed in terms of the following questions which we will attempt to address: What are the generic ingredients of models for machines which can do work in a thermal (Brownian) environment? How do physics requirements constrain the design, performance and efficiency of nanoscale machines? Are there general principles governing how biological systems perform work at the nano-scale? Can we use models devised for understanding the functioning of nano-scale biological motors for insights into guiding principles for the construction of man-made devices at that scale? Finally, what materials properties of nano-scale devices might be optimally selected if they are to be used as machine components?

5.1.6 Provably Efficient Exact Algorithms for NP-hard problems

This is a DST-DAAD joint project with Venkatesh Raman, Somnath Sikdar and Saket Saurabh of theoretical computer science and the research group of Prof Rolf Niedermier of

University of Jena, Germany and two of his students.

The aim of the project is to address problems in exact and parameterized computations utilizing the common interests and complementary skill set of the two groups. The project supports a fixed number of mutual visits of the scientists in the project. Under this project, Somnath Sikdar visited Jena University and Hannes Moser visited IMSc during this year.

In the year 2007-2008, Somnath and Venkatesh visited Jena, and Michael Dom and Rolf Niedermier visited IMSc Chennai.

A number of joint publications has been obtained through these mutual visits.

5.1.7 Real conjugacy classes in finite groups of Lie type

This project is being undertaken with Anupam Singh. The aim is to classify the real, and strongly real, conjugacy classes in the finite groups of Lie type (see research summary). The work is motivated by a conjecture relating conjugacy to representations.

5.1.8 Reversibility and conjugacy

This project is being undertaken with Ian Short. Conjugacy is being examined in various infinite groups, particularly groups of homeomorphisms of compact spaces. One paper has been accepted for publication and more results have been announced (see research summary).

5.1.9 The Debian Project

The Debian project was established in 1993 to provide an operating system that is composed of entirely free software.

The IMSc is one of the few academic institutions in India that runs all its services on free software; indeed it has been a pioneer in this area. In earlier years our contribution has been restricted to reporting bugs and patches for those bugs.

Since November 2004 we have been maintaining some packages that are used by the wide community of Debian users. These include:

1. tex4ht: A system for developing hypertext documents using TEX and LATEX.
2. elvis: An editor that is similar to `vi` but has many more features.
3. par: An intelligent paragraph formatter.
4. pngcrush: A program that reduces the size of `png` graphics files without losing graphic information.
5. swish++: A file indexing and searching system.

5.1.10 The Mechanics of Living Matter

Joint project with Sriram Ramaswamy (IISc, Bangalore), Jacques Prost (Institut Curie, Paris), J.-F Joanny (Institut Curie, Paris), Madan Rao (RRI and NCBS, Bangalore), Yashodhan Hatwalne (RRI, Bangalore) and David Lacoste (Institut Curie, Paris). Funded by the Indo-French Centre for the Promotion of Advanced Research (CEFIPRA). The project will focues on active systems, i.e. systems which contain components which are capable of taking up energy from their surroundings and turning it into motion via an irreversible chemical reaction. They arise primarily in biology, but soft-matter and nonequilibrium statistical physics are essential to understanding them.

5.1.11 Wave Propagation in disordered excitable media and simulated cardiac tissue

This is an IFCPAR project (no. 3404-4) funded by the Indo-French Centre for the Promotion of Advanced Research, being carried out in collaboration with Prof Alain Pumir of INLN, Sophia-Antipolis, France.

5.2 Institute Associateships

The Institute has established short-term associateships in **Mathematics, Theoretical Physics and Theoretical Computer Science** 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 01.04.07 to 31.03.08 are :

Swarup Poria
Midnapore College, Midnapore, West Bengal
24.10.07 to 16.11.07

Subinay Das Gupts
Dept. of Physics, University of Calcutta, Kolkatta
29.05.07 to 15.06.07

G.S.Khadekar
Dept. of Mathematics, RTM Nagpur University, Nagpur
20.05.2007 to 05.06.2007

Ujjal Debnath
Department of Mathematics, Bengal Engineering & Science University, Shibpur, Howrah
25.11.07 to 15.12.07

5.3 Conference Participation and Visits to Other Institutions

Arvind, V.

Participated in *Dagstuhl Workshop in "Algebraic Methods in Computational Complexity".* held at Schloss Dagstuhl, Saarbruecken, Germany during Oct 7 – Oct 12, 2007.

Participated in *FSTTCS 2007: Foundations of Software Technology and Theoretical Computer Science, 27th International Conference.* held at Indian International Centre, New Delhi during Dec 12 – Dec 14, 2007.

Balakrishnan, Radha

Participated in *International Conference on Recent Developments in Nonlinear Dynamics* held at Bharathidasan University, Tiruchirapalli. during Feb 13 – Feb 16, 2008. Gave an invited talk on Nonlinear Dynamics of a thin elastic nanotube and effect of conformations on charge transport

Participated in *International Conference on Nonequilibrium Phenomena in Condensed Matter* held at Indian National Science Academy, New Delhi. during Feb 21 – Feb 23, 2008. Gave an invited talk on Quantum effective potential, electron transport and conformons in biopolymers.

Participated in *Workshop on Integrable Systems* held at Indian Institute of Science, Bangalore during Feb 25 – Feb 26, 2008. Gave Lectures on Differential Geometry of Integrable Equations

Visited Department of Physics, Bharathdasan University, Tiruchirapalli during Mar 18 – Mar 19, 2008. For research discussions and as Ph. D Examiner.

Balasubramanian, R.

Participated in *School and Conference in Analytical Number Theory* held at International Centre for Theoretical Physics, Trieste, Italy during Apr 21 – May 11, 2007.

Basu, Rahul

Visited LAPTH, Annecy, France during Jul 9 – Jul 23, 2007. Research Collaboration

Visited LPTHE, Orsay, Paris, France during Jul 24 – Jul 30, 2007. Research Collaboration

Participated in *Lepton-Photon 2007* held at Daegu, Republic of South Korea during Aug 13

– Aug 18, 2007.

Participated in *QCD at Colliders* held at HRI, Allahabad during Nov 25 – Nov 30, 2007. 4 lectures on QCD calculational techniques

Participated in *Quark Matter 2008* held at Jaipur, India during Feb 4 – Feb 10, 2008. Session Chair

Participated in *QM 2008 Satellite Meeting - Hot and Dense Matter in the LHC Era* held at TIFR, Mumbai during Feb 12 – Feb 14, 2008.

Bhowmick, Samrat

Participated in *Indian Strings Meeting 2007* held at Harish-Chandra Research Institute, Allahabad during Oct 15 – Oct 19, 2007.

Chakraborty, Partha S.

Visited University of Adelaide during Apr 16 – Aug 15, 2007. Visited Prof. Mathai Varghese and gave a series of lectures

Visited University of New Castle, Australia during Jun 19 – Jun 22, 2007. Visited Prof. Wojciech Szymanski and gave a seminar on 21st June.

Visited Australian National University, Canberra during Jul 22 – Jul 28, 2007. Visited Prof. Adam Rennie.

Participated in *Discussion Meeting on Non-commutative Geometry and Operator Algebras* held at Orange County, Coorg during Feb 24 – Mar 1, 2008. Invited Speaker

Chatterjee, Pralay D.

Participated in *Homogeneous Flows, Moduli Spaces and Arithmetic* held at Pisa, Italy during Jun 11 – Jul 6, 2007.

Participated in *Measures and Dynamics on groups and homogeneous spaces* held at TIFR, Mumbai during Dec 18 – Dec 22, 2007.

Date, G.

Participated in *The Sixth International Conference on Gravitation and Cosmology* held at IUCAA, Pune during Dec 17 – Dec 21, 2007.

Digal, Sanatan D.

Participated in *Workshop on High Energy Physics* held at Institute of Mathematica Sciences during Jan 2 – Jan 13, 2008.

Ghosh, Sibasish

Visited Physics and Applied Mathematics Unit, Indian Statistical Institute, Kolkata during May 7 – May 12, 2007. Visited PAMU, ISI, Kolkata to interact with Dr. G. Kar and his students, and also to give a talk.

Visited Physics Department, Pune University during Jun 9 – Jun 17, 2007. Visited the Physics Department of Pune University to have collaborative work with Dr. P. S. Joag and his Ph.D. students. Also gave a talk there.

Participated in *THEOPHYS-07: International Conference on Recent Developments in Theoretical Physics* held at Indian Statistical Institute, Kolkata during Dec 4 – Dec 7, 2007. Was a participant in this conference, but also gave a small talk there entitled, "Hardy's non-locality and general non-signaling theory".

Participated in *Quantum Correlation & Quantum Computing* held at Centre for Theoretical Studies, I. I. T. Kharagpur during Dec 11 – Dec 13, 2007. Gave an invited talk in this conference.

Participated in *A National Symposium on Trends and Challenges in Quantum Theory* held at Department of Applied Mathematics, University of Calcutta during Feb 27 – Feb 28, 2008. Gave here an invited talk

Participated in *International School and Conference on Quantum Information - 2008* held at IOP, Bhubaneswar during Mar 4 – Mar 12, 2008. gave here, in the school (held from 4 to 7 March, 2008), three lectures on Quantum Information and also gave an invited talk at the conference (held from 9 to 12 March, 2008).

Gill, Nick

Visited ISI Bangalore during Nov 4 – Nov 6, 2007. Discussions with N Sastry

Visited TIFR, Mumbai during Mar 15 – Mar 22, 2008. Discussions with N. Singhi, S. Ganguly and H. Helfgott. Talk given on "Projective planes and related notions".

Govindarajan, T. R.

Visited Ruder Boskovic Inst, Zagreb during Jun 8 – Jun 18, 2007. Indo Croatian project, talks

Visited University of Bratislava, Slovakia during Jun 19 – Jul 16, 2007. Talks, Workshop

Participated in *Workshop on Noncommutative Geometry* held at Bratislava, Slovakia during Jun 19 – Jul 16, 2007. Speaker

Visited Albert Einstein Inst for Gravitation Physics, Golm, Germany during Jul 16 – Sep 19, 2007. Talks, Discussions

Visited University of Hannovar, Germnay during Aug 26 – Aug 29, 2007. Seminar

Participated in *Baltics Workshop 2007* held at Kladova, Serbia during Sep 2 – Sep 9, 2007. Invited speaker

Visited Harischandra Research Inst, Allahabad during Nov 13 – Nov 17, 2007. FTAG VI meeting

Visited University of Hyderabad during Mar 5 – Mar 8, 2008. TPSC, talk

Visited SNBOSE, SINP, IISER, Kolkata during Mar 9 – Mar 12, 2008. TPSC, talks

Ivan, Solomon J.

Participated in *International School and Conference on Quantum Information-2008.* held at Institute of Physics, Bhubaneswar. during Mar 4 – Mar 12, 2008. Gave a talk on Nonclassicality and Entanglement.

Jaikumar, Prashanth

Visited Physical Research Laboratory, Ahmedabad during Oct 28 – Nov 3, 2007. Gave a seminar, collaborated on a research project

Participated in *Quark Matter 2008* held at Jaipur during Feb 4 – Feb 10, 2008. Presented a poster

Participated in *Quarks in Astrophysics and Cosmology* held at Toshali Sands, Orissa during Feb 14 – Feb 17, 2008. Gave an invited talk

Jampa, Maruthi Pradeep Kanth

Participated in *"Spring College on Water in Physics, Chemistry and Biology"* held at International Centre for Theoretical Physics, Trieste, Italy during Apr 10 – Apr 20, 2007.

Kesavan, S.

Participated in *Instructional School on the Modern Theory of Partial Differential Equations* held at I. I. T., Mumbai during May 27 – Jun 23, 2007. Delivered a series of six lectures.

Participated in *Symposium on teaching of Functional Analysis, Annual Meeting of the Ramanujan Mathematical Society* held at N. I. T., Suratkal, Mangalore. during Jun 6 – Jun 8, 2007. Delivered an invited talk.

Visited Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu. on Oct 30, 2007. Delivered the S. S. Pillai Endowment Lecture.

Participated in *Refresher Course on Functional Analysis* held at Ramanujan Institute for Advanced Study in Mathematics during Nov 14 – Dec 3, 2007. Delivered the Inaugural Address and two invited lectures.

Visited Federation of Asian Scientific Academies and Societies (FASAS) during Nov 27 – Nov 29, 2007. Attended the Council meeting at Bangkok, Thailand.

Participated in *First International Conference on Science Education in the Asia-Pacific* held at Bangkok, Thailand during Nov 27 – Nov 29, 2007. Made a poster presentation.

Kodiyalam, Vijay

Visited Indian Statistical Institute, Bangalore during May 18 – Jun 8, 2007. Gave a talk on "Knot theory and the Jones polynomial"

Participated in *Summer training program in Mathematics* held at Ramanujam Institute for Advanced Study in Mathematics during Jul 16 – Jul 21, 2007. Gave 5 lectures on "Groups and their actions".

Krishna, M.

Visited Department of Mathematics, University of Delhi on Sep 3, 2007. Gave a talk on Wavelet transforms

Lodaya, Kamal

Visited DAIICT, Gandhinagar on Apr 9, 2007. Talk on "A program is a solution of a set of equations".

Participated in *6th Formal Methods Update* held at IIT Kanpur during Apr 12 – Apr 15, 2007. Spoke on "The monadic logic of finite graphs."

Visited LaBRI, Université Bordeaux-1 during May 15 – Jun 14, 2007. Gave a talk on "Product automata and process algebra".

Visited ILLC, Universiteit van Amsterdam on Jun 15, 2007. Talk on "Marking time".

Participated in *Discover 07, Instructional course on Distributed computing and Software verification* held at NIT Karnataka, Surathkal during Jul 23 – Jul 27, 2007. Gave three lectures.

Participated in *Instructional course on Parallel computing* held at P.B. Siddhartha College of Arts and Science, Vijayawada during Aug 4 – Aug 5, 2007. Gave two lectures.

Visited Indian Institute of Science, Bangalore on Aug 17, 2007. Spoke on "Automata on trees".

Visited IIT Delhi during Sep 29 – Oct 5, 2007. Gave a talk on "Collecting garbage concurrently (but correctly)".

Visited TIFR Mumbai during Nov 5 – Nov 8, 2007.

Participated in *27th FSTTCS* held at New Delhi during Dec 11 – Dec 15, 2007.

Participated in *Seminar on Theory of Computing* held at Kongu Engineering College, Perundurai during Dec 28 – Dec 29, 2007. Spoke on "Algorithms, machines and languages".

Participated in *2nd Indian winter school on logic* held at IIT Kanpur during Jan 14 – Jan 26, 2008.

Visited IIT Roorkee on Jan 19, 2008. Gave two talks on "Algorithms, languages and machines" and "Petri nets".

Participated in *TECS Workshop on Practical Program Verification* held at TCS, Hyderabad during Feb 14 – Feb 18, 2008. Gave a talk on "Logics for verification".

Mahajan, Meena B.

Visited Vellore Institute of Technology on Jan 21, 2008. Lectured in the workshop on Advanced Topics in Theoretical Computer Science, held during 21–23 Jan 2008.

Majumdar, Kaushik K.

Visited National Brain Research Centre, Manesar, Harayana. during Feb 20 – Jul 27, 2007. Invited for a lecture but could not attend.

Mani, Harihara S.

Participated in *NCERT, New Delhi* held at New Delhi during Sep 17 – Sep 21, 2007. Devel-

opment of exemplar problems in Physics

Participated in *QCD at LHC* held at Harish-Chandra Research Institute, Allahabad during Nov 25 – Nov 30, 2007.

Participated in *Frontier Topics in Physics* held at NGM College, Pollachi, Tamil Nadu during Jan 22 – Jan 24, 2008.

Participated in *Nu Horizons* held at Harish-Chandra Reseach Insitute, Allahabad during Feb 13 – Feb 15, 2008.

Participated in *NCERT (Development of Exemplar problems in Physics)* held at NCERT, New Delhi during Mar 3 – Mar 7, 2008.

Participated in *Refresher course,* held at Bharathidasan University, Trichy on Mar 21, 2008. Two lectures were given in the three week programme

Participated in *Beyond Standard Model* held at Indian Institute of Science, Bangalore during Mar 27 – Mar 29, 2008.

Menon, Gautam I.

Visited Saha Institute of Nuclear Physics, Kolkata on May 30, 2007. Delivered an Institute Colloquium on "de Gennes: A Life in Science". Also visited the S.N. Bose National Centre for Basic Science, Kolkata during the period 29th May - 2nd June. Presented a seminar on "Correlations in Glassy Vortex States".

Visited IGCAR, Kalpakkam on Jun 6, 2007. Delivered a lecture at the Summer Student Training programme on "Nano-machines"

Visited Raman Research Institute, Bangalore on Jun 11, 2007. Thesis viva

Visited ESPCI, Paris during Jun 24 – Jul 14, 2007. Visited in connection with an Indo-French project on the "Physics of Living Matter". Presented a seminar on "Phase Transitions in Pressurized Semiflexible Polymer Rings".

Participated in *Physics of Living Matter* held at Aurora Degree College, Hyderabad, India during Jul 19 – Jul 20, 2007. Invited talk on "Molecular Machines"

Participated in *Lecture Workshop on Statistical Thermodynamics* held at Mysore University, Mysore during Sep 7 – Sep 9, 2007. Delivered a series of 4 lectures on Statistical Mechanics

Visited Advanced Centre for Treatment, Research and Education in Cancer, Mumbai on Sep 20, 2007. Meeting of the Biological Sciences Board of HBNI.

Visited Science Club on Nov 3, 2007. Delivered a lecture at the Science Club Meeting at CLRI on "Novel Prize in Physics, 2007"

Visited Childrens Science Club, Mylapore on Nov 11, 2007. Delivered a popular lecture on "Nobel Prize in Physics, 2007"

Participated in *International Workshop on Physics and Biology: A Synergy* held at Central University, Hyderabad on Dec 12, 2007. Invited talk on "Pattern Formation in Motor Microtubule Mixtures"

Visited Raman Research Institute, Bangalore on Jan 3, 2008. Conducted a thesis viva. Presented a seminar on "Universality Class of the Reversible-Irreversible Transition in Sheared Suspensions"

Participated in *International School on Hands-on Research in Complex Systems* held at Institute of Plasma Research, Ahmedabad during Jan 7 – Jan 18, 2008. Visited for three days and delivered a special Invited Colloqium on "Non-equilibrium Steady States in Driven Soft Matter"

Participated in *The Interface of Life* held at IIT Madras, Chennai during Jan 7 – Jan 18, 2008. Member of the Organizing Committee. Also chaired a session at the meeting

Participated in *Mahabaleshwar Seminar on Modern Biology* held at Mahabaleshwar Club, Mahabaleshwar during Jan 26 – Feb 2, 2008. Presented a seminar on "Pattern Formation in Motor Microtubule Mixtures" at the meeting. Participated in discussions on the setting up of the network "Motors and Mechanisms of Transport and Trafficking".

Mishra, Ashok K.

Visited Central Electrochemical Research Institute, Karaikudi during Jun 12 – Jun 14, 2007.

Mukhopadhyay, Anirban

Participated in *School and Conference on Analytic umber theory* held at ICTP, Trieste during Apr 23 – May 11, 2007.

Visited Harish -Chandra Research Institute during Dec 10, 2007 – Jan 12, 2008. conducted tutorials at ATM school

N, Narayanan

Participated in *Colourings Independance and Domination 2007* held at Karpacz, Poland during Sep 16 – Sep 21, 2007. Held by University of Zielonogora, Poland

Visited University of Zielona Gora, Poland during Sep 21 – Oct 14, 2007. Collaborative work with A Fiedorowicz and M Hałuszczak

Participated in *FSTTCS 2007* held at IIT Delhi during Dec 12 – Dec 14, 2007.

Paranjape, Kapil H.

Visited California Institute of Technology, Pasadena, CA, USA during Jan 1 – Apr 2, 2007. 1. Taught a course "Topics in number theory" on the theory of complex multiplication for elliptic curves. 2. Collaborative research with D. Ramakrishnan.

Participated in *RMS Annual meeting 07* held at NITK, Suratkal during Jun 5 – Jun 8, 2007. Organiser of Symposium on Motives, Number theory, Geometry.

Participated in *Workshop in Commutative Algebra and Algebraic Geometry* held at Indian Institute of Technology Madras during Jun 10 – Jun 23, 2007. Gave a course of lectures on topics in algebraic geometry

Participated in *Commutative Algebraic and Algebraic Geometry 07* held at Indian Statistical Institute, Bangalore during Jul 16 – Jul 20, 2007. Gave an invited talk on Varieties defined over number fields

Visited NISER, Bhubaneshwar during Oct 29 – Nov 1, 2007. Invited Colloquium talk on "What is Pi? (An introduction to modern mathematics)"

Visited IISER, Pune on Nov 2, 2007. Presented talk on "What is Pi? (An introduction to modern mathematics)"

Visited IISER, Mohali during Nov 5 – Nov 7, 2007. Curriculum development committee meeting.

Participated in *International Colloquium 2008, TIFR* held at TIFR, Mumbai during Jan 3 – Jan 12, 2008. Presented an Invited Talk on "Modular forms and Calabi-Yau varieties"

Participated in *Conference on K-theory and Algebraic Cycles* held at IMSc, Chennai during Jan 15 – Jan 17, 2008. Talk on "Modular forms and motives"

Participated in *Perspectives in Mathematical Sciences* held at Indian Statistical Institute, Bangalore during Feb 4 – Feb 8, 2008. Gave an invited talk on "A combinatorial approach to algebraic topology: the work of Daniel Kan and Daniel Quillen"

Participated in *Special Convocation* held at Chennai Mathematics Institute on Feb 8, 2008. Invited address on the work of Professor David Mumford

Philip, Geevarghese

Participated in *FSTTCS* held at Indian Institute of Technology, New Delhi during Dec 12 – Dec 14, 2007.

Prasad, Amritanshu

Participated in *the advanced instuctional school on representation theory and its applications* held at Bhaskaracharya Pratishthana, Pune. during Jul 2 – Jul 28, 2007. Lectured on "Representation theory of $GL(2, F_q)$, $SL(2, F_q)$. Beginning of the story for $GL(n, F_q)$ with parabolic induction, and irreducibility of it."

Participated in *the tenth discussion meeting on harmonic analysis* held at Indian Institute of Science, Bangalore during Dec 28, 2007 – Jan 1, 2008. Invited Speaker

Raghavan, K. N.

Participated in *Annual Conference of the Ramanujan Mathematical Society* held at NITK, Surathkal during Jun 5 – Jun 7, 2007. Gave talk entitled "Initial ideals of tangent cones to Schubert varieties in orthogonal Grassmannians."

Rajasekaran, G.

Visited University of California, Riverside,USA during Apr 3 – Jun 30, 2007. Collaborated on research projects with physicists at UCR

Visited Southern Methodist University, Dallas, Texas, USA on Jul 24, 2007. Discussion

Participated in *Workshop on Neutrinoless Double Beta Decay (NDBD)* held at TIFR, Mumbai during Oct 26 – Oct 27, 2007. Gave the Keynote Address titled " Are Neutrinos Majorana Particles?"

Visited IIT, Madras during Nov 14 – Nov 15, 2007. Gave two lectures on Neutrinos and INO

Visited University of Mysore during Nov 18 – Nov 24, 2007. Gave a course of lectures on Continuuum Mechanics

Participated in *Tenth Workshop on HEP Phenomenology (WHEPP 10)* held at IMSc, Chennai during Jan 2 – Jan 13, 2008. Chaired a Session

Visited Banares Hindu University during Feb 11 – Feb 12, 2008. Gave two lectures (1) Is there a Final Theory? (2) Induced QCD and induced gravity

Participated in *Nu-HoRIzons (2008) Workshop on Neutrinos* held at Harish Chandra Research Insitute, Allahabad during Feb 13 – Feb 15, 2008. Gave a talk on "A_4 Symmetry and the Neurino Mass Matrix"

Participated in *Diamond Jubilee Seminar on Current Trends in Physics* held at Panjab University, Chandigarh during Feb 28 – Mar 1, 2008. Gave a talk on "Recent Discoveries in Neutrino Physics and INO"

Rajesh, R.

Participated in *StatPhys Guwahati* held at IIT Guwahati during Jan 8 – Jan 15, 2008. Presented a poster

Raman, Venkatesh

Visited SSN College of Engineering on Jun 2, 2007. Gave a talk on P vs NP problem

Participated in *Conference on Graph Theory, Algorithms and Applications* held at Annamalai University on Jun 7, 2007. Gave a talk on 'Parameterized Algorithms for the Undirected Feedback Vertex Set Problem'

Participated in *Dagstuhl Workshop on Structure Theory, FPT Algorithmics on Graphs, Digraphs and Hypergraphs* held at Dagstuhl, Germany during Jul 9 – Jul 13, 2007.

Visited P. B. Siddhartha College of Arts and Science, Vijayawada during Aug 4 – Aug 5, 2007. Gave two talks on Parallel Algorithms in the teacher training course on Parallel Computing

Participated in *IARCS workshop on Parallel Algorithms* held at Siddhartha College of Arts and Sciences, Vijayawada during Aug 4 – Aug 5, 2007. Gave two talks on Algorithms for Parallel Computers.

Visited Vellore Institute of Technology, Vellore on Aug 18, 2007. Gave a talk on NP-completeness and coping strategies

Visited Vellore Institute of Technology on Nov 23, 2007. Gave two talks on Minimum Spanning Tree algorithms

Visited Mar Athanasius College, Kothamangalam, Kerala during Dec 8 – Dec 9, 2007. Gave a lecture on Minimum spanning tree algorithms and one on coping with NP completeness

Visited Friedrich-Schiller-Universitat, Jena, Germany during Jan 14 – Jan 21, 2008. Gave 3 talks on 'Above guarantee Parameterization, FPT algorithms for Independent Sets and Dominating Sets in graphs with no short cycles, Vector Dominating Set'

Visited Vellore Institute of Technology, Vellore on Jan 23, 2008. Gave two talks, one on Parameterized Complexity and one on Advanced Data Structures

Visited Manonmaniam Sundaranar University, Tirunelveli on Mar 20, 2008. Gave a talk on

'Algorithms from P to NP, and coping with NP completeness'

Ramanujam, R.

Participated in *Indo-French Workshop on Cryptology* held at Paris, France during Jun 11 – Jun 13, 2007. Gave a talk on "algorithmic verification of security protocols"

Participated in *IARCS course for faculty on "Distributed systems and Software verification"* held at NIT, Surathkal during Jul 23 – Jul 27, 2007. Gave a set of 4 lectures in the course.

Participated in *Regional Workshop for faculty on Information Security* held at Adhiparasakthi Engineering College, Chennai. during Aug 2 – Aug 3, 2007. Keynote talk on "Foundations of security".

Participated in *Symposium on Networks and Communication* held at Sri Sai Ram Engineering College, Chennai on Aug 24, 2007. Inaugural lecture on "Theory of message passing".

Participated in *IFIP Working Group 2.2 Meeting on Programming Methodology* held at LORIA, Nancy, France during Sep 17 – Sep 20, 2007. Gave a talk on "Modal logics for games"

Visited Ecole Normale Superieure de Cachan, Paris, France. during Sep 20 – Sep 21, 2007. Gave a talk on "Structured specification of strategies in games on graphs".

Visited Universiteit Dortmund, Germany. during Sep 24 – Sep 28, 2007. Gave a talk on "Decidable logics for security protocols".

Participated in *Seventh Tbilisi Symposium on Language, Logic and Computation* held at Tbilisi, Georgia during Oct 1 – Oct 5, 2007. Gave an invited talk on "Temporal reasoning about messages".

Participated in *Research Directions in Software Engineering* held at IIT, Madras during Dec 27 – Dec 28, 2007. Gave a talk on "Challenges in analysis of security protocols"

Participated in *Winter school on Logic.* held at IIT, Kanpur. during Jan 14 – Jan 26, 2008.

Participated in *ACM Compute Conference* held at IISc, Bangalore. during Jan 18 – Jan 19, 2008. Gave a tutorial on "Automata for XML".

Participated in *Course for faculty on "Practical program verification"* held at TCS, Hyderabad. during Feb 14 – Feb 18, 2008. Gave lectures on temporal logic model checking.

Participated in *AICTE-QIP Short Term Course on Networks* held at Anna University, Chennai. during Feb 18 – Feb 29, 2008. Gave a lecture on Network Security.

Visited Crescent Engineering College, Chennai. on Mar 26, 2008. Gave a lecture on "Insecurity analysis".

Ray, Purusattam

Participated in *Mechanics of Fracture and Fatigue* held at Indian Institute of Technology, Madras during Jun 25 – Jun 30, 2007. The workshop was organized by the Department of Aerospace Engineering and Department of Applied Mechanics and was sponsored by All India Council for Technical Education. Invited to give a guest lecture on the Statistical Physics of Fracture.

Participated in *Statistical physics approaches to multi-disciplinary systems* held at Guwahati, India during Jan 7 – Jan 13, 2008. Invited to deliver two talks at the workshop and chaired a session at the conference.

Sankaran, Parameswaran

Participated in *Summer Training Programme for PG Students* held at Ramanujan Institute of Advanced Study in Mathematics, Chennai during Jul 9 – Jul 28, 2007. Gave three lectures on topology of surfaces

Participated in *International Workshop and Conference in Geometry and Topology* held at IIT Bomay, Powai during Aug 17 – Aug 25, 2007. Gave a talk on 'K-theory of toric manifolds and related spaces'.

Visited Cochin University of Science and Technology, Cochin during Sep 21 – Sep 22, 2007. Gave the Professor Abdi Memorial Endowment Lecture on 'Poincaré conjecture'.

Visited Pondichery University during Feb 7 – Feb 8, 2008. Gave two lectures on 'Skew fields'.

Sathiapalan, Balachandran

Participated in *From Strings to LHC* held at Fireflies Ashram, Bangalore during Dec 11 – Dec 18, 2007.

Saurabh, Saket

Visited Department of Informatics, University of Bergen, Norway. during Sep 1, 2006 – May 31, 2007. Research discussions

Sharma, Chandradew

Participated in *WHEPP X* held at IMSc during Jan 2 – Jan 13, 2008.

Siddharthan, Rahul

Participated in *RECOMB Satellite Meeting on Regulatory Genomics* held at Broad Institute, MIT, Cambridge, MA, USA during Oct 11 – Oct 13, 2007. Contributed poster

Participated in *73rd Annual Meeting of the Indian Academy of Sciences* held at Thiruvananthapuram during Nov 1 – Nov 4, 2007. Invited talk

Participated in *Physics in Biology: A Synergy* held at University of Hyderabad during Dec 12 – Dec 14, 2007. Invited talk

Participated in *Statistical Physics Approaches to Multi-Disciplinary Problems* held at IIT Guwahati during Jan 11 – Jan 13, 2008. Invited talk

Sikdar, Somnath

Visited Friedrich-Schiller University, Jena, Germany. during Aug 1 – Sep 1, 2007.

Participated in *The 18th International Symposium on Algorithms and Computation.* held at Sendai, Japan during Dec 17 – Dec 19, 2007.

Simon, R.

Participated in *International Conference on 'Recent Developments in Theretical Physics' Theophys -07* held at Indian Statistical Institute, Kolkata during Dec 4 – Dec 7, 2007. Gave a talk on 'A new proof of Wigner's Unitary-Antiunitary theorem'

Participated in *National Laser Symposium NLS-7* held at M.S. University of Baroda, Vadodara during Dec 17 – Dec 20, 2007. Gave a talk on 'Classical entanglement helps in resolving an issue in polarization optics'

Participated in *Lecture Workshop on 'Frontier Topics in Physics' of the Indian Academy of Sciences* held at Bishp Heber College, Truchirapalli during Feb 4 – Feb 5, 2008. Gave a talk on 'Entanglement in Classical Polarization Optics'

Participated in *Indo-Singapore Joint Symposium on Current Trends in Physics* held at IIT-Madras during Feb 28 – Mar 1, 2008. Gave a talk on 'Some Open Problems in Quantum Information Theory'

Participated in *International Conference on Quantum Information ISCQI-08* held at Institute of Physics, Bubhaneswar during Mar 9 – Mar 12, 2008. Gave a talk on 'Entanglement of formation for Gaussian mixed staes'

Singh, Anupam

Participated in *AIS on Representation Theory* held at Bhaskaracharya Pratishthana, Pune during Jul 2 – Jul 28, 2007. Was an Associate Teacher

Participated in *AIS on Number Theory* held at Harish-Chandra Research Institute, Allahabad during Dec 3 – Dec 28, 2007. Was a Tutor for a short course

Participated in *Transformation Groups 2007* held at Independent University, Moscow during Dec 17 – Dec 22, 2007. Gave a talk on "Real Elements in Algebraic Groups"

Visited IIT Bombay during Jan 28 – Jan 29, 2008. Gave a talk on "Real Elements in Spin Groups"

Sinha, Nita

Participated in *XXIII International Symposium on Lepton and Photon Interactions at High Energy* held at Daegu, Korea during Aug 13 – Aug 18, 2007.

Participated in *Xth Workshop on High Energy Physics Phenomenology* held at IMSc during Jan 2 – Jan 13, 2008.

Sinha, Sitabhra

Visited Institute Non-lineaire de Nice, Nice, France during May 27 – Jun 23, 2007. As part of IFCPAR project

Participated in *Workshop on Mechanism of Pattern Formation* held at Orange County Resort, Coorg during Dec 6 – Dec 9, 2007. Gave invited lecture on "Patterns of life and death"

Participated in *DAE Solid State Physics Symposium* held at University of Mysore, Mysore during Dec 27 – Dec 30, 2007. Gave invited talk on "Physics of Complex Networks"

Participated in *Statistical Physics Approaches to Multi-disciplinary Problems* held at IIT Guwahati during Jan 7 – Jan 13, 2008. Gave invited talk on "The Importance of Being Modular: The Importance and Utility of Modular Structures in Complex Networks"

Participated in *International Workshop on Complexity with focal theme on living systems* held at West Bengal University of Technology, Kolkata Indian Statistical Institute, Kolkata during Mar 17 – Mar 28, 2008. Gave three invited lectures on complex networks and pattern formation

Sinha, Sudeshna

Participated in *3rd International IEEE Scientific Conference on Physics and Control (PhysCon*

2007) held at Potsdam during Sep 3 – Sep 7, 2007. Invited Speaker

Visited University of Tokyo during Nov 26 – Dec 2, 2007. Collaborative Research

Sridhar, S.

Participated in *Aspects of Complexity in Computational Neuroscience (First triangular Eu-India-China Summer School)* held at Torino,Italy during Jun 25 – Jul 1, 2007.

Participated in *Workshop developing applications for Grid GARUDA, National Grid Computing Iniative.* held at JNU, Delhi during Oct 4 – Oct 6, 2007. The program that was developed was used as an inhouse developed program for testing the Garuda at this workshop.

Participated in *Hands-on Research Complex Systems* held at IPR, Ahmedabad during Jan 6 – Jan 18, 2008.

Srinivas, K.

Participated in *School and Conference on Analytic Number Theory* held at ICTP, Trieste, Italy during Apr 23 – May 11, 2007. Gave a course of lectures on Basics of Riemann Zeta-function and Dirichlet L-series.

Visited University of Genova, Italy during May 12 – May 16, 2007. Delivered a talk.

Visited University of Parma, Italy during May 17 – May 20, 2007. Delivered a talk.

Visited University of Roma Tre, Italy during May 21 – May 23, 2007. Delivered a talk.

Visited Institute of Mathematics and Its Applications, Bhubaneswar during Feb 21 – Feb 26, 2008. Delivered two lectures to the graduate students.

Visited Department of Mathematics, AU, Visakhapatnam during Feb 27 – Feb 28, 2008. Delivered a talk on 'Some Applications of Number Theory'.

Subramanian, C. R.

Visited Washington State University, Vancouver, WA near Portland, Oregon, USA. during Jun 6 – Jun 8, 2007. Participated at the AAIM-2007 conference and gave a talk.

Participated in *Third International Conference on Algorithmic Aspects in Information and Management, AAIM-2007,* held at Washington State University near Portland, Oregon, USA. during Jun 6 – Jun 8, 2007. Presented our work on "Acyclic edge colouring of outerplanar graphs".

Visited Department of Computer Science, University of Oregon, Eugene, Oregon, USA. during Jun 11 – Jun 14, 2007. Had interactions and gave a talk on "Acyclic edge coloring : Some recent developments".

Visited Department of Computer Science and Engineering, University of Washington, Seattle, WA, USA. during Jun 18 – Jun 19, 2007.

Visited Department of Computer Science and Engineering, PennState University, Pennsylvania, USA. during Jun 26 – Jun 27, 2007. Had interactions and gave a talk on "List coloring : Some recent developments".

Participated in *27th International Conference on Foundations of Software Technology and Theoretical Computer Science, FSTTCS-2007.* held at Delhi, India. during Dec 12 – Dec 14, 2007.

Visited Participated in the Seminar on Theory of Computing held at Kongu Engineering College, Perundurai, Erode. during Dec 28 – Dec 29, 2007. Gave two lectures on graph algorithms and NP-completeness.

Participated in *Workshop on Algorithms and Complexity* held at IMSc, India. during Mar 10 – Mar 12, 2008.

Sunder, V. S.

Visited IIT, Bombay during Apr 15 – Apr 28, 2007. Gave an invited 'Distinguished Lecture Series' of four 90 minute talks on *Temperley-Lieb Algebras, subfactors and planar algebras*, as also an 'Institute Lecture' on *Paul Halmos (1916-2006): my teacher, the best in the business.*

Participated in *Science City funded Summer Training Programme in Mathematics for PG students* held at Ramanujan Institute for Advanced Study in Mathematics on Jul 25, 2007. lectured on 'C* algebras'

Participated in *Science City funded Summer Training Programme in Mathematics for PG students* held at Ramanujan Institute for Advanced Study in Mathematics on Jul 26, 2007. Lectured on 'von Neumann algebras'.

Participated in *Workshop on 'Quantum groups and non-commutative geometry'* held at Max Planck Institut fur Matematik, Bonn during Aug 6 – Aug 8, 2007. Gave an invited lecture on *Hopf C^*-algebras and their quantum doubles - from a subfactors point of view*

Participated in *Perspectives in Mathematics* held at Indian Statistical Institute, Bangalore during Feb 4 – Feb 8, 2008. Gave an invited lecture on II_1 *factors and Ergodic Theory*

Participated in *Discussion Meeting on Non-commutative Geometry and Operator Algebras* held at Orange County, Coorg during Feb 25 – Feb 29, 2008. Gave a lecture on *The Tomita-Takesaki Theorem*

Visited Stella Maris College, Chennai on Mar 4, 2008. delivered the Dr. Thangamani Endowment Lecture on the topic *When is a knot not the unknot?*

Participated in *Workshop on* Topics in von Neumann algebras held at Banff International Research Station, Alberta, Canada during Mar 24 – Mar 28, 2008. Gave an invited lecture on *Non-crossing partition and 2-cabled Temperley-Lieb planar algebras*

5.4 Visitors from Other Institutions

Name	Affiliation	Period of Visit
Prajakta Nimbhorkar	TIFR, Mumbai	14.05.07 – 01.06.07
Naveen Surendran	IISc, Bangalore	01.06.07 – 11.06.07
Rajamani Narayanan	Florida International University, USA	05.06.07 – 14.06.07
Parvati Shastri	University of Mumbai, Mumbai	28.05.07 – 16.06.07
A.R.Shastri	IIT, Mumbai	29.05.07 – 16.06.07
Jyoti Prasad Jaha	Bankura Christian College, West Bengal	13.06.07 – 20.06.07
Kaneenika Sinha	University of Toronto, Canada	14.06.07 – 20.06.07
Prajakta S.Nambhorkar	TIFR, Mumbai	13.05.07 – 22.06.07
Sachin Gautam	Northeesten University	22.05.07 – 22.06.07
C.E.Veni Madhavan	IISc, Bangalore	22.06.07 – 22.06.07
Animesh Datta	University of New Mexico, USA	27.06.07 – 29.06.07
K.Gowri Navada	Periyar University	15.05.07 – 30.06.07
Anitha Srinivasan	TIFR, Mumbai	02.04.07 – 14.04.07

Suresh Ramaswamy	Birla Institute, Goa	15.06.07 – 13.07.07
R.Shankar	Yale University	29.06.07 – 16.07.07
Radhika Vathsan	Bits, Pilani	19.06.07 – 13.07.07
Indrajit Mitra	IIT, Kanpur	17.06.07 – 17.07.07
Anish Ghosh	ISI, Kolkatta	12.06.07 – 17.07.07
H.C.Nainwal	Garhwal University	23.07.07 – 26.07.07
Goutam Pal	Institute of Infor. Tech, Kolkatta	01.07.07 – 28.07.07
Sumedha	ISI Foundation, Italy	23.07.07 – 30.07.07
Srinivas Raghavendra	National University of Ireland, Ireland	23.07.07 – 02.08.07
Antone Meyer	LIAFA, Paris	28.07.07 – 05.08.07
Sourav Chakraborty	University of Chicago	04.08.07 – 10.08.07
Vijay Patnakar	Microsoft Research, Bangalore	07.08.07 – 08.08.07
Satya Lokam	Microsoft Research, Bangalore	07.08.07 – 08.08.07
Lata Narayanan	Concordia University, Canada	24.07.07 – 10.08.07
Girija Ravishankar	National Inst. of Engineering, Mysore	18.07.07 – 10.08.07
Bosco Emmanoel	CERI, Karaikudi	16.07.07 – 15.08.07

Paramita Das	Vanderbilt University, USA	12.08.07 – 15.08.07
Shamindra Kumar Ghosh	Vanderbilt University, USA	12.08.07 – 15.08.07
Sameen Ahmed Khan	Salalh College of Technology, Oman	15.08.07 – 18.08.07
Florian Loca	Mathematical Institute, Mexico	05.08.07 – 24.08.07
A.P.Balachandran	Syracuse University, USA	23.08.07 – 26.08.07
Rajish Nath	University of Hannover, Germany	22.08.07 – 25.08.07
Indranil Biswas	TIFR, Mumbai	16.08.07 – 25.08.07
A.S.Unnikrishnan	National Institute, Gao	30.08.07 – 01.09.07
Usha N.Bhosle	TIFR, Mumbai	20.08.07 – 31.08.07
Leon Loveridge	Imperial College, London	28.08.07 – 03.09.07
Jijo.S	Central Polytechnic college, Trivendram	28.08.07 – 03.09.07
S.D.Adhikari	HRI, Allahabad	02.09.07 – 04.09.07
N.Dadhich	IUCAA, Pune	26.08.07 – 07.09.07
M.Sanjay Kumar	S.N.Bose Centre, Kolkatta	15.07.07 – 16.09.07
Rick Mukherjee	Jacobs University, Mumbai	03.09.07 – 14.09.07
Rupert Nash	JCMB, UK	12.08.07 – 17.09.07

Subhasis Sinha	S.N.Bose Centre, Kolkatta	26.08.07 – 15.09.07
Deepak Parashar	Mathematics Institute	19.09.07 – 21.09.07
R.Karaenkel	University of Sao Paolo, Brazil	26.09.07 – 27.09.07
Famaey Benoit	ULB, Belgium	17.09.07 – 21.09.07
R.Thangadurai	HRI, Allahabad	19.09.07 – 29.09.07
Anjan Kumar Chandra	University of Calcutta, Kolkatta	13.09.07 – 05.10.07
Sriganesh M.Srihari	Nanyang Tech University, Singapore	01.08.07 – 06.10.07
Aparna Baskaran	Syracuse University, USA	08.10.07 – 10.10.07
I.Suresh	National Institute of Oceanography, Gao	08.09.07 – 09.09.07
K.R.Parthasarathy	ISI, New Delhi	30.09.07 – 11.10.07
Ankush Sengupta	S.N.Bose Centre, Kolkatta	15.08.07 – 10.10.07
Debajyoti Choudhury	University of Delhi, Delhi	05.10.07 – 13.10.07
Kumar Sankar Gupta	SINP, Kolkatta	09.10.07 – 13.10.07
Anirban Basu	IAS, Princeton	10.10.07 – 16.10.07
Sajeev John	University of Toronto, Canada	15.10.07 – 19.10.07
N.Mukunda	IISc, Bangalore	15.10.07 – 20.10.07

Rajdeep Niyogi	IIT, Roorkee	16.10.07 – 27.10.07
Anuradha Narasimhan	IISc, Bangalore	01.09.06 – 31.10.07
S.Arunagiri	Hiroshima University	27.08.07 – 31.10.07
Govind Swarup	NCRA, Pune	01.11.07 – 03.11.07
Samir Kunkri	Mahadevananda Mahavidyalaya, West Bengal	22.10.07 – 08.11.07
Jyoti Prasad Saha	Bankura Christian College, West Bengal	24.10.07 – 07.11.07
Saikat Basu	Jadavpur University, Kolkatta	26.10.07 – 09.11.07
Sujata Ghosh	Visva Bharati, Santiniketan	22.10.07 – 14.11.07
Varun Sreenivasan	St.aviers College, Mumbai	10.11.07 – 25.11.07
Deepak Dhar	TIFR, Mumbai	19.11.07 – 22.11.07
Shradha Mishra	IISc, Bangalore	27.11.07 – 29.11.07
Swarnendu Sarkar	IOP, Bhubaneshwar	06.11.07 – 07.12.07
Sachindeo Vaidya	IISc, Bangalore	09.12.07 – 14.12.07
C.Harikumar	University of Hyderabad, Hyderabad	17.12.07 – 30.12.07
Jijo.S	Central Polytechnic College, Trivendrum	18.12.07 – 31.12.07

Subroto Mukerjee	University of California, USA	18.12.07 – 19.12.07
Bhaskar Saha	NCCS, Pune	20.12.07 – 23.12.07
Arun Ramachandran	HRI, Allahabad	17.12.07 – 01.01.08
Nabamita Banerjee	HRI, Allahabad	19.12.07 – 19.12.07
S.Neetu	National Institute of Oceanography, Goa	13.12.07 – 22.12.07
Uddipan Sarma	NCCS, Pune	16.12.07 – 23.12.07
I.Suresh	National Institute of Oceanography, Goa	13.12.07 – 22.12.07
Gaurav Khanna	University of Massachusetts, Dartmouth	26.12.07 – 28.12.07
Naveen Surendran	ICTP, Italy	26.12.07 – 27.12.07
Parampreet Singh	Perimeter Institute, Canada	26.12.07 – 28.12.07
Arindam Chatterjee	McMaster University, Canada	16.12.07 – 15.01.08
Srinath Baba	University of Concordia, Canada	03.01.08 – 12.01.08
Gautham Sekar	COSIC, Belgium	11.12.07 – 18.01.08
Emiliano Imeroni	University Libre, Belgium	02.01.08 – 12.01.08
Kimmo Kaski	Helsinki Univeresity, Finland	14.01.08 – 19.01.08
Étieune Ghys	ENS, France	27.12.07 – 29.12.07

M.Ram Murthy	Queen's University	18.12.07 – 02.01.08
G.Prost	ESPCI, Paris	29.12.07 – 01.01.08
Bimal K.Roy	ISI, Kolkatta	31.12.07 – 31.12.07
Shashank Pandey	IIT, Mumbai	07.12.07 – 02.01.08
Srinath Baba	Concordia University, Canada	03.01.08 – 12.01.08
Gilles Pisier	Jussieu, Paris	01.01.08 – 08.01.08
Sourendu Gupta	TIFR, Mumbai	06.01.08 – 13.01.08
V.Kumar Murty	University of Toronto, Canada	25.12.07 – 21.01.08
Michael Schatz	Georgia Tech, Atlanda	20.01.08 – 23.01.08
Anirban Banerjee	Max Planck Institute, Germany	19.01.08 – 22.01.08
Chinmay Das	University of Leeds, UK	18.01.08 – 21.01.08
Pankaj S.Joshi	TIFR, Mumbai	22.01.08 – 24.01.08
Manjari Bagchi	TIFR, Mumbai	20.01.08 – 25.01.08
Kinkar Chandra Das	Sungkyunkwan University, Korea	22.01.08 – 29.01.08
Eleonora Dell'Aquila	Perimeter Institute	17.12.07 – 02.02.08
Saket Saurabh	University of Bergen, Norway	27.12.07 – 03.02.08

Raja Sridharan	TIFR, Mumbai	10.01.08 – 06.02.08
Zahera Jabeen	IIT, Madras	03.12.07 – 31.01.08
Sukadeb Acharya	IIT, Kharagpur	28.11.07 – 21.12.07
Jean-Yves Beziau	University of Neuchatel, Switzerland	30.01.08 – 02.02.08
Paritosh Pandya	TIFR, Mumabi	28.01.08 – 03.02.08
Miguel Afsanjvai	University Rey Juan, Spain	09.02.08 – 12.02.08
Tomasz Kapitaniak	University of Lodz, Poland	09.02.08 – 12.02.08
Punit Paramanda	UAEM, Mexico	10.02.08 – 12.02.08
R.K.Bhaduri	McMaster University	03.02.08 – 16.02.08
Mayank Vahia	TIFR, Mumabi	15.02.08 – 19.02.08
Nisha Yadav	TIFR, Mumbai	15.02.08 – 19.02.08
N.Sabu	IIST, Trivendrum	17.02.08 – 29.02.08
Indranil Biswas	TIFR, Mumbai	13.02.08 – 22.02.08
Raja Paul	NPB, USA	24.02.08 – 26.02.08
Takahashi	University of Nancy	25.02.08 – 28.02.08
Kalathoor Varadarajan	University of Calgary, Canada	01.02.08 – 02.03.08

Alain Pumir	University of Nice, France	12.02.08 – 01.03.08
Snigdha Maru	Sastra University	19.12.07 – 28.02.08
Peter Zvengrowshki	University of Calgury, Canada	20.02.08 – 02.03.08
R.Madhuvanthi	Sastra University, Trivendrum	03.12.07 – 02.03.08
R.Thangadurai	HRI, Allahabad	14.02.08 – 01.03.08
Deepthi Rajagopalan	SASTRA University, Trivendrum	01.01.08 – 01.03.08
J.Srinivasan	IISc, Bangalore	28.02.08 – 29.02.08
Josef Gruska	BHO	28.02.08 – 17.03.08
Shobha Madan	IIT, Kanpur	08.03.08 – 12.03.08
Jijo.S	Central Polytechnic College, Trivendrum	10.03.08 – 11.03.08
Jacobo Toran	University of ULM, Germany	29.02.08 – 17.03.08
Uddipan Sarma	NCCS, Pune	04.02.08 – 15.03.08
Uma Divakaran	IIT, Kanpur	08.03.08 – 14.03.08
Piyush P.Kurur	IIT, Kanpur	13.03.08 – 14.03.08
Ajit Kembhavi	IUCAA, Pune	11.03.08 – 15.03.08
Saket Sourabh	University of Bergen, Norway	13.03.08 – 14.03.08

Johannes Koebler	Humboldt University, Germany	03.03.08 – 31.03.08
K.T.Arasu	Wright State University, USA	16.03.08 – 23.03.08
Vikram Soni	NPL, New Delhi	10.03.08 – 19.03.08
S.Anantha Ramakrishnan	IIT, Kanpur	17.03.08 – 20.03.08
Mark Mandelkern	University of California	22.03.08 – 24.03.08
Subhro Bhattacharjee	IISc, Bangalore	24.03.08 – 28.03.08
Adwait Mevada	BTM, Bangalore	28.03.08 – 28.03.08

Chapter 6

Infrastructure

6.1 Computer Facilities

Ehnancement of Computer Facility during 2007-2008

- The computer facility was enhanced by adding one IBM X3655 rack server, based on 2xAMD Opteron 2.8GHz, 8GB DDR2 RAM, having RAID 0,1,5 8K SAS controller with 5x500GB SATA HDD, running Linux O/S to handle various virtual servers in the network.
- Expanded the printing facility by adding 2 Xerox laser printers with large memory.
- LCD data projectors of different lumens capacity were installed in the class rooms(2) and in the Chandrasekar Hall(1).
- Suitable model of laptops were issued to faculty as a long term loan.
- Students are engraged to use Institute laptops while attending conferences and workshops.
- One Technical Assistant and one Administrative Assistant are appointed to handle the computer system facility.

  Work on IMSc Computer Systems

  The IMSc now has a Virtual Private Network allowing our users to connect securely to our Local Area Network from off campus locations. Similar infrastructure has been created to authenticate on-campus users for access to some resources.

  The IMSc now has a number of different facilities to aid collaborative work over the network. This includes a "Wiki" and mailing list infrastructure.

  The IMSc web services have been split across numerous servers so that servers that contain official data are clearly demarcated from those that contain the personally managed pages of individuals.

6.2 The Library

The Institute Library holds a total collection of 60475 books and bound periodicals as on March 31, 2008. This includes an addition of 940 volumes during the current year April 2007 - March 2008. The library subscribes to over 300 national and international journals in the subject areas of Theoretical Physics, Mathematics and Theoretical Computer Science including journals on exchange. The library has a well balanced collection on these subject areas and is a resource for research workers of the entire southern region.

The NBHM has recognized this Institute library as the Regional Library for Mathematics. There are about 5000 outside users from colleges, universities and research institutions from different parts of the country who made use of the library facilities for their academic and research information needs.

The library has access to over 3000+ 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, BioMedCentral & JSTOR Full digital archive. It has also perpetual online access to backfile collection of journals from Elesevier under DAE consortium 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, 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.

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 8 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:

V.Arvind, IMSc
Rahul Basu, IMSc
Kalyana Rama, IMSc
R. Ramanujam, IMSc

R.Balasubramanian, IMSc
Kamal Lodaya, IMSc
K.N. Raghavan, IMSc
Kaushik Majumdar, IMSc

IGCAR

TIFR

NBHM

Kathmandu University