THE INSTITUTE OF MATHEMATICAL SCIENCES

C. I. T. Campus, Taramani,

Chennai - 600 113.

REPORT ON ACADEMIC ACTIVITIES

FOR THE YEAR 2006 - 2007

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Foreword

I am pleased to present the progress made by the Institute during 2006-2007 in its many sub disciplines and note the distinctive achievements of the members of the Institute.

A perusal of the list of publications of the members of the Institute shows that this year has been an academically productive year. The Institute hosted an international conference and five workshops this year. These include the Indo UK Conference on Number Theory, ISEA Course on Security, Meeting on Modeling Infectious Diseases, ATM Workshop on Algebraic Topology, Annual Foundation School in Mathematics and the first K. S. Krishnan Discussion Meeting on Frontiers in Quantum Science. Further the Institute organized the Albert Einstein Annus Mirabilis Centennial Public Lectures, featuring talks by Nobel Laureates Professor Anthony Leggett and Professor Zhores I. Alferov, and the eminent theoretical physicist, Professor E. C. George Sudarshan.

I am also happy to note that the faculty members of the Institute have served as members in the sectional committees of the academies, in award committees and in the board of studies in Mathematics and Physics of HBNI.

The Subashis Nag Memorial lecture is an annual event where a course of lectures are given by an eminent personality on a subject related to the work of (Late) Professor Subashis Nag. This year the lectures were delivered by Professor M.S. Narasimhan.

Other annual events were also held successfully, like the Institute seminar week, where almost all the faculty members, PDFs and JRFs gave 20 minute talks on their work to the other members of the Institute.

This report was compiled through the efforts of a Annual Report Committee comprising of Drs. Sudeshna Sinha, V. Arvind, Gautam Menon, and the Librarian Dr. Paul Pandian. I also extend my sincere thanks to Drs. Amritanshu Prasad, G. Date, Kapil Paranjape and M.V.N. Murthy for their assistance. I owe my gratitude to all of them.

April, 2007 **R. Balasubramanian**

Contents

Chapter 1

The Institute

1.1 Board

Hon'ble Shri **Dr. K. Ponmudi**, Minister for Higher 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, Siruseri, Padur 603 103
(**Member**)

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

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

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

Dr **C. V. Ananda Bose**, I.A.S., Joint Secretary (R & D) to Government of India, Department of Atomic Energy, CSM Marg, Mumbai 400 001
(**Member**)

Shri **Rahul Asthana**, I.A.S., 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**, Department of Theoretical Physics, Tata Institute of Fundamental Research, Mumbai 400 005
(**Member**)

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

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(**Member**)

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(**Member**)

Shri **Rahul Asthana**, I.A.S., 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*
Mathematics	
Balasubramanian, R.	balu
Chakraborty, Partha Sarthi	parthac
Chatterjee, Pralay	pralay
Iyer, Jaya N.	jniyer
Kesavan, S.	kesh
Kodiyalam, Vijay	vijay
Krishna, M.	krishna
Mukhopadhyay, Anirban	anirban
Nagaraj, D. S.	dsn
Paranjape, Kapil H.	kapil
Prasad, Amritanshu	amri
Raghavan, K. N.	knr
Sankaran, P.	sankaran
Srinivas, K.	srini
Sunder, V. S.	sunder
Physics	
Adhikari, Ronojoy	rjoy
Anishetty, R.	ramesha
Baskaran, G.	baskaran
Basu, Rahul	rahul
Date, G.	shyam
Digal, Sanatan	digal
Ghosh, Sibasish	shibais
Govindarajan, Thupil R.	trg
Hari Dass, N.D.	dass
Indumathi, D.	indu
Jagannathan, R.	jagan
Jayaraman, T.	jayaram
Kaul, R.	kaul
Menon, Gautam I.	menon
Mishra, Ashok K.	mishra
Murthy, M. V. N.	murthy
Parthasarathy, R.	sarathy
Rajesh, Ravindran	rrajesh
Rama, S. Kalyana	krama
Ray, Purusattam	ray
Sathiapalan, Balachandran	bala
Shankar, R.	shankar
Sharatchandra, H. S.	sharat

Siddharthan, Rahul	rsidd
Simon, R.	simon
Sinha, Nita	nita
Sinha, Rahul	sinha
Sinha, Sitabhra	sitabhra
Sinha, Sudeshna	sudeshna
Vemparala, Satyavani	vani

Theoretical Computer Science

Arvind, V.	arvind
Lodaya, Kamal	kamal
Mahajan, Meena B.	meena
Raman, Venkatesh	vraman
Ramanujam, R.	jam
Subramanian, C.R.	crs

1.4 Scientific Staff

Subramoniam, G.	gsmoni
Ravindra, Reddy	ravi

1.5 Technical Staff

Paul Pandian, M.	pandian
Arangarajan, R.	arajan
Mohan, S.	mohan
Venkatesan, G.	gvenkat
Usha Devi, P.	usha

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1.6 Project Scientists

Name	*Userid*
Balakrishnan, Radha	radha
Mani, H.S.	hsmani

1.7 Project Staff

Das, Chittaranjan	crdas
Kausalaya, Ramaswamy	kausalya
Kumar, Dinesh	dinesh
Mangal, Pandi	mangal
Nandy, Ayan	ayan
Ramakrishna, D.V.	dvkrishna
Sreenivasan, N.S.	nss
Sridharan, M.	-
Raina, P.M.	raina

1.8 Post-Doctoral Fellows

Mathematics

Baoulina, Ioulia	baoulina
Ganguly, Satadal	ganguly
Manirul, Ali Md.	-
Raman, Srinivas	-
Rath, Purusottam	rath
Sarkar, Sidhartha	sidhu
Sridharan, Shrihari	shrihari
Subramonian Moothathu,T.K.	tksm

Physics

Biswas, Anindya	anindyab
Das, Chittaranjan	crdas
Das, Prasanta Kumar	dasp
Matlock, Peter William	pwm
Saha, Jyoti Prakash	joyti

Theoretical Computer Science

Majumdar, Kaushik	kaushik
Meyer, Antoine	ameyer

1.9 Ph.D. Students

Name	*Userid*
Mathematics	
Anoop,T.V.	tvanoop
Chattopadhyay, Pratyusha	pratyusha
Dey, Arijit	arijit
Dubey, Umesh Venkatesh	dubey
Gupta, Ved Prakash	vpgupta
Kanhere, Aaloka	aaloka
Krishna, K.S.	krishna
Krishnan, Rajkumar	rkrishnan
Muthukumar, T.	tmk
Pal, Sarbeswar	spal
Patnaik, Sasmita	sasmita
Prem Prakash, Pandey	premsmg
Samuel, Preena	preena
Sarkar, Swagata	swagata
Scaria, George	george
Singh, Ajay Thakur	thakur
Singla, Pooja	pooja
Srikanth, Tupurani	tsrikanth
Sundar, S.	ssundar
Physics	
Banerjee, Kinjal	kinjal
Bhattacharjee, Amit Kumar	amit
Bhowmick, Samrat	samr
Chakravarty, Gaurav	gaurav
Ghose, Somdeb	somdeb
Gopala Krishna, K.	gkrishna
Goyal, Sandeep K.	goyal
Hossain, Golam Mortuza	golam
Kumar, Alok	alok
Laddha, Alok	alokl
Lukose, Vinu	vinu
Mandal, Saptarishi	saptarshi
Mitra, Mithun Kumar	mithun
Misra, Basudha	basudha
Pan, Raj Kumar	rajkp
Pradeep Kanth, J. Maruthi	maruthi
Sabapathy, Krishnakumar	kkkumar
Saket, Abhinav	abhinav
Sengupta,Sandipan	sandi

Sharma, Chandradev	sharma
Singh,Rajeev	rajeev
Sircar, Nilanjan	nilanjan
Solomon, Ivan J.	solomon
Syed, Mohammed Kamil	kamil
Vallan, Bruno Cruz A.	bruno
Varghese,Anoop	ganoop

Theoretical Computer Science

Amaldev, M.	amal
Aravind N.R.	nraravind
Das, Bireswar	bireswar
Geevarghese, Philip,	philip
Joglekar, Pushkar Shripad	pushkar
Limaye, Nutan P.	nutan
Mukhopadhyay, Partha	partham
Muthu, Rahul	rahulm
Narayanan, N.	narayan
Praveen,M.	praveen
Rao, B.V. Raghavendra	bvrr
Saket, Saurabh	saket
Saumya, Paul	saumya
Sharma, Jayalal	jayalal
Sheerazuddin, S.	sheeraz
Sikdar, Somnath	somnath
Simon, Easaw Sunil	ssimon
Srikanth, Srinivasan	srikanth
Sundararaman, Akshay	akshay
Vijayaraghavan, T. C	tcvijay

1.10 Administrative Staff

Name	*Userid*
Ramakrishna Manja *Registrar* (upto 31/10/06)	manja
Vishnu Prasad, S. *Admn. Officer*	svishnu
Palani, V. *Accounts Officer*	palani

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.
Munuswami, M.
Munuswami, 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.
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Usha, Otheeswaran
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Chapter 2

Research and Teaching

2.1 Mathematics

2.1.1 Research Summary

Algebra

The centraliser algebra of a matrix shares many of the attributes of the matrix. For example, the centraliser algebra is semisimple if and only if the matrix is. Therefore, such algebras provide a large class of algebras which are not semisimple. Élie Cartan defined fundamental invariants of Artin algebras, now known as Cartan invariants. The Cartan invariants of the centraliser algebra of a matrix have been calculated in terms of data coming from the Jordan canonical form of the matrix [**D**]. Efforts are underway to further understand these algebras using sophisticated techniques developed by Auslander, Reiten, Ringel and many others.

Algebraic Geometry

Some new results on vector bundles generated by sections on projective varieties are obtained. It is shown that there are no integral solutions to some simultaneous equations. Using these results, it is shown that there are no non constant morphisms from some projective spaces to some Grassmannians. Some new results on vector bundles on non-trivial forms of projective spaces over real numbers are obtained [**N3**].

Arithmetic examples of cycles

As was shown in the thesis of G. V. Ravindra, most of the "classical" examples of algebraic cycles can be detected by "spreading out". The resulting spread-out cycles are on a variety over a number field and (usually) have a non-trivial homology class in all open sets containing the original variety. However, it is interesting to find cycles that are *not* detected by such a topological invariant. Conjecturally, such cycles would then be detected by the intermediate Jacobian of the spread-out variety. The use of arithmetic techniques analogous to the use of the Selmer group for elliptic curves in order to detect such cycles has been studied.

More Calabi-Yau varieties representing Modular forms

The collaboration with D. Ramakrishnan to explore the possibility of representing modular forms by Calabi-Yau varieties is continuing. A number of examples have now been constructed. This includes the first smooth 5 dimensional Calabi-Yau variety representing a modular form of weight 6.

Hilbert functions of points on Schubert varieties in orthogonal Grassmannians have been computed. [**R4**]

Algebraic Number Theory

Some special character sums over finite fields were investigated. The expressions for these sums in terms of Gauss and Jacobi sums have been obtained. The explicit formulas for the number of solutions of diagonal equations and some other special equations over finite fields has been found. The formulas were checked by computer calculations [**Bao5**]–[**Bao1**].

Analytic Number Theory

The following problem regarding Epstein Zeta-function related to a positive definite integral binary quadratic form has been addressed. Given a real number V, how many consecutive zeros are there with ordinates at least V distance apart? Work is in progress regarding number of prime factors of class number of real quadratic number fields. In particular, it is proved that there are infinitely many such fields with "many" prime factors.

Differential Equations

The homogenization of a class of optimal control problems whose state equations are given by second order elliptic boundary value problems with oscillating coefficients and posed on perforated and non-perforated domains, was studied. The limit problem, when the cost of the control is of the same order as that describing the oscillations of the coefficients, was described in the situations when the state and the control are both defined over the boundary or both defined over the entire domain (kesh-2006.5)

The generalised von Kármán equations, which constitute a mathematical model for a nonlinearly elastic plate subjected to 'von Kármán type' boundary conditions on only one portion of the lateral face (the remaining portion being free) were studied by reducing them to a single cubic nonlinear operator equation in a suitable Sobolev space. The convergence of a conforming finite element approximation was established. The important challenges come from the lack of strict positivity of the cubic part of the equation and the lack of an associated functional (kesh-2006.6)

Eigenfunctions of the Laplace-Beltrami operator on hyperboloids in Lorentz type spaces were studied in the spirit of the treatment of spherical harmonics by Stein and Weiss, using nothing more than multi-variable calculus. As a special case, a simple self-contained proof of Laplace's integral for a Legendre function was obtained [**Pr3**].

Mathematical Physics

Work was done on the density of states and a new continuity result was obtained [**Kr**]. Work is in progress on the distribution of level spacing of models with independent randomness.

Ergodic Theory

Ideas from thermodynamic formalism and basic Fourier transforms are used to study the distribution of values of ergodic sums of functions on periodic orbits of product hyperbolic quadratic polynomials defined on their product Julia sets. This generalises a result due to the author in the 2-dimensional case and an error term for functions that satisfy a Diophantine condition is obtained [**Sr2**].

The family of hyperbolic quadratic polynomials $P_c(z) = z^2 + c\ ;\ c \in [0, 1/4)$ is considered, and its Lyapunov characteristic exponents are discussed. The structural stability of this family is used to show that the results of Manning on Lyapunov exponents for Julia sets do not generalise to other Bernoulli measures [**Sr1**].

Operator Algebras

The planar algebra $\mathcal{P}(H)$ of the asymptotic inclusion of the fixed-point subfactor $R^H \subset R$ of an outer action of a finite-dimensional Kac algebra was identified with a certain planar subalgebra of the fixed-point subfactor $P(H^{*\ op})$ corresponding to the opposite of the dual Kac algebra of H. (This will be part of the doctoral thesis of S. Jijo.)

As part of the doctoral work of Ved Prakash Gupta, it was shown that the planar algebra of the subgroup-subfactor $R^G \subset R^G$ (where H is a subgroup of a group G acting outerly on R) is the algebra of invariants for an action of G as automorphisms of the planar algebra associated to the bipartite graph $*_n$ (with one 'even' vertex and $n = [G : H]$ 'odd' vertices).

It was shown that the so-called 2-cabling of the Temperley-Lieb planar algebra $TL(\delta)$ may be described as 'the non-crossing partition planar algebra' $NC(\delta^2)$. (See [**Sun**].)

Work was completed on the book [**S**].

The torus group $(S^1)^{\ell+1}$ has a canonical action on the odd dimensional sphere $S_q^{2\ell+1}$. We take the natural Hilbert space representation where this action is implemented and characterise all odd spectral triples acting on that space and equivariant with respect to that action. This characterisation gives a construction of an optimum family of equivariant spectral triples having nontrivial K-homology class thus generalising our earlier results for $SU_q(2)$. We also relate the triple we construct with the C^*-extension

$$0 \longrightarrow \otimes C(S^1) \longrightarrow C(S_q^{2\ell+3}) \longrightarrow C(S_q^{2\ell+1}) \longrightarrow 0.$$

The quantum group $SU_q(\ell+1)$ has a canonical action on the odd dimensional sphere $S_q^{2\ell+1}$. All odd spectral triples acting on the L_2 space of $S_q^{2\ell+1}$ and equivariant under this action have been characterised. This characterisation then leads to the construction of an optimum family of equivariant spectral triples having nontrivial K-homology class. These generalise our earlier results for $SU_q(2)$.

Representation Theory

The representation theory of general linear groups over a finite field is well understood, since the work of J. A. Green in 1955. Green showed that such representations can either be obtained by parabolic induction, or are cuspidal. He showed that cuspidal representations can be parametrised by purely number theoretic data. Recent work has generalised this correspondence to general linear groups over the ring of integers of a non-Archimedean local field.

Topology

Theta characteristics on a compact Riemann surface are the 'square roots' of the canonical bundle. This set is naturally partitioned into even and odd characteristics. When the genus of the surface is at least two, the set of all theta characteristics are acted on by the (finite group) of automorphisms of the Riemann surface, preserving the parity. It was shown in [**S1**] that if an automorphism fixes all even theta characteristics then the surface is hyperelliptic and the automorphism is the hyperelliptic involution.

Stronger forms of sensitivity formulated in terms of the set of deviation times are considered. Within the familiar classes of dynamical systems such as interval maps and subshifts, sensitive systems are partitioned into three: (i) cofinitely sensitive (ii) syndetically sensitive but not cofinitely sensitive, (iii) sensitive but not syndetically sensitive. [**Su1**]

With respect to the dynamics of iteration, Darboux-like real functions can exhibit some strange properties. There is an extendable real function which possesses every orbit of every real function up to an arbitrary small translation, and which has orbits asymptotic to any real sequence. There is a real function whose every power is almost continuous and has dense graph, in spite of the fact that all of its orbits are finite. [**Su2**]

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.

[**B**]
R. Balasubramanain, S. Kanemitsu*, and H. Tsukada*.
Contributions to the theory of Lerch zeta function.
In R. Balasubramanain and K. Srinivas, editors, *The Riemann Zeta Function and the Related Themes. Papers in honour of Professor K. Ramachandra*, page 29. Ramanujan Mathematical Society, Mar 2007.

[**Ba1**]
Sukumar Das Adhikari*, R. Balasubramanian, F. Pappalardi*, and P. Rath.
Some zero sum constants with weights.
Proceedings of the Indian academy of Sciences, 2007.
(To be published).

[**Ba2**]
R. Balasubramanian, C. Colado*, and H. Queffelec*.
The Bohr inequality for ordinary Dirichlet series.
Studia Math., **175**, 285, 2006.

[**Ba3**]
R. Balasubramanian, R. Ponnusamy*, and D. J. Prabhakaran*.
Convexity of integral transforms and function spaces.
Integral Transforms and Special Functions, **18(1)**, 1, 2007.

[**Ba4**]
R. Balasubramanian and Gyan Prakash.
Asymptotic formula for sumfree sets in finite abelaian groups.
Acta Arithmetica, **127**, 115, 2007.

[**Ba5**]
R. Balasubramanian, G. Garg*, and C. E. Venimadhavan.
Large prime variations of the lattice sieve.
In *SRM International Conference on Information Security and Computer Forensics*, page 7, Dec 2006.

[**Bao1**]
Ioulia Baoulina.
On the number of solutions to the equation $(x_1 + \cdots + x_n)^2 = ax_1 \cdots x_n$ in a finite field.
International Journal of Number Theory, 2006.
(Submitted).

[**Bao2**]
Ioulia Baoulina.
On a generalized problem of Carlitz.
Chebyshevskiĭ Sbornik, 2006.
(To be published).

[**Bao3**]
Ioulia Baoulina.
On the equation $x_1^{m_1} + \ldots + x_n^{m_n} = ax_1 \cdots x_n$ over a finite field.
Finite Fields and Their Applications, 2006.
(To be published).

[**Bao4**]
Ioulia Baoulina.
On the equation $(x_1^{m_1} + \ldots + x_n^{m_n})^k = ax_1 \cdots x_n$ over a finite field.
International Journal of Number Theory, **2(3)**, 351, 2006.

[**Bao5**]
Ioulia Baoulina.
Generalizations of the Markoff-Hurwitz equations over finite fields.
Journal of Number Theory, **118(1)**, 31, 2006.

[**Ch1**]
Partha Sarathi Chakraborty and Arupkumar Pal*.
On equivariant Dirac operators for $SU_q(2)$.
Proceedings Indian Academy of Sciences, **116(4)**, 531, 2006.

[**Ch2**]
Partha Sarathi Chakraborty and Arupkumar Pal*.
Torus equivariant spectral triples for odd-dimensional quantum spheres coming from C^*-extensions.
Letters in Mathematical Physics, 2007.
(To be published).

[**Ch3**]
Partha Sarathi Chakraborty and Arupkumar Pal*.
Characterization of $SU_q(\ell+1)$-equivariant spectral triples for the odd dimensional quantum spheres.
2007.
(Preprint: arXiv:math/0701738).

[**Cha1**]
Pralay Chatterjee and Dave Witte Morris*.
Divergent torus orbits in homogeneous spaces of **Q**-rank two.
Israel Journal of Mathematics, **152**, 229, 2006.

[**Cha2**]
Pralay Chatterjee.
On the power maps, orders and exponentiality of p-adic algebraic groups.
(Submitted)

[**Cha3**]
Pralay Chatterjee.
Automorphism invariant Cartan subgroups and power maps of disconnected groups.
(Submitted)

[**D**]
Umesh V. Dubey, Amritanshu Prasad, and Pooja Singla.
The Cartan matrix of a centraliser algebra.
2006.
(Submitted).

[**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., 2006.
(To be published).

[**I2**]
Jaya N. Iyer.
Murre's conjectures and finite dimensionality for some varieties.
2006.
(Submitted).

[**I3**]
Jaya N. Iyer.
Chern invariants of some flat bundles in the arithmetic Deligne cohomology.
Math. Zeitschrift., 2007.
(To be published).

[**I4**]
Jaya N. Iyer and Uma N. Iyer*.
Secondary classes of flat connections on supermanifolds.
2007.
(Submitted).

[**I5**]
Jaya N. Iyer and Carlos T. Simpson*.
A relation between the parabolic Chern characters of the de Rham bundles.
Math. Annalen., 2006.
(To be published).

[**I6**]
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.
Proceedings of 'Geometry and Dynamics of groups and spaces', in memory of A.Reznikov, at Max Planck Institute, Bonn., 2006.
(To be published).

[**K1**]
Cherif Amrouche*, Philippe G. Ciarlet*, L. Gratie*, and S. Kesavan.
On Saint Venant's compatibility conditions and Poincaré's lemma.
C. R. Acad. Sc., Paris, Ser. I, **342(11)**, 887, 2006.

[**K2**]
Cherif Amrouche*, Philippe G. Ciarlet*, L. Gratie*, and S. Kesavan.
New formulations of linearized elasticity problems, based on extensions of Donati's theorem.
C. R. Acad. Sc., Paris, Ser. I, **342(10)**, 785, 2006.

[**K3**]
Cherif Amrouche*, Philippe G. Ciarlet*, Liliana Gratie*, and S. Kesavan.
On the characterizations of matrix fields as linearized strain tensor fields.
Jounal de Mathématiques Pures et Appliquées, **86(2)**, 116, 2006.

[**K4**]
Philippe G. Ciarlet*, Liliana Gratie*, and S. Kesavan.
On the generalized von Kármán equations and their approximation.
Mathematical Models and Methods in Applied Sciences, 2006.
(To be published).

[**K5**]
S. Kesavan and T. Muthukumar.
Low cost control problems on perforated and non-perforated domains.
Proceedings of the Indian Academy of Sciences (Mathematical Sciences), 2006.
(Submitted).

[**Ko1**]
Vijay Kodiyalam, Vishwambhar Pati*, and V. S. Sunder.
Subfactors and $1 + 1$ dimensional TQFTs.
Internat. J. Math., **18(1)**, 69, 2007.

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

[**Kr**]
M. Krishna.
Continuity of integrated density of states - independent randomness.
Proceedings of Indian Academy of Sciences - Mathematical Sciences, 2006.
(To be published).

[**M1**]
Anirban Mukhopadhyay, Florian Luca*, **and Kalyan Chakraborty***.
Exponents of class groups of real quadratic fields.
International Journal of Number Theory, 2006.
(To be published).

[**M2**]
Anirban Mukhopadhyay and Kotyada Srinivas.
A zero density estimate for the selberg class.
International Journal of Number Theory, 2006.
(To be published).

[**N1**]
V. Balaji*, **I. Biswas***, **D. S. Nagaraj, and P. E. Newstead***.
Universal families on moduli spaces of principal bundles on curves.
Int. Math. Res. Not., **41**, 1, 2006.

[**N2**]
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Absolutely split real algebraic vector bundles over a real form of projective space.
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[**P1**]
Pralay Chatterjee.
On the power maps, orders and exponentiality of p-adic algebraic groups.
2007.

[**P2**]
Pralay Chatterjee.
Automorphism invariant Cartan subgroups and power maps of disconnected groups.
2007.

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Uri Onn*, **Amritanshu Prasad, and Leonid Vaserstein***.
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Amritanshu Prasad.
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Mathematics Newsletter of the Ramanujan Mathematical Society., **16(4)**, 73, 2007.

[**Pr3**]
Amritanshu Prasad and M. K. Vemuri*.
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(Submitted).

[**R1**]
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Transactions of the American Mathematical Society, **358(12)**, 5401, 2006.

[**R2**]
V. Lakshmibai*, **K. N. Raghavan, and Parameswaran Sankaran**.
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[**R3**]
V. Lakshmibai*, **K. N. Raghavan, Parameswaran Sankaran, and Pradeep Shukla***.
Standard monomial bases, moduli spaces of vector bundles & invariant theory.
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[**R4**]
K. N. Raghavan and Shyamashree Upadhyay*.
Hilbert functions of points on Schubert varieties in orthogonal Grassmannians.
2007.
math.CO.07040542 (Submitted).

[**S1**]
Indranil Biswas*, **Siddhartha Gadgil***, **and Parameswaran Sankaran**.
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Bulletin des Sciences Mathematiques, 2007.
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[**S2**]
Parameswaran Sankaran and V. Uma*.
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Stronger forms of sensitivity for dynamical systems.
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[**Sund1**]
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[**K**]
S. Kesavan.
Symmetrization and Applications, volume 3 of *Series in Analysis.*
World Scientific, Singapore, 2006.

[**Kr**]
Michael Demuth* **and M. Krishna**.
Determining Spectra in Quantum Theory, volume 44 of *Progress in Mathematical Physics.*
Birkhauser Verlg, Boston, 2006.

[**R**]
Balasubramanian R. and Srinivas K., editors.
The Riemann Zeta Function and Related Themes: Papers in honour of Professor K. Ramachandra., volume 2 of *Lecture Notes Series.*
Ramanujan Mathematical Society, India., Department of Mathematics University of Mysore, Mysore-570 006, India, 2007.

[**S**]
Siva Athreya* **and V. S. Sunder**.
Measure and Probaility.
Universities Press, 160 Anna Salai,Chennai 600002, 2007.
(To be published).

2.2 Physics

2.2.1 Research Summary

Biological Physics

Investigation of models for pattern formation in motor-microtubule mixtures is ongoing. Extensions of a model proposed earlier include studying the effects of motors which combine a + and a - head. Such motors diffuse fast along local regions of nematic alignment but cannot move through regions of polar alignment. A set of model hydrodynamic equations in terms of the basic fields which should contain some of the physics of this problem has been derived.

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. Multiple methods that defibrillate with low-amplitude electrical stimuli have been proposed by us. In a recent review [**Sinhas9**] various control methods that have been proposed to date have been contrasted.

One of the factors complicating the issue of successful defibrillation by low-amplitude electrical stimulation is the role of anatomical inhomogeneities such as blood vessels or scar tissue. There has been controversy about whether such heterogeneities promote or hinder the onset of spatiotemporal chaos, and therefore, VF. Experimental studies have not returned an unquivocal verdict either way. This problem has been investigated through extensive simulation studies. It has been found that this occurs because the dynamics of interaction of spirals with anatomical inhomogeneities have a fractal basin boundary [**Sinhas3**]. This means that extremely small changes in the details of the anatomical obstacle can mean the difference between promotion and suppression of spiral turbulence. These results have strong implications for the efficacy of defibrillation therapies, as most patients suffering from cardiac arrhythmias have a range of anatomical inhomogeneties in their heart.

Classical and Quantum Gravity, Black Holes, Cosmology

Developing a systematic semi-classical approximation for a given quantum theory is a general problem. This is conveniently addressed using a geometrical view of the quantum framework. The projective Hilbert space of any quantum system can be viewed as an (in)finite dimensional symplectic manifold with the usual Schrodinger evolution appearing as a Hamiltonian evolution. This has been already done for systems based on separable Hilbert spaces. The method has been extended to deal with non-separable Hilbert spaces arising in Loop Quantum Cosmology. The extension permits to extract topologically non-trivial classical phases spaces and develop a semi-classical approximation. This is illustrated for three different examples [**Dat1**].

A review of recent developments in Loop Quantum Cosmology, focusing particularly on the singularity resolution, has been given in [**Dat2**].

Condensed Matter Physics

Work on the mixed phase of type-II superconductors presents a general theoretical approach to the study of surface melting in type-II superconductors. A technique has been devised, the "substrate+DFT" approach, which combines the methodological advantages of density functional approaches to thermal melting with improved mean-field theoretical approaches to interactions in layered superconductor[**M2**, **M3**, **Me2**]. An outstanding problem in the type-II superconductivity literature, the presence of asymmetric hysteresis across the melting transition, has been solved by showing how a pre-melted layer of liquid at the surface can assist the penetration of the liquid phase into the bulk at the transition point[**M2**]. Thus, flux-line lattices cannot be superheated but they can be supercooled.

Further extensions of this work which are either completed or underway include the derivation of the Clausius-Clapeyron relation within density functional theory[**M1**], the calculation of the effects of masks which can impose a specific ordering at the surface and predictions for low-energy muon-spin-rotation experiments which probe the first few layers of a layered superconductor.

Many condensed matter systems are capable of existing in more than one crystalline form (polymorphs). Even non-material lattices, such as Abrikosov flux-line lattices in the mixed state of type-II superconductors or Skyrmion lattices in quantum Hall systems can transit between different (triangular and rectangular) crystalline symmetries as parameters such as the magnetic field are varied. Colloidal PMMA spheres coated with a low-molecular weight polymer undergo a remarkable variety of solid-solid transformations in an external field. What is the effect of quenched disorder on the static and dynamical properties of such systems? While the depinning and flow of periodic media over a quenched randomly pinned (disordered) background has been studied extensively, the implications of an underlying structural transition remains unexplored. The complex non-equilibrium phase behaviour exhibited by a two-dimensional crystal driven across a disordered background, when the ground state of the crystal is tuned through a square-triangular transition has been studied[**Me7**]. 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 is conjectured[**Me2**]. 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 such ideas should find application. Functionalized colloidal particles driven over random substrates constitute a novel system on which these proposals can be tested. Such experiments would help to clarify the interplay between disorder and an underlying equilibrium phase transition, as monitored through dynamical quantities.

Simple coupled map lattice models for the "rheochaos" seen in experiments on sheared complex fluids are currently being studied. Here the chaos arises from the non-linearity of the constitutive relation of the complex fluids, since these are very low Reynolds number flows.

The variation of chemical potential and the energy per particle is calculated as a function of temperature for a gas of neutral fermionic atoms at ultra-low temperatures, with the attractive interaction tuned to Feshbach resonance. This is done by assuming the system to be an ideal gas obeying the Haldane-Wu fractional exclusion statistics. The results for the untrapped gas compare favourably with the recently published Monte Carlo calculations of two groups. For a harmonically trapped gas, the results agree with experiment, and also with other published work ([**Mu**]).

A frustrated quantum spin model on a hexagonal lattice, originally proposed and analyzed by A. Kitaev, has been studied. This model has an infinite numbers of conserevd quantities. The Jordan-Wigner transformation was applied to this model, yielding a fermionic model with local interactions. Earlier results were reproduced and it was shown that conserved quantities simplify considerably, making it possible to explicitly construct exact eigenstates. The two spin dynamical correlation function has been calculated and shown to be identically zero beyond nearest neighbhour seperation. This is true in any eigenstate. A spin-flip was found to fractionalize into two infinitely massive pi-fluxes and a dynamical Majorana fermion at all energy scales. The nature of topological degeneracy for the ground state has been investigated. Current work concentrates on understanding the quantum entanglement content in this model as well as the nature of different quantum critical regimes of this model.

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

Research work in these areas has focused on the clean signals for New Physics. It was shown in a model independent way that, within the Standard Model, the deviation in the measured − mixing phase caused by pollution from another amplitude is always less in magnitude, and has the same sign as the weak phase of the polluting amplitude. The exception is to have large destructive interference between the two amplitudes: any deviation larger than a few degrees is only possible if the observed decay rate results from fine tuned cancellations between significantly larger amplitudes. Since this is unlikely given our understanding of B decays, even if the deviation reduces to a few degrees in the future, New Physics would still likely be implied [**Sinh1**]. This work received significant international press coverage with a breaking news editorial in Physorg.com (http://www.physorg.com/news79793376.html) and several reproductions of it at other cites. Independent news articles also appeared in Russian, Chinese and Dutch science news sites.

It was shown that any new physics (NP) which affects B decays with penguin contributions can be absorbed by redefinitions of the standard-model (SM) diagrammatic amplitudes. Hence, there are no clean signals of new physics in such decays unless there is an accurate theoretical estimate of parameters or a justifiable approximation can be made. In all decays with penguin contributions, new physics simultaneously affects pairs of diagrams. The evidence for a large color supressed tree from fits to $B \to K\pi$ data is naturally explained if new physics contributes to the electroweak penguin, since NP affects the electroweak penguin and color supressed tree diagrams as a pair. The weak phase γ measured in $B \to K\pi$ decays will always agree with its standard model value even in the presence of NP, if the NP contributes in such a way that the amplitudes retain the standard model form after suitable redefinitions [**Sha2**].

The $B \to K^*\rho$ modes that are analogues of the much studied $B \to K\pi$ modes with B decaying to two vector mesons instead of pseudoscalar mesons, using topological amplitudes in the quark diagram approach, was studied. The $B \to K^*\rho$ modes can be used to obtain many more observables than those for $B \to K\pi$ modes, even though the quark level subprocesses of both modes are exactly the same. All theoretical parameters (except for the weak phase γ), such as the magnitudes of the topological amplitudes and their strong phases, can be determined in terms of the observables without any model-dependent assumption. How $B \to K^*\rho$ can also be used to verify if there exist any relations between theoretical parameters, such as the hierarchy relations between the topological amplitudes and possible relations between the strong phases, has been demonstrated. Conversely, if there exist reliable theoretical estimates of amplitudes and strong phases new physics could be probed. It was shown that certain assumptions on the sizes and strong phases of amplitudes may allow a clean signal of New Physics. A numerical study has been presented to examine which of the observables are more sensitive to new physics [**Sha3**].

If, at the see-saw scale the quark and lepton mixing matrices are assumed to be equal (the so-called high-scale mixing unification hypothesis), it can be shown that RG evolution down to low-energies magnify two of the neurino mixing angles while keeping the third angle (the reactor angle) small, because of the quasi-degeneracy of the neutrino masses. This calculation has now been extended to include the CP violating phases - both the Dirac and Majorana phases. The magnification mechanism works for quite a wide range of CP violating phases [**R**].

Any new physics which affects B decays with penguin contributions can be shown to be absorbed by redefinitions of the standard-model diagrammatic amplitudes. Hence, there are no clean signals of new physics in such decays unless there is an accurate theoretical estimate of parameters or a justifiable approximation can be made. In all decays with penguin contributions, new physics simultaneously affects pairs of diagrams. The evidence for a large color suppressed tree from fits to $B \to K\pi$ data is naturally explained if NP contributes to the electroweak penguin, since NP affects the electroweak penguin and color suppressed tree diagrams as a pair. The weak phase γ measured in $B \to K\pi$ decays will always agree with its SM value even in the presence of NP, if the NP contributes in such a way that the amplitudes retain the SM form after suitable redefinitions. [**Sha1**]

Possible new physics effects in all possible decay modes of b quark were studied. As an example of a general formalism, $B \to \pi K$ decays were studied because present data are at odds with the predictions of the standard model (SM). The amplitudes for B decays have been written using the diagrammatic decomposition method. In this approach the amplitudes are written in terms of few diagrams(based on all possible quarks decays of b quark) : the color-favoured and color-suppressed tree amplitudes T and C, the gluonic penguin amplitude P, the color-favoured and color-suppressed electroweak penguin amplitudes P^{EW} and P^{CEW}, the annihilation and exchange amplitudes A and E, and the penguin-annihilation diagram

PA. It is shown that any new physics which affects B decays with penguin contributions can be removed by redefinitions of the standard-model diagrams. As such, there are no clean signals of NP in such decays – one requires an estimate of the size of the SM diagrams, or certain terms must be neglected.

In many decays, such as $B \to \pi K$, the NP simultaneously affects both the (P^{EW} and C) diagrams and (P^{CEW} and T), as these are topologically equivalent [**Sinh3**].

The $B \to K^*\rho$ modes that are analogues of the much studied $B \to K\pi$ modes with B decaying to two vector mesons instead of pseudoscalar mesons, using topological amplitudes in the quark diagram approach, was studied. The $B \to K^*\rho$ modes can be used to obtain many more observables than those for $B \to K\pi$ modes, even though the quark level subprocesses of both modes are exactly the same. All the theoretical parameters (except for the weak phase γ), such as the magnitudes of the topological amplitudes and their strong phases, can be determined in terms of the observables without any model-dependent assumption. It is shown that $B \to K^*\rho$ can also be used to verify if there exist any relations between theoretical parameters, such as the hierarchy relations between the topological amplitudes and possible relations between the strong phases. A model independent understanding of the relative sizes of the topological amplitudes and relations between their strong phases could provide valuable insights into New Physics searches [**Sinh2**].

3.0mmSeveral B-meson related phenomenology, braneworld phenomenlogy and most recently phenomenology associated with the non-commutative geometry were studied. The implication of a light brane-world in the rare $B_s \to \mu + \mu-$ decay has been explored [**D**]. In another work, the top-Yukawa, Higgs quartic couplings which gets modified in the presence of a light stabilized radion was investigated [**Da**]. The moduli(radion) contribution to muon anomaly is also being investigated, which in turn allows us to impose constraints on radion mass and it's vacuum expectation value. Exploiting these modified coupling constants along with the anomaly constrained radion mass and radion vacuum expectation value, a lower bound on the Higgs mass as a function of the radion mass was obtained. It was found that a sizable region of the parameter space, was consistent with the LEP2 lower bound of Higgs mass.

Heavy quark (top) pair production in the Linear Collider context, to order α_s, is being examined. A detailed analysis of the final state lepton coming from the W decay followed by the t decay, is the main goal of this project. Another study involves looking for signals of New Physics(related to the recently observed HyperCP events) in the rare decay mode $B_s \to l{+}l-$ ($l = e, mu$). Further, the Higgs hierarchy in large and warped spatial dimensional models, and a problem based on the implication of the twisted statistics in the non-commutative framework on Bhaba scattering, is being studied.

Mathematical Physics

Using a realization of the q-exponential function as an infinite multiplicative series of ordinary exponential functions new nonlinear connection formulae are obtained for q-orthogonal polynomials such as q-Hermite, q-Laguerre and q-Gegenbauer polynomials in terms of their respective classical analogues [**J**].

Nonlinear Dynamics, Solitons and Chaos

The effect of conformations on charge transport in a thin elastic tube has been studied. Its curvature satisfies a nonlinear differential equation which supports exact periodic solutions in the form of Jacobi elliptic functions. This in turn induces a quantum effective periodic potential for an electron in the tube, causing its delocalization. Possible applications of this novel mechanism are discussed.[**B1**]

The geometric phase acquired by polarized light after it traverses cyclic paths described by the boundary curves of various twisted closed strips is studied. A mapping to a quantum Hamiltonian shows that the inflexion points of the twisted strips manifest themselves as diabolic crossings of eigenvalues. The Möbius strip gets singled out as the only case for which the critical width where the diabolic geometry resides, also corresponds to the width for which the optical geometric phase shift is minimal.[**B3**]

Starting with the widely used definition for the twist of a thin ribbon, and invoking the principle of gauge invariance, a definition for the twist of a space curve is obtained. Its value is unique and independent of the frame chosen to describe the curve, and is valid even if the space curve has inflexion points. Some applications are presented.[**B2**]

Problems of synchronization in a wide variety of systems have been studied. In arrays of coupled maps it was shown (both analytically and numerically) that random coupling leads to spatiotemporal regularity. The synchronizing effects of random links in biological systems, such as networks of neurons [**Pr**] and coupled cell pathways [**Sinhasu7**] was also investigated. It was also shown that dynamic rewiring leads to more efficient synchronization than static (quenched) random links.

A scheme to obtain key logic-gate structures, using synchronization of nonlinear systems [**Sinhasu6**] was introduced. The idea was demonstrated explicitly by numerics and experiments on nonlinear circuits. A significant feature of this scheme is that a single nonlinear drive-response circuit can be used to flexibly yield the different logic gates, and switch logic behaviour by small changes in the parameter of the response system. So the response system can act as a "logic output controller". Thus this scheme may help to construct dynamic general purpose computational hardware with reconfigurable abilities.

A long-standing controversy in the study of complex systems is whether increasing diversity of a network (in terms of its size, connectivity and strength of connections) makes it more or less robust against perturbations. Linear stability analysis seems to suggest that increasing complexity decreases stability, while empirical results in many fields seem to indicate the opposite. To answer many critics of the existing theoretical argument, a random network of nonlinear maps exhibiting a wide range of local dynamics, with the links having normally distributed interaction strengths [**Sinhas8**], is considered. Starting from a knowledge of the micro-level behaviour at each node, a macroscopic description of the system is developed in terms of the statistical features of the subnetwork of active nodes. The asymptotic characteristics of this subnetwork are found to be remarkably robust: the size of the active set is independent of the total number of nodes in the network, and the average degree of the active nodes is independent of both the network size and its connectivity. These results suggest that very different networks evolve to active subnetworks with the same characteristic features. This has strong implications for dynamical networks observed in the natural world, notably the existence of a characteristic range of links per species across ecological systems.

Biological neural network have recently been analysed in detail in order to understand whether the constraint of efficient information processing imposes certain structural constraints on the network. For this purpose the C. elegans nematode has been chosen, as the entire connectivity pattern of all its 302 neurons have been mapped. Doing a k-core analysis of the network, it has been found 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 [**Sinhas2**]. It has been noted 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. A full dynamical model of the network of 280 non-pharyngeal neurons is currently being built to investigate the network dynamics underlying information processing in C. elegans.

Perturbative QCD

Next-to-leading logarithmic threshold and joint resummation for prompt photon production are extended to include leading collinear effects. The impact of these effects is assessed for both fixed-target and collider kinematics. They are found, in general to be small, but noticeable.

Dijet azimuthal correlations are used to check BFKL physics in hadro-production. This is a cleaner test of BFKL physics than looking for forward jets or forward single particle production.

QFT, Topological QFT, Conformal Field Thoery

The Bethe-Salpeter equation is related to a generalized quantum mechanical Hamiltonian. Instability of the presumed vacuum, indicated by a tachyon is related to a negative energy eigenstate of this Hamiltonian. The variational method shows that an arbitrarily weak long range attraction leads to chiral symmetry breaking, except in the scale invariant case when the instability occurs at a critical value of the coupling. In the case of short range attraction, an upper bound for the critical coupling is found.

The role of quantum statistics in twisted Poincare invariant theories has been elaborated. It is shown that, in order to have twisted Poincare group as the symmetry of a quantum theory, statistics must be twisted. It is also confirmed that the removal of UV-IR mixing (in the absence of gauge fields) in such theories is a natural consequence[**G2**]. The need for noncommutative geometry and its potential implications are discussed. Particularly results for modifications in statistics and corrections to QED are discussed[**G1**].

Statistical Mechanics

A model for collective effects in semi-realistic models for interacting molecular (or "Brownian") motors has been studied. These models were originally proposed to have the same hydrodynamic behaviour as the noisy Burgers equation, or equivalently the KPZ equation. It is shown that such models exhibit the same boundary driven phase transitions as the simpler exclusion processes in which such transitions were initially proposed. A possibility for robust behaviour in biological systems, the *robustness of certain non-equilibrium steady states of biological systems to wide classes of physical perturbations* is suggested.

The breakdown of heterogeneous materials under stress is studied. The aim is to understand how the precursor power-law development of ruptures takes place in a material and the dynamics of the rupturing processes [**Ray1**].

Surfaces generated from brittle fracture are highly rough and have anomalously high roughness exponent around 0.8. This behavior is quite universal (independent of the material or the mode of application of stress). The surfaces also show multiaffine scaling properties. In order to understand the fracture process better, fracture-surface morphology has been studied using extensive experimental data on widely different materials and geometries [**Ray2**].

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. A fruitful area for seeking such patterns is the evolution of collective choice from individual behavior, e.g., the sudden popularity or 'success' of certain ideas or products, compared to their numerous (often very similar) competitors. Empirical investigation of such popularity distributions may shed light on this issue. Towards this end, how popularity is distributed in a wide variety of contexts, including scientific papers, movies and electoral candidates [**Sinhas6**] has been studied. The results show that in almost all cases such distributions fit a log-normal distribution, suggesting that a multiplicative stochastic process is the basis for emergence of popular products. Evidence suggesting the existence of other universalities hitherto unsuspected in social phenomena, e.g., in the time-evolution of the popularity of a specific product has been obtained. One such "stylized fact", the occurrence of bimodality in many empirical distributions, has been explained using a simple agent-based model inspired by spin models in physics [**Sinhas7**].

The analysis of popularity can also be seen as part of a broad investigation into the general features of inequality in society. 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. Such models have been reviewed 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 [**Sinhas1**].

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. An exhaustive analysis of price fluctuations in the Indian market has been carried out to demonstrate that not only does it follow the inverse cubic law, but the time development of the distribution shows that self-organization to the power law form occurred almost immediately after the creation of the National Stock Exchange of Indian in 1994 [**Sinhas5**, **Pa**]. An agent-interaction model that shows how this "inverse cubic law" distribution can occur spontaneously as a result of dynamic changes in the interaction network[**Sinhas4**] has been proposed.

There is no general formalism for understanding the properties of systems far from equilibrium. In the absence of such a formalism, one could ask whether there is a rule obeyed by a subclass of systems. For the class of driven dissipative systems of the turbulent type, an exact relation that should be satisfied by a particular correlation function is derived. This law generalizes the well known 4/5th law of fluid turbulence. The applications include diverse phenomena like aggregation and wave turbulence [**Ra1**].

The above law is extended to include systems which are not purely of the turbulent type. Herein, there is no separation between driving scale and the dissipation scale. [**Ra2**]

String Theory

The connection between the new loop variable formalism for string theory, which is gauge invariant and the more established approaches to string theory is something that needs to be established. Thus one needs to show that this new formalism does in fact describe the same physical theory. To this end what has been done is i) to show explicitly for the free theory at level two and level three that there is a map between the fields, constraints and gauge transformations in the gauge fixed loop variable formalism and the corresponding quantities of the old covariant formalism. Furthermore this can only be done in the critical dimension, i.e. for the critical string. and ii) assuming this is true to all levels - this is expected for the free theory simply on grounds of gauge invariance - it can also be argued that the S-matrices are the same. Thus they should describe the same physical theory (at tree level). [**S**]

It has been shown earlier that one of the advantages of the loop variable formalism is that one can write down gauge invariant (open string) equations (both free and interacting) in a curved background without too much difficulty. This is because gauge invariance does not depend on the world sheet properties and it is therefore expected that the issue of background independence can be addressed in this formalism. However these equations as written down earlier cannot be derived from an action. When this is attempted for the free theory, for a general curved background, it is found that one has to modify the equations by terms involving arbitrarily high powers of curvature tensors. In the case of constant curvature (AdS or dS) the answer is expected to simplify. The equations and the action are explicitly worked for the massive spin two field in AdS. [**S**].

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*.
Effect of conformations on charge transport in a thin elastic tube.
2007.
(Submitted).

[**B2**]
Radha Balakrishnan and Indubala I. Satija*.
Frame-independent geometry of a space curve and applications.
2007.
(Submitted).

[**B3**]
Indubala I. Satija* and Radha Balakrishnan.
Optical phase shifts and diabolic topology in Möbius type strips.
2007.
cond-mat/0701393 (Submitted).

[**Ba**]
G. Baskaran, Saptarshi Mandal, and R. Shankar.
Exact results for spin dynamics and fractionization in the kitaev model.
arXive:Cond-Mat, 2007.
(Preprint: 06115472v2).

[**Bas1**]
Patrick Aurenche*, Rahul Basu, and Michel Fontannaz*.
Test of bfkl physics in dijet electro and hadro-production.
2007.
(Preprint: IMSc-2007/03/03).

[**Bas2**]
Rahul Basu, Eric Laenen*, Anuradha Misra*, and Patrick Motylinksi*.
Soft-collinear effects in prompt photon production.
Physical Review, 2006.
(Preprint: IMSc-2006/10/24).

[**D**]
Prasanta K. Das, Jyoti P. Saha, and Basudha Misra.
$\overline{B}_s \to \mu^+\mu^-$ decay in the Randall-Sundrum model
Physical Review D, **74(074011)**, 074011–1, 2006.

[**Da**]
Prasanta K. Das.
Muon anomaly and a lower bound on higgs mass due to a light stabilized radion in the Randall-Sundrum model.
International Journal of Modern Physics A, **21(26)**, 5205, 2006.

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Physics Letters B, 2006.
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M. K. Parida* and Nita Sinha.
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Sitabhra Sinha and S. Sridhar.
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Synchronization in coupled cells with activator-inhibitor pathways.
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2.3 Theoretical Computer Science

2.3.1 Research Summary

Algorithms and Data Structures

It is shown [**M2**] that every problem in MaxSNP has a nontrivial lower bound on the optimum solution size and that the above guarantee question with respect to this nontrivial lower bound is fixed parameter tractable. A lower bound is *nontrivial* if it is an increasing function of the input size. The notion of tight upper and lower bounds for the optimum solution is introduced and it is shown that the parameterized version of a variant of the above guarantee question with respect to the tight lower bound cannot be fixed parameter tractable unless P = NP, for a class of optimization problems.

Some recent results on parameterized and exact computation which are obtained through nice and simple graph theoretical results are surveyed in [**Ram2**]. These include structural results and efficient algorithms for well studied problems like Feedback Set Problems, Odd Cycle Transversal and Maximum r-Regular induced subgraph.

Branch & Reduce and dynamic programming on graphs of bounded treewidth are among the most common and powerful techniques used in the design of exact (exponential time) algorithms for NP hard problems. In [**S**] the efficiency of *simple* algorithms based on combinations of these techniques is discussed. Several examples of possible combinations of branching and programming are given which provide the fastest known algorithms for a number of NP hard problems: MINIMUM MAXIMAL MATCHING and some variations, counting the number of maximum weighted indepndent sets. It is also briefly discussed how similar techniques can be used to design parameterized algorithms. As an example, a fastest known algorithm solving k-WEIGHTED VERTEX COVER problem is given.

Given a graph $G = (V, E)$ on n vertices, the MAXIMUM r-REGULAR INDUCED SUBGRAPH (M-r-RIS) problems ask for a maximum sized subset of vertices $R \subseteq V$ such that the induced subgraph on R, $G[R]$, is r-regular. In [**Ram5**], a $\mathcal{O}(c^n)$ time algorithm for these problems for any fixed constant r is given, where c is a positive constant strictly less than 2. As a corollary, $\mathcal{O}(c^n)$ $(c < 2)$ time algorithm for MAXIMUM INDUCED MATCHING and MAXIMUM INDUCED CUBIC SUBGRAPH problems are obtained. These algorithms are then generalized to solve *counting* and *enumerating* version of these problems in the same time. An interesting consequence of the enumeration algorithm is, that it shows that the number of maximal r-regular induced subgraphs for a fixed constant r on any graph on n vertices is upper bounded by $o(2^n)$. Then combinatorial lower bounds on the number of *maximal* r-regular induced subgraphs possible on a graph on n vertices is given and also matching *algorithmic* upper bounds are given. Finally, improved exact algorithms for a special case of Induced Subgraph Isomorphism that is Induced r-Regular Subgraph Isomorphism, where r is a constant, Efficient Edge Dominating Set and δ-Separating Maximum Matching problems are obtained using the approach and the results obtained in the paper.

In [**Ram2**], some recent results of the authors on parameterized and exact computation which are obtained through nice and simple graph theoretical results are surveyed. These include structural results and efficient algorithms for well studied problems like Feedback Set Problems, Odd Cycle Transversal and Maximum r-Regular Induced Subgraph.

Automata, Logic and Concurrency

A model of labelled product systems of automata has been defined. Bisimilarity of labelled product systems is proposed using a new definition of bisimulation with renaming. Concurrent μ-expressions are defined to describe labelled product systems. This leads to complete axiomatizations and algorithms for bisimulation and failure equivalence over labelled product systems, and Kleene characterizations, algorithms and complete axiomatizations for equality of recognizable trace languages [**Lo1**]. The latter solves a problem posed in the earlier survey paper [**Lo4**].

A sublogic of Zhou and Hansen's interval logic, with measurement functions which provide real-valued measurement of some aspect of system behaviour in a given time interval, is considered over a variety of time domains (continuous, sampled, integer), providing a unified treatment of many diverse temporal logics including duration calculus (DC), interval duration logic (IDL) and metric temporal logic (MTL). A sublogic GIML with restricted measurement modalities is introduced which subsumes most of the decidable timed logics considered in the literature. A guarded first-order logic with measurements MGF is also introduced. A generalisation of Kamp's theorem is proved, showing that over arbitrary time domains, the measurement logic GIML is expressively complete for MGF. MGF is also shown to have the 3-variable property. In addition, a nesting-free subset of GIML is shown decidable when interpreted over timed words [**Lo2**].

Logical studies of cryptographic protocols continues. While logics for security protocols need to be abstract (without explicitly dealing with nonces, encryption etc), ignoring details may result in any verification of abstract properties worthless. We would like the verification problem for the logic to be decidable as well, to allow for automated methods for detecting attacks. From this viewpoint, in [**Ra2**], we study a quantified logic and prove its decidability for an interesting subclass of security protocols.

In work on logical foundations of game theory, a central question relates to how players' strategies are constructed. In [**Ra1**], we study a logic for reasoning about composite strategies in games, where players' strategies are like programs, composed structurally, and present a complete axiomatization.

Computational Complexity

Given a bipartite graph $G = (V, E)$, a perfect matching in it is a subset of edges $M \subseteq E$

such that every vertex of G has exactly one incident edge in M. Testing whether a bipartite graph has a unique perfect matching (exactly one) is the problem BUPM, and seems easier than testing whether it has some perfect matching. In [**M1**], tighter bounds are obtained for BUPM. It is shown that the problem is contained in the exact logspace counting class $\mathrm{C_=L}$, as well as in $\mathrm{NL}^{\oplus\mathsf{L}}$, where NL is nondeterministic logspace and $\oplus\mathsf{L}$ denotes the class parity logspace. Furthermore, it is shown that BUPM is hard for NL. A (unary) weighted version of the problem is also considered. It is shown that testing uniqueness of the minimum-weight perfect matching problem for bipartite graphs is in $\mathrm{L}^{\mathsf{C_=L}}$ and in $\mathrm{NL}^{\oplus\mathsf{L}}$.

The parallel complexity class NC^1 has many equivalent models such as bounded width branching programs BWBP. Arithmetizations of two of these classes, $\#\mathrm{NC}^1$ and #BWBP, had been considered in the literature. In [**L1**], this study is carried further to include arithmetization of other classes. In particular, it is shown that counting paths in branching programs over visibly pushdown automata has the same power as #BWBP, while counting proof-trees in logarithmic width formulae has the same power as $\#\mathrm{NC}^1$. Next, the SC hierarchy is studied; SC^i consistes of problems solvable by algorithms using simultaneosuly polynomial time and $O(\log n)^i$ space. It is known that SC^0 equals NC^1. Polynomial-degree restrictions of SC^i, denoted sSC^i, are defined in [**L1**], and it is shown that the Boolean class sSC^1 is sandwiched between NC^1 and LOG, whereas sSC^0 equals NC^1. On the other hand, the arithmetic class $\#\mathrm{sSC}^0$ contains #BWBP and is contained in FLOG, and $\#\mathrm{sSC}^1$ contains $\#\mathrm{NC}^1$ and is in SC^2. Some closure properties of the newly defined arithmetic classes are also investigated.

In [**M3**], the landscape of complexity classes lying between with NC^1 and AC^1 (polynomial size $O(\log n)$ depth Boolean circuits) is surveyed.

In [**A3**] we give a deterministic polynomial-time algorithm to check whether the Galois group of an input polynomial over rationals is nilpotent. In [**A1**] we show that Quasigroup Isomorphism is not hard for the limited nondeterminism class $\mathrm{NP}(\log^2 n)$ unless the coNP-complete problem has polynomial-size proofs checkable in subexponential time with a polynomial-size advice. The *Minimum generating set problem* for groups given by multiplication tables was also studied. Specfically, we give a deterministic polynomial-time algorithm for the case when the input group is nilpotent.

In [**A2**] we show that Tournament Canonization is polynomial-time reducible to Tournament Isomorphism and Rigid-Tournament Canonization. Extending the Babai-Luks Tournament Canonization algorithm, we give an $n^{O(k+\log n)}$ algorithm for canonization and isomorphism testing of k-hypertournaments.

Graph Theory and Combinatorics

The *acyclic chromatic index*, denoted by $a'(G)$, of a graph G is the minimum number of colours used in any proper edge colouring of G such that the union of any two colour classes does not contain a cycle, that is, forms a forest. In [**Mu4**], it is shown that $a'(G\Box H) \leq a'(G) + a'(H)$ for any two graphs G and H such that $\max\{a'(G), a'(H)\} > 1$. Here, $G\Box H$ denotes the cartesian product of G and H. This extends a recent result of [**Mu1**] where tight and constructive bounds on $a'(G)$ were obtained for a class of grid-like graphs which can be expressed as the cartesian product of a number of paths and cycles.

In [**Mu2**], it is shown that $a'(G) \leq \Delta(G) + 1$, if G is an outerplanar graph. This bound is tight within an additive factor of 1 from optimality. Our proof is constructive leading to a simple $n \log \Delta$ time algorithm. Here, $\Delta = \Delta(G)$ denotes the maximum degree of the input graph.

The choice number of a graph is the minimum number of colors required to be present in lists assigned to each vertex, to admit a proper colouring irrespective of the contents of the lists. It is well known that choice number is at least the chromatic number if the lists are arbitrarily chosen. In [**Su2**], it is shown, however, that if the lists are drawn randomly from a suitably large universe of colors, one can almost surely find a proper coloring even if the list sizes are much smaller than the chromatic number.

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 and Jacobo Toran*.
The complexity of quasigroup isomorphism and the minimum generating set problem.
In Tetsuo Asano, editor, *Proceedings of the 17th Intl Symposium on Algorithms, Automata, and Computation, Lecture Notes in Computer Science, vol. 4288, Springer Verlag, Dec 2006.*, page 233. Springer Verlag, Dec 2006.

[**A2**]
V. Arvind, Partha Mukhopadhyay, and Bireswar Das.
On isomorphism and canonization of tournaments and hypertournaments.
In Tetsuo Asano, editor, *Proceedings of the 17th Intl Symposium on Algorithms, Automata, and Computation, Lecture Notes in Computer Science, vol. 4288, Springer Verlag, Dec 2006.*, page 449. Springer Verlag, Dec 2006.

[**A3**]
V. Arvind and Piyush P. Kurur*.
A polynomial time nilpotence test for galois groups and related results.
In Rastislav Kralovic and Pawel Urzyczyn, editors, *31st International Symposium on Mathematical Foundations of Computer Science (MFCS 2006), Lecture Notes in Computer Science vol. 4162, Springer Verlag.*, page 134. Springer Verlag, Aug 2006.

[**A4**]
V. Arvind and Bireswar Das.
Szk proofs for black-box group problems.
Theory of Computing Systems (Special issue for the CSR 2006 conference)., 2007.
(To be published).

[**A5**]
V. Arvind and Piyush P. Kurur*.
Graph isomorphism is in spp.
Information and Computation., **204(5)**, 835, 2006.

[**L1**]
Nutan Limaye, Meena Mahajan, and B. V. Raghavendra Rao.
Arithmetizing classes arround NC^1 and L.
In Wolfgang Thomas and Pascal Weil, editors, *Proceedings of the 24th International Symposium on Theoretical Aspects of Computer Science STACS, LNCS vol. 4393.*, pages 477–488. Springer, Feb 2007.

[**Lo1**]
Kamal Lodaya.
Product automata and process algebra.
In P.K. Pandya and D.v. Hung, editors, *4th SEFM*, pages 128–136. IEEE, Sep 2006.

[**Lo2**]
Kamal Lodaya and Paritosh K. Pandya*.
A dose of timed logic, in guarded measure.
In Eugene Asarin and Patricia Bouyer, editors, *4th FORMATS*, pages 260–273. Springer, Sep 2006.

[**Lo3**]
Kamal Lodaya.
Petri nets, event structures and algebra.
In K. Rangarajan K.G. Subramanian and M. Mukund, editors, *Formal models, languages and applications*. World Scientific, 2006.

[**Lo4**]
Kamal Lodaya.
A regular viewpoint on processes and algebra.
Acta Cybernetica, **17(4)**, 751–763, 2006.

[**M1**]
Thanh Minh Hoang*, Meena Mahajan, and Thomas Thierauf*.
On the bipartite unique perfect matching problem.
In M. Bugliesi, B. Preneel, V. Sassone, and I. Wegener, editors, *Proceedings of 33rd International Colloquium on Automata, Languages and Programming ICALP, LNCS Vol. 4051.*, pages 453–464. Springer, Jul 2006.

[**M2**]
Meena Mahajan, Venkatesh Raman, and Somnath Sikdar.
Parameterizing MAXSNP problems above guaranteed values.
In Hans L. Bodlaender and Michael A. Langston, editors, *Proceedings of 2nd International Workshop on Parameterized and Exact Computation, IWPEC'06. LNCS vol. 4169.*, pages 38–49. Springer, Sep 2006.

[M3]
Meena Mahajan.
Polynomial size log depth circuits: between NC^1 and AC^1.
In Vladimiro Sassone, editor, *The Computational Complexity Column (ed. Jacobo Toran), Bulletin of the EATCS, vol. 91.* EATCS, 2007.

[M4]
Meena Mahajan, R. Rama*, Venkatesh Raman, and S. Vijayakumar*.
Approximate block sorting.
International Journal on Foundations of Computer Science, **17(2)**, 337, 2006.

[M7]
Meena Mahajan, R. Rama*, and S. Vijayakumar*.
On sorting by 3-bounded transpositions.
Discrete Mathematics, **306(14)**, 1569–1585, 2006.

[Ma1]
Kaushik Majumdar and Robert Kozma*.
Studies on sparse array cortical modeling and memory cognition duality.
In *Proc. Int. Joint. Conf. Neural Networks*, page 4954. IEEE Neural Networks Society, Jun 2006.

[Ma2]
Kaushik Majumdar.
Detection of phase synchronization between two firing neurons by fast fourier transform.
Journal of Computational Neuroscience (Springer), 2007.
(Submitted).

[Ma3]
Kaushik Majumdar.
A new measure of phase synchronization for a pair of time series and seizure focus localization.
Physica D, 2007.
(Submitted).

[Ma4]
Kaushik Majumdar.
A structural and a functional aspect of stable information processing by the brain.
Cognitive Neurodynamics (Springer), 2007.
(Submitted).

[Ma5]
Kaushik Majumdar.
Behavioral response to strong aversive stimuli: A neurodynamical model.
Brain and Cognition (Elsevier), 2007.
(Submitted).

[**Ma6**]
Kaushik Majumdar and Robert M. Frank*.
Three linear discriminators for separating scalp human eeg signals during rsvp tasks.
Neurocomputing (Elsevier), 2006.
(Submitted).

[**Ma7**]
Kaushik Majumdar and Mark H. Myers*.
Amplitude suppression and chaos control in epileptic eeg signals.
J. Comp. Math. Methods in Medicine (TaylorFrancis), **7(1)**, 53, 2006.

[**Maj**]
Kausik 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).

[**Me**]
Arnaud Carayol* and Antoine Meyer.
Context-sensitive languages, rational graphs and determinism.
Logical Methods in Computer Science, 2006.
(To be published).

[**Mu1**]
Rahul Muthu, N. Narayanan, and C. R. Subramanian.
Optimal acyclic edge colouring of grid like graphs.
In D.Z. Chen and D.T. Lee, editors, *12th Annual International Conference on Computing and Combinatorics (COCOON 2006)*, pages 360–367. Springer, Aug 2006.

[**Mu2**]
Rahul Muthu, Narayanan N, and Chinthamani Subramanian.
Acyclic edge colouring of outerplanar graphs.
In M Y Kao and X Y Li, editors, *Lecture Notes in Computer Science, LNCS 4508*, pages 144–152. Springer, Mar 2007.
4508 (To be published).

[**Mu3**]
Rahul Muthu, N. Narayanan, and C. R. Subramanian.
Acyclic edge colouring of outerplanar graphs.
2006.
(Submitted).

[**Mu4**]
Rahul Muthu and C. R. Subramanian.
Cartesian product and acyclic edge colouring.
2006.
(Submitted).

[**R**]
Muthu Rahul, Narayanan N, and Chinthamani Subramanian.
Improved bounds on acyclic edge coloring.
Discrete Mathematics, 2007.
DISC 6610 (To be published).

[**Ra1**]
R. Ramanujam and Sunil Simon.
Axioms for composite strategies.
In van der Hoek Bonanno and Wooldridge, editors, *Proc. Logic and the Foundations of Game and Decision Theory*, page 34. Elsevier, Jun 2006.

[**Ra2**]
R. Ramanujam and S. P. Suresh*.
A (restricted) quantifier elimination for security protocols.
Theoretical Computer Science, **367**, 228, 2006.

[**Ram1**]
Venkatesh Raman and Saket Saurabh.
Triangles, 4-cycles and parameterized (in)tractability.
In *Proceedings of the Scandinavian Workshop on Algorithm Theory (2006)*, page 304. Springer Verlag, Jul 2006.

[**Ram2**]
Venkatesh Raman and Saket Saurabh.
Exact and parameterized algorithms through (old and new) structural graph theoretic results.
In *Proceedings of the International Conference on Discrete Mathematics*, page 177, Dec 2006.

[**Ram3**]
Sushmita Gupta*, Venkatesh Raman, and Saket Saurabh.
Fast exponential algorithms for maximum r-regular induced subgraph problems.
In *Proceedings of the 26th FSTTCS Conference, Kolkotta, India*. Springer Verlag, Dec 2006.

[**Ram4**]
Venkatesh Raman and Saket Saurabh.
Triangles, 4-cycles and parameterized (in-)tractability.
In Rusins Freivalds Lars Arge, editor, *Proceedings of 10th ScandinavianWorkshop on Algorithm Theory (SWAT 06)*, pages 304–315. Lecture Notes in Computer Science, Springer-Verlag, Jul 2006.

[**Ram5**]
Sushmita Gupta*, Venkatesh Raman, and Saket Saurabh.
Fast exponential algorithms for maximum r-regular induced subgraph problems.
In Naveen Garg S. Arun-Kumar, editor, *Proceedings of 26th International Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2006)*, pages 139–151. Lecture Notes in Computer Science, Springer-Verlag., Dec 2006.

[**Ram6**]
Venkatesh Raman and Saket Saurabh.
Exact and parameterized algorithms through (old and new) structural graph theoretical results.
In *Proceedings of the International Conference on Discrete Mathematics (2006)*, pages 177–189. Ramanujan Mathematical Society, Dec 2006.

[**Ram7**]
Richard R. Geary*, **Rajeev Raman***, **and Venkatesh Raman**.
Succinct ordinal trees with level ancestor queries.
ACM Transactions on Algorithms, **2(3)**, 510, 2006.

[**Ram8**]
Venkatesh Raman, Saket Saurabh, and C. R. Subramanian.
Faster fixed parameter tractable algorithms for finding feedback vertex sets.
ACM Transactions on Algorithms (TALG)., **2(3)**, 403–415, 2006.

[**Ram9**]
Venkatesh Raman, Saket Saurabh, and C. R. Subramanian.
Faster fixed parameter tractable algorithms for finding feedback vertex sets.
ACM Transactions on Algorithms, **2(3)**, 403–415, 2006.

[**Ram10**]
Venkatesh Raman, Saket Saurabh, and C.R. Subramanian.
Faster fixed parameter tractable algorithms for finding feedback vertex sets.
ACM Transactions on Algorithms, **2(3)**, 403, 2006.

[**S**]
Fedor V. Fomin*, **Serge Gaspers***, **and Saket Saurabh**.
Branching and treewidth based exact algorithms.
In Tetsuo Asano, editor, *Proceedings of 17th International Symposium on Algorithms and Computation (ISAAC 2006)*, pages 16–25. Lecture Notes in Computer Science, Springer-Verlag, Dec 2006.

[**Si**]
Hannes Moser* **and Somnath Sikdar**.
The parameterized complexity of the induced matching problem in planar graphs.
Springer, Aug 2007.
(To be published).

[**Su1**]
C. R. Subramanian.
Analysis of a heuristic for acyclic edge colouring.
Information Processing Letters, **99(6)**, 227–229, 2006.

[**Su2**]
C. R. Subramanian.
Coloring graphs using random lists of colors.
2006.
(Preprint: —).

[**Su3**]
C. R. Subramanian.
List set colouring : Bounds and algorithms.
Combinatorics, Probability and Computing, **16(1)**, 145–158, 2007.

[**V**]
Arvind V., Bireswar Das, and Partha Mukhopadhyay.
The complexity of black-box ring problems.
In *12th Annual International Computing and Combinatorics Conference (COCOON 2006)*. Springer-Verlag, Apr 2006.
(To be published).

2.4 Student Programmes

2.4.1 Degrees Awarded

Doctoral Degrees Awarded during 2006 – 2007

Mathematics

Name: **Prakash, Gyan**
Thesis Title: On some problems in additive number theory
Thesis Advisor: Balasubramanian, R.
University: ISI Kolkatta

Physics

Name: **Sarkar, Swarnendu**
Thesis Title: Aspects of Noncommutativity in Field and String Theory and Closed String Tachyon Condensation
Thesis Advisor: Sathiapalan, Balachandran
University: University of Madras

Theoretical Computer Science

Name: **Meenakshi, B.**
Thesis Title: Reasoning about Distributed Message Passing Systems
Thesis Advisor: Ramanujam, R.
University: University of Madras

Doctoral Theses Submitted during 2006 – 2007

Mathematics

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

Name: **Arijit, Dey**
Thesis Title: Principal Bundles and Bundles with Parabolic Structure
Thesis Advisor: Nagaraj, D. S.
University: University of Madras

Masters Theses during 2006 – 2007

Mathematics

Name: **Sekhar, Gautham**
Thesis Title: Design and Analysis of T-function based stream cipher primitives
Thesis Advisor: Srinivas, K.
University: B.I.T.S, Pilani

Theoretical Computer Science

Name: **Joglekar, Pushkar S.**
Thesis Title: The Deterministic Complexity of Polynomial Factorizarion over Finite Fields
Thesis Advisor: Arvind, V.
University: Anna University

2.4.2 Lecture Courses During 2006 – 2007.

The following **lecture courses** were offered during 2006 – 2007.

Course Title	Period	Lecturer
Mathematics		
Complex Analysis	Jan-Mar 2006	Srinivas, K.
Differential Equations	Jan-Feb 2006	Krishna, M.
Functional Analysis	Jan-Mar 2006	Kesavan, S.
Topology	Jan-May 2006	Kodiyalam, Vijay
Ergodic Theory	Mar-Apr 2006	Sridharan, Shrihari
K- theory for C^*-algebras (Reading Course)	Jul-Dec 2006	Sunder, V. S.
Algebra	Aug-Dec 2006	Kodiyalam, Vijay
Characteristic classes (Seminar Course)	Aug-Nov 2006	Sankaran, Parameswaran
Measure Theory	Aug-Nov 2006	Kesavan, S.
Operator Algebras	Aug-Nov 2006	Chakraborty, Partha
Topics in Representation Theory	Aug-Dec 2006	Prasad, Amritanshu
Topology -I	Aug-Dec 2006	Sankaran, Parameswaran
Complex Analysis	Jan-Apr 2007	Balasubramanian, R.
Financial Mathematics (Reading Course)	Jan-Mar 2007	Krishna, M.
Functional Analysis	Jan-Mar 2007	Krishna, M.
Noncommutative Geometry	Jan-Apr 2007	Chakraborty, Partha
Number Theory	Jan-Apr 2007	Srinivas, K.

Topology II	Jan-Feb 2007	Sankaran, Parameswaran

Physics

String theory	Nov-Mar 2006	Sathiapalan, Bala; Kalyana Rama, S.
Condensed Matter Physics	Jan-Mar 2006	Menon, Gautam I.
Quantum Field Theory I	Jan-Apr 2006	Basu, Rahul
Statistical Mechanics	Jan-May 2006	Sinha, Sitabhra
Classical Electrodynamics	Aug-Dec 2006	Indumathi, D.
Classical Mechanics	Aug-Dec 2006	Sinha, Sudeshna
Mathematical Methods	Aug-Dec 2006	Rajesh, R.
Quantum mechanics	Aug-Dec 2006	Govindarajan, T. R.
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, B.

Theoretical Computer Science

Automata and concurrency	Jan-Apr 2006	Lodaya, Kamal
Computational Complexity	Jan-Mar 2006	Arvind, V.
Mathematical Logic	Jan-Mar 2006	Ramanujam, R.
Randomized Algorithms	Jan-Feb 2006	Raman, Venkatesh
Infinite graphs and automata (Seminar Course)	Feb-Apr 2006	Lodaya, Kamal; Meyer, Antoine
Randomized Algorithms	Mar-Apr 2006	Subramanian, C. R.
Algebraic automata theory	Aug-Dec 2006	Lodaya, Kamal
Complexity Theory II	Aug-Nov 2006	Arvind, V.
Design and Analysis of Algorithms	Aug-Dec 2006	Raman, Venkatesh
Discrete Mathematics	Aug-Dec 2006	Mahajan, Meena B.
Logic II: automata and model theory	Aug-Dec 2006	Ramanujam, R.
Programming languages	Aug-Dec 2006	Lodaya, Kamal
Randomized algorithms for sampling and counting (Reading Course)	Aug-Dec 2006	Subramanian, C. R.
Theory of Computation	Aug-Dec 2006	Ramanujam, R.
Algebra and Computation	Jan-Mar 2007	Arvind, V.
Computational Complexity	Jan-Apr 2007	Mahajan, Meena B.
Mathematical Logic	Jan-Apr 2007	Ramanujam, R.
Probability and Randomization	Jan-Mar 2007	Subramanian, C. R.
Timed and hybrid systems (Seminar Course)	Jan-Apr 2007	Lodaya, Kamal ; Madhavan, Mukund

In addition, the following **lecture courses** were offered during 2006 – 2007 by IMSC faculty in the National Undergraduate programme of the Chennai Mathematical Institute.

Course Title	Period	Lecturer
Mathematics		
Analysis I	Aug-Nov 2006	Kesavan, S.
Lie theoretic methods in Analysis	Mar-May 2007	Prasad, Amritanshu
Physics		
Computational Physics	Jan-Apr 2006	Siddharthan, Rahul
Gravitation and Cosmology	Jan-Apr 2006	Rajasekaran, G.
Quantum Mechanics II	Jan-Mar 2006	Mani, Harihara S.
Condensed Matter Physics	Aug-Nov 2006	Ray, Purusattam
Overview of Physics	Aug-Nov 2006	Rajasekaran, G.
undergraduate labaratory	Aug-Mar 2007	Mani, Harihara S.
Electromagnetism I	Jan-Apr 2007	Govindarajan, T. R.

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, 2006 - Mar, 2007.

Student	Faculty
Mathematics	
Sharma , Vandana , IIT, Madras	Paranjape, Kapil H.
Physics	
Kulkarni, Suchita, Mumbai University	Basu, Rahul
Sharma, Neha, University of Rajasthan	Basu, Rahul
Bhanukiran, P., CMI	Jagannathan, R.
Raghuraman, Aarti, MCC, Chennai	Rajesh, R.
Ghare, Nikhil, IIT Bombay	Rajesh, R.
Jain, Bithika, St. Xaviers college, Mumbai	Sharatchandra, H.S.
Vishwanathan, Niveditha, St. Stephen's College, Delhi	Sinha, Sitabhra

Theoretical Computer Science

Kumar, Arvind, IIT Kanpur	Raman, Venkatesh
Lakshminarayan, Srividya, NIT, Tiruchirappalli	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, 2006 - Mar, 2007.

Student	Faculty

Physics

Saveetha, , Queen Mary's College	Indumathi, D.
Anupriya, , Presidency College	Indumathi, D.
Mazumdar, Arindam, Indian Institute of Technology, Delhi	Murthy, M.V.N.
Bakke, Jan H., Norwegian Institute of Science and Technology, Trondheim, Norway	Ray, Purusattam

Theoretical Computer Science

Sriram, Janani, Sri Venkateswara College of Engineering	Raman, Venkatesh

2.5 Honours and Awards

Chakraborty, Partha S. was awarded Endeavour India Executive Award, for 2006, by the Department of Education Science and Training, Government of Australia.

Das, Prasanta K. was awarded the SERC Fast Track Proposal for Young Scientists, by Department of Science and Technology.

Sankaran, Parameswaran was elected Fellow of the National Academy of Sciences, Allahabad.

Sankaran, Parameswaran was elected Fellow of the Indian Academy of Sciences, Bangalore.

Saket, Saurabh was awarded the Best Student Paper Award for the paper titled *Branching and Treewidth Based Exact Algorithms*, by the ISAAC Programme Committee, 2006.

Chapter 3

Other Professional Activities

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

Arvind, V.

PC Co-chair of Programme Committee of the 27th Annual FSTTCS Conference. during Dec 2006 – Mar 2007.

Balasubramanian, R.

Member of Fellowship Scrutiny Committee The National Academy of Sciences, Allahabad during Apr 2005 – Apr 2006.

Member of Governing Council Chennai Mathematical Institute during Apr 2005 – Apr 2006.

Member of DST-PAC for Mathematics, Electronics and Computer Science during Apr 2005 – Apr 2006.

Member of visitor's Nominee for Mathematics, Statistics and Computer Science, Hydrabad University during Apr 2005 – Apr 2006.

Area coordinator of ILTP during Apr 2005 – Apr 2006.

Chairman of PRSG during Mar 2006 – Mar 2007.

Vice president of Malibnet during Mar 2006 – Mar 2007.

Member of the Scientific Committ of Indo-French Institute of Mathematics (IFIM)

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

Member of governing Council ,HRI

Convener of Local Organising Committee for Indo Uk Conference on Number theory held at IMSc during Aug 3 – Aug 5, 2006.

Baoulina, Ioulia

Reviewer of Mathematical Reviews, AMS during Jul 2003 – Mar 2007.

Chakraborty, Partha S.

Convener of Local Organising Committee for Instructional Workshop on Noncommutative Geometry held at IMSc during Jan 8 – Jan 19, 2007.

Date, G.

Secretary of The Indian Association for General Relativity and Gravitation

Govindarajan, T. R.

Member of National Organising Committee for FTAG V held at BITS, Goa during Dec 18 – Dec 23, 2006.

Kesavan, S.

Member of Board of Studies in Mathematics (Undergraduate), University of Madras during Jul 2003 – Jul 2006.

Fellow of Forum d' Analystes during Apr 2005 – Mar 2007.

Member of National Board for Higher Mathematics

Professor-in-charge of all teach of Programme Implementation Committee, National Undergraduate Programme, Chennai Mathematical Institute

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

Jul 2006 – Mar 2007.

Member of Executive Committee, ICM, 2010 during Sep 2006 – Mar 2007.

Kodiyalam, Vijay

Reviewer of Mathematical Reviews

Lodaya, Kamal

Member of Programme committee, 10th Fossacs conference, Braga, 2007

Mani, Harihara S.

Member of Council, Indian Institute of Asrophysics

Convener of Local Organising Committee for SERC preperatory school held at Indian Institute of Science, Bangalore during Oct 30 – Nov 18, 2006.

Member of Local Organising Committee for WIN07 held at Saha Institute of Nuclear Physics, Kolkata during Jan 15 – Jan 20, 2007.

Menon, Gautam I.

Convener of Local Organising Committee for Modeling Infectious Diseases held at IMSc during Sep 4 – Sep 6, 2006.

Murthy, M.V.N.

Memder 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)

Member of Editorial Board, Journal of the Ramanujan Mathematical Sciences

Member of Advisory Board of arXiv.org

Rajasekaran, G.

Member of The Council and the Governing Board of IUCAA, Pune during Apr 2006 – Feb

2007.

Popular Article at Pune on May 1, 2006. With coauthors D Indumathi and M V N Murthy, wrote a popular article "Neutrinos and how to catch them (India-based Neutrino Observatory)" which was published in "Physics Education", May 2006.

Popular Lecture at University of Mysore on Nov 12, 2006. Gave a Lecture entitled " Is there a Final Theory?"

Member of Academic and Administrative Audit Committee of the University of Mysore during Jan – Mar, 2007.

Popular Lecture at Meenakshi College, Chennai on Jan 5, 2007. Gave a Lecture entitled " Is there a Final Theory?"

Raman, Venkatesh

Member of Steering Committee of the International Workshop on Parameterized and Exact Computation during Jul 2005 – Mar 2007.

Member of Program Committee of the Second International Workshop on Parameterized and Exact Computation during Nov 2005 – Apr 2006.

Member of Program Committee of the International Conference on Discrete Mathematics during Jan – Dec, 2006.

Ramanujam, R.

Member of Programme Committee of Computer Science Logic, Szeged, Hungary (Sep 25 to 29, 2006). during Feb – Oct, 2006.

Convener of National Organising Committee for ISEA Course on Security held at IMSc during May 15 – Jun 9, 2006.

Member of Programme Committee of Symposium on theoretical Aspects of Computer Science, Aachen, Germany (February 22-24, 2007). during Jun 2006 – Feb 2007.

Sankaran, Parameswaran

Reviewer of Mathematical Reviews

Academic Member of Board of Studies in Mathematics, University of Madras. during Sep 2006 – Mar 2007.

Reviewer of Zentralblatt für Mathematik during Oct 2006 – Mar 2007.

Convener of Local Organising Committee for Annual Foundation School- (Part-I) held at IMSc during Dec 4 – Dec 30, 2006.

Convener of Local Organising Committee for Subhashis Nag Memorial Endowment Lecture held at IMSc on Jan 25, 2007.

Sathiapalan, Balachandran

Member of National Organizing Committe for the String Woprkshop in Puri 2006 during Dec – Dec, 2006.

Sinha, Rahul

Member of Expert Panel on Fast Track Proposals for Young Scientists in Physical and Mathematical Sciences.

Sinha, Sitabhra

Convener of Local Organising Committee for Workshop on Modeling Infectious Diseases held at IMSc during Sep 4 – Sep 6, 2006.

Sinha, Sudeshna

Editor of American Institute of Physics Journal "Chaos"

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 Feb – Mar, 2007.

Sunder, V. S.

Member of Editorial Board of the Proceedings of the Indian Academy of Sciences (Math. Sci.). during Aug 2001 – Mar 2007.

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 2007.

Member of Council of the Indian Academy of Sciences during Jan 2004 – Dec 2006.

Member of Sectional Committee for Mathematical Sciences, Indian National Science Academy during Jan 2005 – Mar 2007.

Member of Council of Council of the Indian Academy of Sciences, Chennai during Apr – Dec, 2006.

Member of Council of Council of the Indian Academy of Sciences, Chennai during Apr – Dec, 2006.

External expert of Selection/Promotion Committee for School of Mathematics in University of Hyderabad during Jul 2006 – Mar 2007.

External expert of Selection/Promotion Committee for Theoretical Statistics and Mathematics during Jul 2006 – Mar 2007.

Chapter 4

Colloquia, Conferences and Workshops held at IMSc

4.1 Albert Einstein Annus Mirabilis Centennial Public Lectures at IMSc

The Institute hosted a series of lectures by world renowned physicists on Jan 10 and 11, 2007. Public lectures by Nobel Laureates Professor Anthony J Leggett and Professor Zhores I. Alferov, and the eminent theoretical physicist, Professor E. C. George Sudarshan (former director of MatScience), were given on Jan 10 to a packed hall of research scientists, science teachers and students from various institutions in and around Chennai. These lectures were followed by technical presentations by the scientists the following day. The programme was organised jointly by the Institute of Mathematical Sciences and the Delhi-based Centre for Philosophy and Foundations of Science.

Professor Anthony Leggett spoke on the unusual properties of quantum liquids and superfluids, exposing the audience to the developments in this field, encompassing ideas and experiments over the past century. He was awarded the Physics Nobel prize in 2003 for his work on elucidating the nature of superfluidity in an isotope of Helium. He described recent developments in Bose-Einstein condensation, a remarkable quantum phenomenon observed in ultra-cold alkali atoms such as sodium and rubidium.

Professor George Sudarshan described his pioneering work in the field of quantum mechanics and fundamental notions of measurement in quantum theory. These could play an important role in quantum computation. In addition to his work on the foundations of quantum mechanics, Prof Sudarshan is famous for his $V - A$ theory which explains the nature of weak interactions as well as for his seminal contributions in the field of quantum optics.

Professor Zhores Alferov narrated the development of the class of semi-conductor structures called heterostructures for which he was awarded the Physics Nobel prize in 2000. The impact of his discoveries on daily life is tremendous—such heterostructure-based technology underlies the modern cell-phone, CD player, optical fibre-based communications, solar cells, etc. He guided his captivated audience gently, but firmly, to the conclusion that 99 percent of future electronics will be based on these heterostructures. It was a treat for the audience to hear the story straight from the father of modern electronics.

The evening lectures were preceded by the release of a monumental volume comprising of the collected scientific publications of Professor George Sudarshan by Professor R. Balasubramanian, Director, Institute of Mathematical Sciences.

4.2 Indo UK Conference on Number theory

India-UK Number Theory Conference, was held in IMSc during September 18-23, 2006. It was supported by the Royal Society, UK, and was sponsored by Ramanujan Mathematical Society. The principal speakers were:

- V. Abrashkin (Durham) : Galois modules arising from Faltings's strict modules
- U.K. Anandavardhanan (IIT, Mumbai) : Root numbers of Asai L-functions.
- R. Balasubramanian (IMSc, Chennai)
- T. Browning (Bristol) : Quartic forms in many variables.
- D. Burns (Kings College, London) : On the main conjecture of non-commutative Iwasawa theory
- J. Coates (Cambridge) : Root numbers and noncomutative Iwasawa theory
- K. Chakraborty (HRI, Allahabad) : Exponents of class groups of real quadratic fields.
- John Cremona (Nottingham) : The elliptic curve database for conductors to 130000.
- T. Dokchitser (Cambridge) : Parity of ranks for elliptic curves with a cyclic isogeny.
- I. Fesenko (Nottingham) : On poles of zeta function of minimal regular model of elliptic curve over global fields.
- E. Ghate (TIFR, Mumbai) : Examples of locally indecomposable ordinary representations.
- R. Heath-Brown (Oxford) : Cubic forms in 14 variables.
- J. Manoharmayum (Sheffield) : Lifting mod l- Galois representations to characteristic zero
- R. Parimala (TIFR, Mumbai) : Arithmetic of certain two dimensional geometric fields
- C.S. Rajan (TIFR, Mumbai) : On the irreducibility of characters irreducible representations of simple Lie algebras.
- A.J. Scholl (Cambridge) : Higher fields of norms and (phi-Gamma) modules
- T.N. Shorey (TIFR, Mumbai) : Squares in products of terms in arithmetic progression
- A. Skorobogatov (Imperial College, London) : Del Pezzo surfaces and representation theory

- R. Sreekantan (TIFR, Mumbai) : A non-Archimedean analogue of the Hodge-D-conjecture for products of elliptic curves
- R. Sujatha (TIFR, Mumbai) : Root numbers and noncomutative Iwasawa theory
- R. Tandon (Hyderabad) : Completing a theorem of Tunnell
- M. Taylor (Manchester) : Arithmetic Euler Characteristics.

4.3 K. S. Krishnan Discussion Meeting on Frontiers in Quantum Science

Professor K S Krishnan was a pioneer in what is now called quantum condensed matter physics and co-discover of Raman effect. His fundamental contributions to Raman effect, anisotropic magnetic properties of molecules and solids, discoveries of quasi 2 dimensional electron transport and Landau diamagnetism in graphite, theory and experiments on the electron transport in alloys (Krishnan-Bhatia formula) and other phenoemena gave credence to quantum theory of matter that was being vigorously developed then. Impressed by Krishnan's insights into quantum mechanics, during a lecture course at Calcutta, Sommerfeld is known to have invited Krishnan to coauthor a book on quantum mechanics. Quantum science, nurtured by people like Krishnan has matured over decades and is setting the agenda for a large part of modern science and technology. An example of the latest among them is quantum computers, a most exciting frontier in theoretical and experimental physics.

In response to an invitation from Dr T Ramasami, President of K S Krishnan Memorial Trust, Chennai, it was felt that it was appropriate to have a two day discussion meeting, once a year, under the above title, in one of the frontiers. This will be a platform for exposure and discussion of work done and fostering collaboration. The Meets are to be sponsored jointly by Institute of Mathematical Sciences, Chennai and K S Krishnan Memorial Trust, Chennai. The venue of the first meet held on 13-14 December 2006, was the Institute of Mathematical Sciences. It was organized by G Baskaran, A Mishra, R Shankar and R Simon, focussing on *Novel Quantum Phenomena in Graphene*.

Some of the topics covered were :quantum Hall phenomena, anomalous electric field effects, Raman effect, local experimental probes, Klein paradox, exploration of relativistic quantum field analogies, superconductivity in graphene related systems, spin-1 excitations, mesoscopic electrical conduction and Luttinger liquid like behaviour in graphene related systems.

Speakers and Discussion Leaders included: S. Banerjee (SINP), G. Baskaran (IMSc), S. Das (Weizmann), M. Deshmukh (TIFR), A. Ferrari (Cambridge, UK), Arindam Ghosh (IISc), A. Jafari (Iswahan, Iran), S.K. Kulkarni (Univ. of Pune), Vinu Lukose (IMSc), K.S. Narayan (JNCASR), Sumathi Rao (HRI), M. Sardar (IGCAR), Diptiman Sen (IISc), K. Sengupta (SINP), R. Shankar (IMSc), Ajay Sood (IISc), M. Sutherland (Cambridge, UK).

On the occasion there was also a Special Evening Lecture by T. Ramasami (Secretary, DST, Govt. of India) on *Fusion of Arts and Science : Case study of Mridangam.*

K S Krishnan was also a great populariser of science and was a selfless enthusiast who shared his scientific insights and knowledge liberally with young students from various colleges, even as a student and later as an young techer at Madurai and Chennai. To commemorate this aspect a popular talk on frontiers of quantum science by Professor Ajay Sood was organized. The venue for this popular lecture was the Madras Christian College, an Alma Mater of K S Krishnan.

4.4 Meeting on Modeling Infectious Diseases

A two-day meeting on "Modeling Infectious Diseases", supported by the IMSc Complex Systems Project, was held during September 4-6, 2006 at IMSc. About 40 participants – biologists, clinicians, public health specialists working on infectious diseases and scientists from a modeling background – attended this meeting. This workshop was planned mainly as an open-ended interaction between members of the clinical and public health community working on infectious diseases and members of the applied mathematics and theoretical physics community with a background in mathematical modelling. Its other purpose was to see if current ideas in complex systems research, network analysis and agent-based modeling might be useful in understanding aspects of the spread of infectious diseases.

The spreading of infectious diseases can be modeled at many levels of description, ranging from the single cell to the tissue, organism and society. Modelers distill, from this complexity, those components which admit a mathematical or computational description. An important component of the meeting was discussion sessions aimed at identifying the questions which could be addressed by modeling. Much was clarified in these discussions and we summarize their conclusions here: Micro-level and macro-level phenomena cannot be strictly compartmentalized, even though the principles governing the modeling may differ superficially. Biologists tend to see the underlying complexity in predicting infectious disease progression and may not necessarily make the distinction between what is less important and what is more important in terms of abstracting to simple models. In contrast, modelers tend to simplify matters first and then to construct models in which such simplifying assumptions are built in from the start. There is thus a need for continued interaction between these communities to reconcile these very diverse approaches; until a common language is developed, understood and assimilated by the interacting partners, fruitful collaborations are unlikely to emerge.

The other point made was that modelers require access to data to evaluate model predictions and make suggestions for data acquisition, but often have no idea where such data might be available. Data sharing requires, typically, a formalized arrangement between those who collect clinical and epidemiological data and users of such data, but the general feeling at the meeting was that negotiating such access for academic purposes would not be a problem. Material which relates to such data, describing the type of data available and listing persons who may be contacted in this regard, will be placed on the meeting web-site.

The talks at this meeting are listed below:

- B Raveendran (ILS, Bhubaneswar) Hygeine Hypothesis: Is the proof too far ?
- Vineeta Bal (NII, Delhi) Vaccines to prevent infectious diseases: Why do we have very few success stories?

- Debashish Chowdhury (IITK, Kanpur) Modelling Immune Response: Discrete and Continuum Approaches
- Bhaskar Saha (NCCS, Pune) Reciprocal signaling through CD40 induces counteractive effector functions
- Parongama Sen (U. of Calcutta, Kolkata) Spatial Models of Epidemics
- Gautam Menon (IMSC, Chennai) Using Agent-Based Models to study Epidemic Spreading
- Sitabhra Sinha (IMSc, Chennai) Excitable Media with Long-range connections: Modeling waves of epidemic spreading
- Niloy Ganguly (IITKGP, Kharagpur) Epidemic spreading on networks: A topographic view
- Somdatta Sinha (CCMB, Hyderabad) Parasite Invasion in Space: Modelling and Data Analysis
- Mohan D Gupte (NIE, Chennai) Epidemiological Modelling of (a) Leprosy and (b) HIV Sudeshna Sinha (IMSc, Chennai) Dynamic Transitions in a Model of Infection Spreading
- Aparup Das (NIMR, Delhi) Evolutionary Genomic Perspective of Malaria
- S S Manna (SNBNCBS, Kolkata) Disease Spreading in a Diffusive System
- Sunita Gakkhar (IIT Roorkee, Roorkee) Complex dynamical behavior in epidemiological systems

4.5 Annual Foundation School- (Part-I)

The Annual Foundation School (Part-I) is part of a series of schools in mathematics held at different levels in several Institutions and Universities by Advanced Training Schools, funded by the National Board for Higher Mathematics. The AFS is held in two parts, the first of which was held at IMSc during the month of December 2006. There were 33 registered participants of which 30 were out-station participants, from various parts of the country. There were nine courses, three in each of the brances: analysis, algebra, and, geometry and topology. Of the nine faculty members, seven of the faculty for the school were members of IMSc., and one each from Chennai Mathematical Institute, Siruseri, and Indian Institute of Technology-Madras. There were seven Unity of Mathematics Lectures, two each by Professors M. Ram Murty, K. H. Paranjape and R. Sridharan, and one by Prof. R. Balasubramanian.

As cultural part of the workshop, a vist of Mamallapuram was arranged. The Director hosted a dinner on the penultimate day of the School.

4.6 Subhashis Nag Memorial Endowment Lecture

The Subhashis Nag Memorial Endowment Lecture for the year 2006-07 was delivered by Professor M. S. Narasimhan. The title of his lecture was 'Conformal blocks and generalized theta functions'. The lecture was well attended by the academic members of the Institute as well as from neighbouring institutions. Professor Narasimhan was in residence at the Institute for two weeks and gave two seminar lectures on the same theme.

The Director hosted a lunch for all on the occasion of the Endowment lecture.

4.7 Instructional Workshop on Noncommutative Geometry

This was a two week instructional workshop. Speakers were P.S. Chakraborty, (4 lectures) Debashish Goswami, (6 lectures) Jerome Kaminker, (7 lectures) Amiya Mukherjee, (2 lectures) Arup Pal, (7 lectures) and V. S. Sunder (2 lectures). Number of participants were around 20.

4.8 ISEA Course on Security

This course is part of the Information Security Education and Awareness project being implemented by the Department of Information Technology, Government of India. The course was principally intended as a training programme for teachers and researchers at the National Institutes of Technology and other nodal centres identified by the DIT. The course, which ran for 4 weeks, consisted of 4 mini-courses, three of which covered fundamental concepts and techniques. The fourth was a set of special lectures on themes introduced in the basic courses. The mini-courses were on Cryptography, Systems and Applications Security and Security Protocols. The course featured 22 resource persons from 12 institutes in the country and had 31 teacher participants from 26 states.

4.9 Other Conferences/Workshops Organized by IMSc

4.9.1 FTAG V

The fifth annual meeting in a series of discussion meetings on Field Theoretic Aspects of Gravity was held at the Goa campus of Birla Institute of Technology and Science from 18th to 23rd December, 2006. It was jointly organized by the Institute of Mathematical Sciences (IMSc), Inter University Centre for Astronomy and Astrophysics (IUCAA) and BITS-Pilani Goa Campus. The aim of this series was to bring together researchers in the areas of Classical and Quantum Gravity, Cosmology and Field Theory. The informal lecture format and schedule will allowed free discussions and interventions by the participants. T R Govindarajan and Ghanshyam Date contributed in the National organising committee. It was attended by about 40 researchers from various Institutes and Universities in India.

4.10 Seminars

Mathematics

Date	Speaker Affiliation	Title
21-04-2006	Pratyusha Chattopadhyay IMSc	Serre's conjecture
26-04-2006	Preena Samuel IMSc	K_0 of Dedekind domains
27-04-2006	Sarbeswar Pal IMSc	Applications of the Riemann-Roch Theorem
09-05-2006	Animikh Biswas University of North Carolina at Charlotte, USA	Commutant lifting in univariate and multivariate setting
10-05-2006	S. C. Bagchi Indian Statistical Institute, Kolkata	Weak Paley-Wiener theorem and the Mackey Machine
26-05-2006	S. D. Adhikari Harish Chandra Institute, Allahabad	Sets of uniqueness of a distribution function of $\{\xi(p/q)^n\}$ and related questions.
21-06-2006	Vivek Dadu IIIT, Allahabad	Analysis of Quadratic Sieve Factorisation
14-07-2006	Gyan Prakash Harish Chandra Institute, Allahabad	Number of orbits of largest sum-free sets in certain finite abelian groups
17-07-2006	David Sinnou Institut de Mathematiques de Jussieu, Paris, France	Bounds for rational points on families of curves
17-07-2006	David Sinnou Institut de Mathematiques de Jussieu, Paris, France	Bounds for rational points on families of curves

10-08-2006	V S Sunder IMSc	Planar Algebras and (1+1)-dimensional TQFT's
17-08-2006	Arnaud Chadozeau Bordeaux, France	On the distribution of reduced residues: toward a new estimate for the Jacobsthal function
07-09-2006	Kapil Hari Paranjape IMSc	20th Century Mathematics: Linear Algebra
12-10-2006	Kapil Hari Paranjape IMSc	Sheaves and Topology
26-10-2006	V. S. Sunder IMSc	P.R. Halmos (1916-2006): my teacher, the best in the business
24-11-2006	Michel Waldschmidt Institut de Mathematiques de Jussieu, Paris, France	From classical arithmetics to information science: some applications of abstract research
28-11-2006	Pooja Singla IMSc	Zelevinsky's approach to the representations of the symmetric and finite general linear groups
30-11-2006	Pralay Chatterjee IMSc	n-th power maps on Lie groups and algebraic groups
14-12-2006	Changchang Xi Beijing Normal University, China	Finitistic dimensions of Artin algebras
15-12-2006	Changchang Xi Beijing Normal University, China	Standardly Stratified Algebras
19-12-2006	Ram Murty Queen's University, Canada	Logic and Number Theory
21-12-2006	Ram Murty Queen's University, Canada	The Sato-Tate Conjecture and Variations
22-12-2006	Ram Murty Queen's University, Canada	The Art of Research
09-01-2007	Maria-Christina Caputo MSRI, USA	A Highly Degenerate Curvature Flow

19-01-2007	Jerome Kaminker IUPUI	Noncommutative Geometry and Gap Labelling
30-01-2007	V. Lakshmibai Northeastern University, USA	Affine Schubert varieties
05-02-2007	Alladi Sitaram Indian Statistical Institute, Bangalore	Lectures on SL(2,R)
08-02-2007	Goutam Pal RCC-Institute of Information Technology	On sequences of positive integers containing no p terms in arithmetic progression
09-02-2007	Raghavan Narasimhan University of Chicago, Chicago, USA	The Levi problem for strongly pseudoconvex domains and applications to geometry
15-02-2007	Adam Koranyi CUNY, USA	Potential theory on Heisenberg type groups
16-02-2007	Alladi Sitaram Indian Statistical Institute, Bangalore	SL(2,R)
16-02-2007	Raghavan Narasimhan University of Chicago, Chicago, USA	The Levi problem for strongly pseudoconvex domains and applications to geometry
23-02-2007	Raghavan Narasimhan University of Chicago, Chicago, USA	The Levi problem for strongly pseudoconvex domains and applications to geometry
27-02-2007	Charles Vial ENS, Paris, France	Algebraic Groups and the topology of Lie groups
27-02-2007	Olivier Dudas ENS, Paris, France	Markov trace on Hecke algebras of type A
28-02-2007	Alladi Sitaram Indian Statistical Institute, Bangalore	SL(2,R) (the Plancherel formula for spherical functions)

02-03-2007	Raghavan Narasimhan University of Chicago, Chicago, USA	The Levi problem for strongly pseudoconvex domains and applications to geometry
15-03-2007	T.K.S. Moothathu University of Hyderabad, Hyderabad	Ellis Semigroup in Topological Dynamics
16-03-2007	Jayadev Athreya Yale University, USA	Billiard in polygons and Teichmuller theory
19-03-2007	R. Balasubramanian IMSc	Catalan's Conjecture
22-03-2007	Anirban Mukhopadhyay IMSc	Class number of quadratic fields
28-03-2007	Stephan Ruscheweyh Wuerzburg University, Germany	Universally Convex Univalent Functions
29-03-2007	S. Sundar IMSc	The maximal C^* qoutient of Temperley Lieb algebra,

Physics

Date	Speaker Affiliation	Title
3-4-2006	Vinu Lukose IMSc	Novel electric field effects on Landau levels in Graphene
5-4-2006	P.Boyko ITEP & MIPT, Moscow, Russia	Lattice Yang-Mills Topology Made Easy
7-4-2006	S.Kalyana Rama IMSc	A Stringy Correspondence Principle in Cosmology
10-4-2006	Subrata Bal DIAS, Dublin, Ireland	Dynamical Generation of Gauge Group in Matrix Model

12-4-2006	S.Boinepalli Adelaide University, Australia	Electromagnetic properties of baryons from Lattice QCD
13-4-2006	E.Harikumar Instituto de Fisica, Universidade de Sao Paulo, Brazil	Dirac operator on the q-deformed Fuzzy sphere and Its spectrum
21-4-2006	K.Narayan TIFR, Mumbai	Time dependent phenomena in string theory
26-4-2006	N.V.Suryanarayana Perimeter Institute, Waterloo, Canada	Single-charge extremal small black holes
2-5-2006	T.Senthil IISc, Bangalore	Deconfined quantum criticality
9-5-2006	A.Ghosal University of California, Los Angeles, USA	Toward Strong Interactions in Circular Quantum Dots: Correlation Induced Inhomogeneity
15-5-2006	P.Ramadevi IIT, Mumbai	Topological Strings, Matrix Models and Supersymmetric Gauge Theories
17-5-2006	V.E.Sacksteder IV S.N.Bose, Kolkatta	Approximate calculation of matrix functions in disordered systems
22-5-2006	V.Sundararajan Centre for Development of Advanced Computing, Pune	Evolving protein structures using genetic algorithms
21-6-2006	Vikram Vyas St. Stephen's College, Delhi	Large Time Behaviour of Super Wilson Loops in Planar QCD
30-6-2006	M.Gopalakrishnan Harish Chandra Institute, Allahabad	Fluctuations and response of a signaling module with feedback
12-7-2006	Sachin Vaidya CHEP, IISc, Bangalore	New effects in QED on noncommutative spaces
21-7-2006	Roberto Car Princeton University, USA	Kinetic theory of transport at the nanoscale

26-7-2006	Rajarshi Ray SINP, Kolkata	QCD Phase Transition: Model Confronts Lattice
2-8-2006	A.M.M.Pruisken University of Amsterdam, Netherlands	Localisation, interactions and superuniversality in the Quantum Hall Effect
7-8-2006	Siddhartha Lal ICTP, Italy	Towards an understanding of transport through junctions in quantum-Hall systems
9-8-2006	Naveen Surendran CHEP, IISc, Bangalore	Criticality in dimerised spin chains
14-8-2006	P.N.Pandita NEHU, Shillong	Neutrino Masses and Supersymmetry
21-8-2006	Anuradha Jagannathan Laboratoire de Physique des Solides, Orsay, France	Explorations in the world of two dimensional quantum antiferromagnets at absolute zero
22-8-2006	M.Muthukumar University of Massachusetts, Amherst, USA	Genome Packing: Chemical Sequence or Electrostatics?
23-8-2006	A.K.Chattopadhyay University of Padova, Italy	Immunological Synapse: a stochastic analysis
30-8-2006	P.Majumdar SINP, Kolkata	The mysterious warmth of black holes
1-9-2006	Ujjwal Sen ICFO-Institut de Ciencies Fotoniques, Barcelona, Spain	Distributed quantum information processing
6-9-2006	K.Sengupta SINP, Kolkata	Superfluid-Insulator transition of Bosons on Kagome lattice at non-integer filling
8-9-2006	Aditi Sen (De) ICFO-The Institute of Photonic Sciences, Barcelona, Spain	Cloning of entangled states: its applications in quantum cryptography

15-9-2006	Sanjay Siwach Seoul National University, Korea	Strings, Spacetime Singularities and Matrices
26-9-2006	R.Shankar IMSc	Exact Haldane Mapping at all S
13-10-2006	Rishikesh Vaidya TIFR, Mumbai	$bs + \gamma$ in Supersymmetry without R-parity
17-10-2006	Rishikesh Vaidya TIFR, Mumbai	Explorations in CP Violating Flavor Conserving and Flavor
25-10-2006	Subinay Dasgupta Universityof Calcutta, Kolkata	Critical Behaviour in Frustrated Quantum Ising Chain
31-10-2006	V.V.Sreedhar IIT, Kanpur	On the Topological Origin of
7-11-2006	Bernard Tamain France	Energy: what solutions for tomorrow?
28-11-2006	S.Mukerjee University of California, Berkeley, USA	Aspects of high temperature transport in strongly correlated systems
1-12-2006	A.Bansil Northeastern University, Boston, USA	Some Recent Correlation Induced Surprises with the Electronic Structures of the High Temperature Superconductors
7-12-2006	S.Kalyana Rama IMSc	A Principle to Determine the Number $(3 + 1)$ of Large Spacetime Dimensions
8-12-2006	S.Ananth AEI, Potsdam, Germany	Deformations of N=4 Yang-Mills and ultra-violet finiteness
12-12-2006	K.Damle TIFR, Mumbai	Spin-nematics and magnetization plateau in anisotropic $S = 1$ magnets on the Kagome lattice
15-12-2006	Arunava Sen Indian Statistical Institute, Delhi	How Should We Design Voting Systems and Auction Mechanisms?

29-12-2006	Laxmi Parida IBM TJ Watson Research Center	Permutations in Bioinformatics
4-1-2007	Shivakumar Jolad Penn State University, USA	Electron operator at the edge of the 1/3 fractional quantum Hall liquid
5-1-2007	Nemani V. Suryanarayana Imperial College, London, UK	Towards Counting Microstates of AdS Black Holes
10-1-2007	C. Burden Centre for Bioinformation Sciences, The Australian National University, Australia	Anisotropic thermal motions of atoms in protein molecules
11-1-2007	Sumithra Sankararaman	Formation and Interaction of Loops on DNA
12-1-2007	Piotr Decowski Smith College, USA	How strange is the proton?
12-1-2007	Nalini Easwar Smith College, USA	Force-velocity correlations in a dense, collisional, granular flow
12-1-2007	Malgorzata Pfabe Smith College, USA	Isospin Equilibration in Heavy Ion Reactions
16-1-2007	Madhav Ranganathan Institute for Non-equilibrium Phenomena, Marseilles, France	Dynamics of Steps on Crystal Surfaces: Theory and Experiment
18-1-2007	Ivan Andric Theoretical Physics Division, Rudjer Boskovic Institute, Zagreb, Croatia.	Matrix Models Dualities in the Collective-Field Formulation
22-1-2007	P.A.Sundararajan MIT, USA	Numerical evolution of black hole perturbations
23-1-2007	K.Subramanian IUCAA, Pune	Magnetogenesis in the Universityrse
24-1-2007	Rupamanjari Ghosh JNU, New Delhi	Dynamics of open quantum systems

29-1-2007	Smitha Vishveshwara University of Illinois at Urbana Champaign, USA	Probing fractional statistics in quantum Hall systems: Anyon there?
31-1-2007	P.Narayana Swamy Southern Illinois University, USA	Gravitational Heisenberg relation and Harmonic Oscillator
2-2-2007	Subrata Pal University of Hyderabad, Hyderabad	Have we discovered QGP at RHIC?
5-2-2007	Amit Apte University of North Carolina at Chapel Hill, USA	A Bayesian approach to data assimilation
12-2-2007	Michael L. Klein University of Pennsylvania, USA	Nothing amuses more harmlessly than computation ...
14-2-2007	L.Stodolsky Max-Planck-Institut for Physik, Munchen, Germany	Bursts from Early Universityrse
15-2-2007	Govind S Krishnaswami Utrecht University, Netherlands	Naturalness and a line of fixed points in a 4d O(N) scalar field model
16-2-2007	Carlo Albert Institute for Theoretical Physics, ETH Zurich	Batalin-Vilkovisky Quantization, Homogeneous Spaces and Chern-Simons theory
19-2-2007	Govind S Krishnaswami Utrecht University, Netherlands	The baryon in 2 dimensional QCD
21-2-2007	Alain Pumir Institut Non Lineaire de Nice, CNRS, Valbonne, France	Nonlinear Dynamics of the Single Photon Response in Invertebrate Photoreceptors
22-2-2007	R.Srianand IUCAA, Pune	Constraining the variation of fundamental constants using QSO absorption lines
5-3-2007	A.Gopakumar Theoretisch-Physikalisches Institut, Jena, Germany	Inspiral dynamics of compact binaries: its applications and

6-3-2007	Pushan Majumdar Muenster University, Germany	Gluonic flux tubes - Effective string theories?
7-3-2007	P.Padma Kumar University of Illinois, Urbana-Champaign, USA	Atomistic Simulation of Thermally Activated Processes Employing Molecular Dynamics and Metadynamics Technique
12-3-2007	Arijit Bhattacharyay INFM Padova, Italy	Modeling active motion in living systems
20-3-2007	Ferdinand Evers Institute for Nano-technology, Forschungszentrum Karlsruhe, Germany	Multifractality at conventional and unconventional Anderson transitions
26-3-2007	Apu Sarkar VECC, Kolkata	Time Series Analysis of Complex Systems
27-3-2007	R.Nityananda NCRA, Pune	Radio astronomy in the twenty first century
27-3-2007	George K. Miley Leiden University, Netherlands	Radio sources as probes of the early Universityrse

Theoretical Computer Science

Date	Speaker Affiliation	Title
20-04-2006	Paritosh K. Pandya TIFR, Mumbai	Model Checking Interval Duration Logic
21-04-2006	Paritosh K. Pandya TIFR, Mumbai	ComputerVaadan: On Computer Analysis and Synthesis of Indian Music
02-05-2006	Meena Mahajan IMSc	On the Bipartite Unique Perfect Matching Problem
05-05-2006	Pushkar Joglekar IMSc	Finding isomorphisms between finite fields

09-05-2006	N. R. Aravind IMSc	Divisors in Residue Classes, Constructively
10-05-2006	Saket Saurabh IMSc	Triangles, 4-cycles and Parameterized (In-)Tractability
23-06-2006	N.S. Narayanaswamy IIT-Madras	K-tree characterizing integer sequences
28-06-2006	Hemangee K. Kapoor IIT, Guwahati	Formal Modelling and Verification of an Asynchronous DLX Pipeline
12-07-2006	N. Narayanan IMSc	Optimal Acyclic Edge Colouring of Grid-like Graphs
08-08-2006	Pushkar Joglekar IMSc	Deterministic Complexity of Polynomial Factorization over Finite Fields (Survey)
10-08-2006	Raghav Kulkarni University of Chicago, Chicago, USA	Determinant, Trees, Matchings, Permanent and Their Planar Restrictions
11-08-2006	Somnath Sikdar IMSc	Parameterized Complexity of the Induced Subgraph Problem
16-08-2006	N. R. Aravind IMSc	The Distribution of Carmichael Numbers
17-08-2006	Manoj M Prabhakaran University of Illinois at Urbana-Champaign, USA	Zero-Knowledge Proofs
24-08-2006	Jayalal Sarma IMSc	Complexity of Optimizing Matrix Rank (survey)
03-11-2006	Gautham S. IMSc	Cryptanalysis of Py, Py6, Pypy, Pypy6 and TSC-4 - Stream Ciphers based on Random Shuffle
27-11-2006	Kamal Lodaya IMSc	Collecting garbage concurrently (but correctly)

11-12-2006	Sanjukta Bhowmick Penn State University, USA	Evolution of Scientific Computing Algorithms—The Synergy with Computer Science
13-12-2006	Pavol Hell Simon Fraser University, Canada	Generalized Colourings with Emphasis on Forbidden Subgraph
14-12-2006	Piyush Kurur IIT-Kanpur	Complexity upper bounds using permutation group theory
22-12-2006	Sunil Chandran IISc, Bangalore	Boxicity and maximum degree
26-12-2006	Bruno Courcelle LaBRI, France	Graph structuring and Monadic Second-order logic
27-12-2006	Bruno Courcelle LaBRI, France	Graph structuring and Monadic Second-order logic
27-12-2006	Venkatesan Guruswami University of Washington, USA.	List Decoding with Optimal Rate: Folded Reed-Solomon Codes
28-12-2006	Mike Fellows Universityof New Castle, Australia	Bounded treewidth – a new trick
12-01-2007	Joseph Halpern Cornell University, USA	Computer Science Meets Game Theory: Robust Mechanisms for Implementing Mediators with Cheap Talk
23-01-2007	Sathish Govindarajan Max Planck Institute fur Informatik, Saarbrucken, Germany	Conflict-Free Coloring for Rectangle Ranges
06-02-2007	B V Raghavendra Rao IMSc	Arithmetizing classes around NC^1 and L
12-02-2007	Madhusudan Parthasarathy University of Illinois at Urbana-Champaign, USA	Learning algorithms and formal verification

19-02-2007	Hannes Moser Friedrich-Schiller Universityrsitaet Jena, Germany	Parameterized Complexity of Finding Regular Induced Subgraphs
23-02-2007	Rama Murthy IIIT, Hyderabad	Multi-dimensional neural networks
26-02-2007	Eugen Zalinescu LORIA, France	From passive to active security via a simple transformation
27-02-2007	H Venkateswaran Georgia Institute of Technology, USA	Towards derandomization of probabilistic auxiliary pushdown automata classes
23-03-2007	Johannes Koebler Humboldt University, Berlin, Germany	A General Dimension for Query Learning and Applications

Chapter 5

External Interactions

5.1 Collaborative Projects with Other Institutions

5.1.1 India-based Neutrino Observatory

The INO proposal is currently with the Government of India and included in the Mega Science Project proposals. The project is awaiting approval. 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 two full time project members N.S. Sreenivasan and D.V. Ramakrishna are involved in the INO group activities at IMSc.

The activities of the Engineering Task Force (ETF) are being 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, is overseeing the preparation of the INO site related Detailed Project Report (DPR). The draft of the DPR has been submitted by TNEB which was entrusted with the task of preparation of DPR. Simultaneously an Environmental Impact Assessment (EIA) has also been prepared by the Salim Ali Centre for Ornithology and Natural History(SACON).

The IMSc group is also involved in analysing the Physics and Simulation issues 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 are taking active part in outreach activities, by 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.

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

This is a joint project with 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?

5.1.3 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.

5.1.4 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:

[tex4ht] A system for developing hypertext documents using TeX and LaTeX.

[elvis] An editor that is similar to `vi` but has many more features.

[par] An intelligent paragraph formatter.

[pngcrush] A program that reduces the size of `png` graphics files without losing graphic information.

[swish++] A file indexing and searching system.

5.1.5 The Mechanics of Living Matter

This is a joint project with Sriram Ramaswamy (IISc, Bangalore), Jacques Prost (Institut Curie, Paris), J.-F Joanny (ESPCI, Paris), Madan Rao (RRI and NCBS, Bangalore), Yashodhan Hatwalne (RRI, Bangalore) and David Lacoste (ESPCI, Paris), and is funded by the Indo-French Centre for the Promotion of Advanced Research (CEFIPRA). The project will focus 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.

5.1.6 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.

Associates who visited the institute during the period 01.04.06 to 31.03.07 are :

Swarup Poria
Midnapore College, Midnapore, West Bengal
17.05.2006 to 30.06.2006 28.09.2006 to 02.11.2006

M.K.Parida
Dept. of Physics, Tezpur University, Tezpur - 784028
30.11.2006 to 07.12.2006

Subinay Das Gupts
Dept. of Physics, University of Calcutta, Kolkatta
04.10.2006 to 30.10.2006

G.S.Khadekar
Dept. of Mathematics, RTM Nagpur University, Nagpur
25.05.2006 to 05.06.2006

P.N.Pandita
Dept. of Physics, NEHU, Schillong
01.08.2006 to 17.08.2006 22.01.2007 to 24.02.2007

Dibyendu Das
Dept. of Physics, I.I.T. Bombay, Mumbai
03.12.2006 to 24.12.2006

Ramandeep S.Johal
Dept. of Physics, Luallpur Khalsa College, Jalandhar
12.05.2006 to 05.06.2006 12.12.2006 to 03.01.2007

Ujjal Debnath
Department of Mathematics, Bengal Engineering Science University, Shibpur, Howrah
12.12.2006 to 04.01.2007

5.3 Conference Participation and Visits to Other Institutions

Arvind, V.

Participated in *17th Intl Symposium on Algorithms, Automata and Computation, ISAAC 2006.* held in Kolkata, India, during Dec 18 – Dec 20, 2006.

Balakrishnan, Radha

Participated in *K. S. Krishnan Discussion Meeting on Frontiers in Quantum Science* held at IMSc, Chennai during Dec 13 – Dec 14, 2006. Chaired a session.

Visited George Mason University, Fairfax, U. S. A. during Mar 5 – Mar 26, 2007. Research Collaboration.

Balasubramanian, R.

Visited university of Lille during Aug 1 – Aug 7, 2006.

Participated in *International Congress of Mathematicians* held at Madrid , Spain during Aug 20 – Aug 30, 2006.

Participated in *Workshop on Perspectives and future prospects in Higher Mathematics* held at National Institute for advanced studies , Bangalore during Oct 25 – Oct 26, 2006. Gave a lecture on in the panel discussion on Research and Devolopement in Pure Mathematics

Participated in *Number Theory Conference* held at Allahabad during Dec 1 – Dec 3, 2006.

Participated in *Number Theory Conference* held at Allahabad during Feb 15 – Feb 17, 2007.

Baoulina, Ioulia

Visited Harish-Chandra Research Institute, Allahabad during Apr 10 – May 10, 2006. Gave a lecture.

Participated in *International conference "Analytical and combinatorial methods in Number Theory and Geometry"* held at Moscow State University, Moscow, Russia during May 25 – May 31, 2006. Gave a talk.

Participated in *21st Annual Conference of the Ramanujan Mathematical Society* held at University of Hyderabad during Jul 3 – Jul 8, 2006. Presented a paper.

Participated in *India-UK Conference in Number Theory* held at Institute of Mathematical Sciences, Chennai during Sep 18 – Sep 23, 2006.

Participated in *International Conference on Number Theory* held at Harish-Chandra Research Institute, Allahabad during Dec 1 – Dec 5, 2006. Gave a talk.

Participated in *International Conference on Number Theory and Applications* held at Ramakrishna Mission Vivekananda College, Chennai during Dec 27 – Dec 29, 2006. Gave a talk.

Participated in *International Conference on Number Theory and Cryptography* held at Harish-Chandra Research Institute, Allahabad during Feb 23 – Feb 27, 2007.

Basu, Rahul

Visited LAPTH, Annecy France during Jul 10 – Jul 26, 2006. Collaborative Work

Visited NIKHEF,Theory Group, Amsterdam, The Netherlands during Jul 27 – Aug 1, 2006.

Participated in *SERC Preparatory School in High Energy Physics* held at CHEP, IISc Bangalore during Oct 30 – Nov 18, 2006. Delivered 12 lectures on Particle Physics and Standard Model

Participated in *SERC School in QGP and Hadronic Physics (Part of Nuclear Physics SERC School)* held at IOP, Bhubaneswar during Dec 21, 2006 – Jan 9, 2007. Delivered 12 lectures on Quantum Field Theory

Chakraborty, Partha S.

Participated in *International Congress of Mathematicians* held at Madrid, Spain during Aug 21 – Aug 30, 2006.

Participated in *Kalyan Sinha Conference* held at Indian Statistical Institute, New Delhi during Dec 5 – Dec 6, 2006. Invited participant, gave a talk

Visited TIFR, Bombay during Jan 20 – Jan 26, 2007. Attending talks by Prof. Alain Connes

Participated in *National Seminar on Recent Advances in Mathematics* held at Periyar University, Salem during Mar 12 – Mar 13, 2007. Invited speaker, gave a talk

Visited Indian Statistical Institute, Bangalore during Mar 26 – Mar 28, 2007. Gave a talk

Das, Prasanta K.

Visited Saha Institute of Nuclear Physics, S.N.Bose center for Theoretical Physics, ISI, Kolkata and IOP, Bhubaneswar. during Nov 20 – Dec 5, 2006, as a TPSC speaker.

Date, G.

Visited Inter University Centre for Astronomy and Astrophysics, Pune during May 3 – May 30, 2006.

Participated in *Amal Kumar Raychaudhuri School on GR* held at Indian Association for Cultivation of Science, Kolkata during Oct 16 – Oct 20, 2006. Gave a course of eight lectures on Loop Quantum Gravity/Cosmology.

Participated in *The 24th IAGRG Meeting* held at Centre for Theoretical Physics, Jamia Millia Islamia, New Delhi during Feb 5 – Feb 8, 2007. Gave an invited talk on *Singularity Resolution in Isotropic Loop Quantum Cosmology: Recent Developments.*

Govindarajan, T. R.

Visited Albert Einstein Institute for Gravitational Physics, Potsdam, Germany during Feb 26 – Jun 30, 2006. Research Collaboration, sabbatical, seminars

Participated in *Bayrisczhell Workshop on Noncommutative geometry,* held at Bayrischzell, Munich, Germany during Apr 21 – Apr 25, 2006. Discussions

Visited University of Wroclaw during May 23 – May 28, 2006. Seminar on Twist symmetries of QFT's in noncommutative spaces

Visited Dublin Institute of Advanced Studies, Ireland during Jun 4 – Jun 10, 2006. Seminar, Workshop

Participated in *XVII DAE-BRNS HEP SYMPOSIUM* held at Kahragpur IIT during Dec 10 – Dec 15, 2006. Invited speaker

Participated in *Field Theoretic Aspects of Gravity* held at BITS, Goa during Dec 18 – Dec 23, 2006. Organiser, Speaker

Participated in *Workshop on Phenomenology of Noncommutative field theories* held at IMSc, Chennai during Dec 26 – Dec 30, 2006. speaker, organiser

Indumathi, D.

Participated in *COSPA 2006* held at Taipei, Taiwan during Nov 15 – Nov 17, 2006. Gave an invited talk on "Status Update of India-based Neutrino Observatory"

Participated in *DAE-HEP Symposium* held at IIT, Kharagpur during Dec 11 – Dec 15, 2006. Gave an invited talk on India-based Neutrino Observatory

Jayalal Sarma, M.N.

Participated in *Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2006)* held at Indian Statistical Institute Kolkata, INDIA during Dec 13 – Dec 15, 2006.

Participated in *Workshop on Recent Advances in Approximation Algorithms* held at Indian Statistical Institute Kolkata, INDIA on Dec 16, 2006.

Participated in *Sixth Annual Inter Research Institute Student Seminar in Computer Science (IRISS 2007)* held at International Institute of Information Technology, Hyderabad during Jan 4 – Jan 5, 2007.

Participated in *Annual Technical Symposium by Microsoft Research India (TechVista 2006)* held at JN Tata Auditorium, Indian Institute of Science, Bangalore on Jan 23, 2007.

Kesavan, S.

Visited Vel Tech Engineering College on Apr 29, 2006. Delivered the inaugural address to launch their mathematics association.

Participated in *General Assembly of the International Mathematical Union* held at Santiago de Compostela, Spain during Aug 18 – Aug 19, 2006. Went as part of the official Indian delegation sent by the Indian National Science Academy and presented India's bid to hold the ICM,2010 at Hyderabad.

Participated in *International Congress of Mathematicians (ICM), 2006* held at Madrid, Spain during Aug 22 – Aug 30, 2006.

Participated in *workshop on Linear Algebra and Analysis* held at University of Hyderabad. during Sep 16 – Sep 17, 2006. Delivered two invited talks.

Participated in *Refresher Course on Differential Equations* held at University of Madras on Nov 3, 2006. Delivered inaugural and keynote address.

Participated in *Refresher Course on Differential Equations* held at University of Madras during Nov 20 – Nov 21, 2006. Delivered four invited lectures.

Participated in *Third Annual Foundational School, Part I* held at IMSc. during Dec 4 – Dec 30, 2006. Delivered seven invited lectures.

Participated in *Workshop on Harmonic Analysis* held at IIT, Madras on Jan 4, 2007. Delivered an invited talk.

Participated in *International Symposium on Nonlinear Analysis* held at IIT, Madras during Jan 6 – Jan 7, 2007. Delivered a plenary lecture.

Participated in *International Symposium on Harmonic Analysis, Wavelets and PDE* held at IIT, Madras on Jan 8, 2007. Delivered an invited talk.

Participated in *National Conference on Analysis and Graph Theory* held at Barathidasan university, Tiruchirappalli during Mar 9 – Mar 10, 2007. Delivered a plenary lecture.

Visited Institute of Physics, Bhubaneswar during Mar 21 – Mar 22, 2007. To plan the curriculum for the undergraduate programme of NISER.

Krishna, M.

Visited Department of Mathematics, McMaster University, Hamilton, Canada during Apr 1 – Apr 19, 2006. Gave two talks and interacted with faculty and students. The titles of talks are "Spectral theory of random operators" and "Volume-Price relation and consequences in stock markets"

Visited Department of Mathematics Rurh University Bochum, Bochum, Germany during Sep 5 – Sep 9, 2006. Worked with Prof W Kirsch on a question relating to the density of states.

Participated in *"Spectral and scattering theory" (Demuth Festschrift)* held at Department of Mathematics Technical University of Clausthal Clausthal-Zellerfeld Germany during Sep 10 – Sep 11, 2006. Gave a talk on "Continuity of integrated density of states"

Participated in *Analysis, Geometry and Probability (conf in honour of Prof K B Sinha)* held at Indian Statistical Institute New Delhi during Dec 5 – Dec 6, 2006. Gave a talk on "Wavelet transform and its uses for random operators."

Participated in *Spectral Theory of Random Operators and Related Fields in Probability Theory - (Kotani Festschrift)* held at Department of Mathematics, Kyoto University, Kyoto Japan during Dec 11 – Dec 15, 2006. Gave a talk on "Averages of spectral measures for random operators".

Lodaya, Kamal

Participated in *5th formal methods update* held at IIT Guwahati during Jul 3 – Jul 6, 2006. Talk on "Logical characterization of pushdown and automatic graphs."

Participated in *Special Seminar of the Calcutta Logic Circle* held at Jadavpur University during Jul 7 – Jul 9, 2006. Talk on "What is the logic of Google?"

Visited Dept of CIS, University of Hyderabad on Sep 7, 2006. Talk on "A dose of temporal logics".

Participated in *4th SEFM* held at Pune during Sep 13 – Sep 15, 2006. Presented a paper on "Product automata and process algebra."

Participated in *26th FSTTCS* held at Kolkata during Dec 11 – Dec 15, 2006. Gave a talk in the *Workshop on Advances and Issues in Timed Systems*.

Participated in *Logic, navya-nyāya and applications* held at Kolkata during Jan 3 – Jan 7, 2007. Gave a talk on "An informatic history of first order time".

Visited TIFR, Mumbai during Feb 6 – Feb 28, 2007. Gave three talks on "Jewels of regular languages".

Visited IIT Bombay on Feb 14, 2007. Talk on "Starfree languages".

Participated in *Perspectives on science, technology and development* held at Mumbai during Mar 1 – Mar 3, 2007.

Participated in *Workshop on Models of embedded computation* held at Banasthali Vidyapith during Mar 15 – Mar 19, 2007. Gave two talks on "Timed and hybrid automata".

Mahajan, Meena B.

Participated in *National Conference on Mathematical Foundations of Coding, Complexity, Computation and Crytpography* held at Dept of Math, IISc, Bangalore. during Jul 20 – Jul 22, 2006. Gave an invited talk titled "Computability and Complexity Theory: An Introduction"

Visited Max-Planck Institute für Informatik, Saarbrücken, Germany during Nov 1 – Nov 7, 2006. Gave a talk titled "The complexity of changing matrix rank"

Participated in *Dagstuhl Research Seminar on Circuits, Logic and Games* held at Schloss Dagstuhl, Saarland, Germany during Nov 8 – Nov 10, 2006. Gave a talk titled "Some classes between NC^1 and LogCFL".

Participated in *2nd National Frontiers of Science Symposium* held at INSA, New Delhi during Dec 3 – Dec 4, 2006.

Visited Microsoft Research, India during Mar 20 – Mar 22, 2007.

Majumdar, Kaushik K.

Visited University of Oregon during Apr 1 – Aug 31, 2006. Research

Visited Columbia University during Jul 31 – Aug 2, 2006. Invited Lecture

Visited Indian Statistical Institute, Calcutta on Oct 22, 2006. Invited Lecture

Mandal, Saptarshi

Participated in *SERC School on Condensed matter and Material Physics* held at University of Hyderabad during Nov 13 – Dec 9, 2006.

Participated in *Condensed Matter Rsearch: Magnetic Material, an one day workshop organised by INSA and Hungarian Academy of Sciences* held at Hyderabad University on Dec 4, 2006. Prsented a Poster.

Maruthi Pradeep Kanth, J.

Participated in *Appreciating Physics in Everyday Life* held at IMSc, Chennai during Aug 26 – Aug 27, 2006.

Participated in *School on "Understanding Molecular Simulations"*

held at Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore. during Jan 22 – Jan 27, 2007.

Participated in *Conference on "Nucleation, Aggregation and Growth"* held at Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore. during Jan 29 – Jan 31, 2007.

Menon, Gautam I.

Participated in *Systems Biology: New Initiatives and Perspectives* held at Manesar, Haryana during Apr 3 – Apr 5, 2006.

Participated in *Workshop on Driven States in Soft and Biological Matter* held at ICTP, Trieste during Apr 18 – Apr 28, 2006. Workshop Director, jointly with Madan Rao, Sriram Ramaswamy and Jacques Prost

Visited Max Planck Institute for Complex Systems. Dresden during Jun 25 – Jul 3, 2006. Presented a seminar on "Statistical Mechanics of DNA Cyclization"

Participated in *11th International Vortex Workshop* held at Wroclaw, Poland during Jul 4 – Jul 9, 2006. Chaired session on "The Depinning Transition" and presented a poster.

Participated in *Appreciating Physics in Everyday Life* held at IMSc, Chennai during Aug 26 – Aug 27, 2006. Popular Talk on "How Things Flow"

Participated in *Modeling Infectious Diseases* held at IMSc, Chennai during Sep 4 – Sep 6, 2006. Invited Talk on "Using Agent-Based Models to study Epidemic Spreading"

Visited S.N. Bose National Centre for Basic Sciences, Kolkata during Sep 14 – Sep 19, 2006. Delivered a Colloquium on "Machines at the Molecular Scale" and a talk on "Cyclization of Short Double-Stranded DNA Molecules"

Participated in *SERC School on Condensed Matter Physics* held at Central University, Hyderabad during Nov 13 – Dec 9, 2006. Delivered a set of 4 lectures on "Disordered Magnetic Systems and Disordered Superconductors"

Participated in *National Frontiers of Science* held at INSA, New Delhi during Dec 3 – Dec 4, 2006. Invited Talk on "Vortex Lines in Superconductors: Why are they interesting?"

Participated in *Statphys - Kolkata VI* held at Ffort Radisson, Raichak during Jan 5 – Jan 9, 2007. Invited talk on "Surface Melting of the Vortex Lattice"

Participated in *Indo-US Symposium on the Frontiers of Science* held at Beckman Centre of the National Academies of Science, Irvine, USA during Jan 18 – Jan 20, 2007. Joint Organizer of the Physics, Astronomy and Astrophysics session

Visited TRIUMF, University of British Columbia during Jan 22 – Jan 30, 2007. Visitor to the group of Jess Brewer. Gave a seminar on "DNA Looping" at TRIUMF and another on "Correlations in Glassy Vortex States" at the University of British Columbia, Vancouver

Visited University of Waterloo, Canada during Jan 30 – Feb 3, 2007. Visited the group of Michel Gingras at the University of Waterloo. Presented two seminars on " Loop Formation in a model for short DNA Molecules"and "Correlations in Glassy Vortex States".

Participated in *Trends in Computational Materials Science* held at CCMS, JNCASR, Bangalore during Feb 15 – Feb 17, 2007. Invited talk on "Unusual Phases of Driven Disordered Systems and their Experimental Implications"

Participated in *Assembly, Organization and Propulsion in Complex Systems* held at IIT, Chennai during Feb 22 – Feb 24, 2007. Chaired a session on "Active Fluids". Member of the Advisory Committee

Participated in *Physics Program for Mysore University students* held at IMSc, Chennai on Mar 17, 2007. Popular Talk on "Molecular Machines"

Mishra, Ashok K.

Visited Harish Chandra Research Institute, Allahabad during Apr 17 – Apr 28, 2006. Delivered talks on 'Metal - Insulator transition in an adsorbed layer at elctrochemical interface' and 'Orthofermi quantum statistics and its application to the infinite U Hubbard model'.

Mukhopadhyay, Anirban

Participated in *International Conference on Number Theory* held at Harish-Chandra Research Institute, Allahabad during Dec 1 – Dec 5, 2006. Talked on "Class groups of quadratic fields"

Participated in *Conference on number theory* held at Vivekananda College, Chennai during Dec 27 – Dec 29, 2006. Talked on "Distribution of zeros of zeta function"

Participated in *Conference on number theory* held at University of Mumbai, Mumbai during Jan 17 – Jan 18, 2007. talked on "Class groups on quadratic fields"

Murthy, M.V.N.

Visited IGCAR, Kalpakkam on Jul 1, 2006. Summer training program in Physics and Chemistry: Two lectures on Classical Dynamics.

Visited Institute of Mathematical Sciences on Aug 26, 2006. Appreciating Physics in Everyday Life (APEL): Delivered a lecture on "Powering the Sun".

Visited Department of Physics, University of Mysore during Sep 29 – Oct 10, 2006. Delivered a set of lectures on Introduction to Quantum Physics, V semester students.

Visited Department of Physics, University of Mysore during Sep 29 – Oct 10, 2006. Delivered a lecture on "A physicist's view of number partitions".

Visited Tamil Nadu Science Forum (TNSF, Kalpakkam) on Dec 26, 2006. Delivered a two lectures on the "Evolution of Quantum Physics".

Nagaraj, D. S.

Visited Alggappa University, Karaikudi. during May 22 – May 23, 2006. Guest lecturer at the summer school in Algebra for P.G. students and Research Scholars. Gave four lectures on Algebra.

Visited University of Lille during Jun 1 – Jun 30, 2006. Vector bundles generated by sections are considered and the morphism that they induce to Grasmaniann's are studied. Gave a talk titled "Vector bundle generated by sections and morphism to Grassmaniann"

Participated in *International conference on Algebraic Geometry* held at Tata Institute of Fundamental Research, Mumbai during Aug 14 – Aug 16, 2006. Gave invited talk titled "Vector Bundles Generated by sections and Morphisms to Grassmanian"

Visited University of Lille and Univesity of D'Artois, France. during Dec 27, 2006 – Mar 1, 2007. Some new proofs of some old results of vanishing theorems along with some new results are obtained. Morphisms from projective plane and three space to Grassmaniann $Gr(2, 4)$ were studied. Gave two talks.

Pan, Raj K.

Participated in *SFI Complex Systems Summer School* held at Beijing, China during Jul 9 – Aug 4, 2006.

Participated in *European Conference on Complex Systems 2006 (ECCS '06)* held at Said Business School, University of Oxford, UK during Sep 25 – Sep 29, 2006. Presented talk on "Role of modular and hierarchical structure in making networks dynamically stable".

Participated in *STATPHYS-KOLKATA VI, International conferences on Statistical Physics* held at Ffort Radisson Resort, Raichak, India during Jan 5 – Jan 9, 2007. Presented poster on "Modular networks emerge from multi-constraint optimization".

Paranjape, Kapil H.

Participated in *Conference on Algebraic Geometry in honour of Vikram Mehta* held at TIFR, Mumbai during Aug 14 – Aug 16, 2006. Gave an invited talk on "Some restrictions on the Betti numbers of Algebraic Varieties".

Participated in *Internation Congress of Mathematicians* held at Madrid, Spain during Aug 22 – Aug 30, 2006, as NBHM delegate.

Prasad, Amritanshu

Visited the Australian National University in Canberra, Australia during Sep 20 – Oct 16, 2006. Carried out research collaboration with Amnon Neeman and Uri Onn.

Participated in *the 50th Annual meeting of the Australian Mathematical Society* held at Macquarie University, Sydney, Australia, during Sep 25 – Sep 29, 2006. Gave a lecture titled 'towards Schubert varieties for general linear groups over local rings'.

Participated in *the ISI workshop on group theory (classification of reductive algebraic groups)* held at Indian Statistical Institute, Bangalore during Dec 18, 2006 – Jan 5, 2007. Taught a course.

Visited the Tata Institute of Fundamental Research, Mumbai. during Jan 15 – Jan 23, 2007. Discussed research with Arvind Nair, gave seminars on Higher Level Green Correspondence for Cuspidal Representations, and on Brauer's theorem on the number of irreducible representations of a finite group over a field of positive characteristic.

Raghavan, K. N.

Visited International Centre for Theoretical Physics, Trieste, Italy during Apr 1 – Jun 25, 2006, as Regular Associate

Visited Department of Mathematics, University of Genova during Apr 11 – Apr 13, 2006. Gave a talk "On a certain ring of polynomial invariants"

Participated in *Annual Conference of the Ramanujan Mathematical Society* held at University of Hyderabad, Hyderabad during Jul 5 – Jul 8, 2006.

Participated in *International Conference on Algebraic Geometry* held at Tata Institute of Fundamental Research, Mumbai during Aug 14 – Aug 16, 2006.

Visited Indian Statistical Institute, Bangalore during Oct 9 – Oct 10, 2006. Preparing for ISI Group Theory Workshop in December-January

Participated in *Advanced Foundational School* held at Institute of Mathematical Sciences, Chennai during Dec 11 – Dec 15, 2006, as resource person

Participated in *ISI Workshop on Group Theory* held at Indian Statistical Institute, Bangalore during Dec 18, 2006 – Jan 5, 2007, as resource person

Rajasekaran, G.

Visited Chennai Mathematical Insitute during Apr 1, 2006 – Mar 31, 2007. Visited CMI many times during the year and helped running the Physics UG teaching proramme.

Participated in *DAE-DST Workshop on Road Map for High Energy Physics and Nuclear Physics* held at Homi Bhabha Centre for Science Education, Mumbai during Apr 7 – Apr 8, 2006. Chaired a Session and also talked on two topics: 1.Road Map for HEP 2.Human Resource Development for Basic Science Projects in India

Visited Saha Institute of Nuclear Physics, Kolkata on Jul 3, 2006. Attended INO Meeting

Visited Tata Institute of Fundamental Research, Mumbai on Aug 6, 2006. Attended INO Meeting

Visited Banares Hindu University during Aug 26 – Aug 29, 2006. Gave two lectures on "Recent Discoveries in Neutrino Physics" and a lecture entitled "Is there a Final Theory?"

Visited Inter-University Centre for Astronomy and Astrophysics, Pune during Sep 26 – Sep 28, 2006. Attended the Governing Board Meeting and also had discussions with IUCAA members on their research and teaching programmes.

Visited Saha Institute of Nuclear Physics, Kolkata on Oct 19, 2006. Attended INO Meeting

Visited University of Mysore during Nov 7 – Nov 14, 2006. Gave a course of 15 lectures on Quantum Mechanics to the Integrated MSc students.

Participated in *XVII High Energy Physics Symposium* held at Indian Institute of Technology, Kharagpur during Dec 11 – Dec 15, 2006. Gave a Keynote Address

Participated in *Fifth Meeting on Field Theoretic Aspects of Gravity* held at Birla Institute of Technology, Goa during Dec 18 – Dec 23, 2006. Gave a talk on "Induced QCD and Induced Gravity"

Participated in *Workshop on the Phenomenology of Noncommutative Quantum Field Theories* held at IMSc during Dec 25 – Dec 28, 2006. Gave a talk entitled "Quantum Statistics in Noncommutative Quantum Field Theory"

Participated in *International Workshop on Weak Interactions and Neutrinos (WIN 07)* held at Saha Institute of Nuclear Physics, Kolkata during Jan 15 – Jan 20, 2007. Member of the International Advisory Committee for the Workshop; chaired a Session; a paper was presented by one of my collaborators

Rajesh, R.

Participated in *Non-equilibrium statistical mechanics & turbulence* held at University of Warwick, UK during Jul 15 – Jul 21, 2006. Gave a talk

Participated in *STATPHYS-KOLKATA VI* held at Kolkatta during Jan 5 – Jan 9, 2007. Gave a talk

Raman, Venkatesh

Participated in *IARCS mini course on Algorithms and Data Structures* held at VOC College, Tuticorin during Sep 28 – Sep 29, 2006. One of the two resource persons

Participated in *International Conference on Discrete Mathematics* held at IISc, Bangalore during Dec 15 – Dec 18, 2006. Presented a paper on 'Efficient Exact and Parameterized Algorithms through (old and new) graph theoretic structural results'

Visited Indian Institute of Technology, Gauhati during Dec 29, 2006 – Jan 1, 2007. Gave a talk on 'Parameterized Complexity'

Visited Indian Institute of Technology, Kharagpur during Jan 3 – Jan 5, 2007. Gave a talk on 'Parameterized Complexity'

Participated in *National Conference on Emerging Trends in Computing* held at Vasavi College, Erode on Feb 2, 2007. Gave a talk on 'Recent Trends in Theoretical Computer Science'

Participated in *Foundational Course on Algorithms* held at Kerala University, Trivandrum during Feb 10 – Feb 11, 2007. Main resource person

Participated in *Foundational Course on Algorithms* held at Cochin University of Science and Technology during Mar 3 – Mar 4, 2007. Main resource person

Participated in *National Workshop on Algorithms* held at Lady Doak College, Madurai during Mar 20 – Mar 21, 2007. One of the two resource persons

Ramanujam, R.

Participated in *Computer Science Logic* held at University of Szeged, Hungary during Sep 25 – Oct 1, 2006.

Visited Institute for Logic, Language and Computation, University of Amsterdam, Netherlands during Oct 2 – Oct 10, 2006. Gave two lectures titled: "Security protocols: A Logical Quagmire" and "Structured strategies for games on finite graphs".

Participated in *Logic, Navya Nyaya and applications* held at Jadavpur University, Kolkata during Jan 3 – Jan 7, 2007. Gave a talk titled, "From logics of games to logics of strategies"

Participated in *Second Indian conference on Logic and applications* held at IIT, Bombay during Jan 9 – Jan 11, 2007. Gave a talk on "Challenges for epistemic logic from security theory".

Participated in *Conference on network security* held at Stella Maris College, Chennai during Feb 16 – Feb 17, 2007. Gave a talk titled, "Foundations of security protocol analysis".

Visited Annamalai University, Chidambaram. during Mar 2 – Mar 3, 2007. Gave University Endowment Lectures: one on the "Cake cutting problem", and one on "Cryptographic protocols".

Ray, Purusattam

Participated in *Statphys Kolkata VI* held at Raichak, India during Jan 5 – Jan 9, 2007. Chaired a session

Sankaran, Parameswaran

Visited Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, during Mar 28 – May 13, 2006.

Visited University of Paul Sabatier, Toulouse, France, during Apr 10 – Apr 16, 2006. Gave a talk on K-theory of quasi-toric manifolds.

Visited University of Vienna, Vienna, Austria during May 2 – May 5, 2006. Gave a talk on K-theory of quasi-toric manifolds

Participated in *International Conference on Toric Topology* held at Osaka City University, Osaka, Japan. during May 29 – Jun 3, 2006. Gave a talk on K-theory of quasi-toric manifolds

Visited Research Institute for Mathematical Sciences, Kyoto, Japan, during Jun 5 – Jun 10, 2006.

Participated in *International Conference on geometric methods in topology,* held at Indian Institute of Science, Bangalore, during Jun 19 – Jun 20, 2006. Gave a talk on K-theory of quasi-toric manifolds

Participated in *International conference on algebraic geometry* held at Tata Institute, Mumbai. during Aug 14 – Aug 16, 2006.

Participated in *International Congress of Mathematicians,* held at Madrid, Spain. during Aug 22 – Aug 30, 2006.

Visited M. S. University of Baroda, Vadodara during Jan 4 – Jan 5, 2007. Gave a talk on 'Coarse Geomery.' Also, gave the Indian Mathematics Society Special Lecture on 'Poincaré conjecture'

Participated in *National Seminar on Recent Developments in Mathematics* held at Periyar University, Salem during Mar 12 – Mar 13, 2007. Gave a talk on 'Poincaré Conjecture'

Sathiapalan, Balachandran

Visited CHEP, IISC, Bangalore on Sep 18, 2006. Gave a talk on "Loop Variables and Background Independence"

Participated in *Field Theoretic Aspects of Gravity* held at BITS,Pilani, Goa Campus during Dec 18 – Dec 23, 2006. Gave a Talk on "Loop Variables and the Bosonic String in AdS Background"

Sharma, Chandradew

Participated in *KodaiKanal Summer School* held at Indian Institute of Astrophysics, Kodaikanal during May 3 – May 13, 2006. I participated the Kodaikanal Summer school as a tutor for the special theory of relativity.

Participated in *International conference on Physics near the mott Transition* held at Indian Institute of Sciences, Bangalore during Jul 23 – Jul 28, 2006.

Siddharthan, Rahul

Visited National Centre for Cell Science during May 2 – May 5, 2006. Collaboration with

Dr Bhaskar Saha

Visited National centre for biological sciences during May 12 – May 14, 2006. Collaboration with Prof K VijayRaghavan

Participated in *DNA and Chromosomes* held at Cargese (Corsica, France) during Jun 19 – Jun 30, 2006. Participant

Participated in *International symposium on computational biology and bioinformatics* held at Bhubaneshwar during Dec 15 – Dec 17, 2006. Contributed talk

Participated in *International conference on bioinformatics* held at New Delhi during Dec 18 – Dec 20, 2006. Invited talk

Participated in *Assembly, organisation and propulsion in complex systems* held at IIT, Chennai during Feb 22 – Feb 24, 2007. Invited talk

Sikdar, Somnath

Visited Friedrich-Schiller University, Jena, Germany. during Aug 15 – Oct 15, 2006. Collaborative project.

Participated in *Parameterized and Exact Computation, Second International Workshop, IWPEC 2006.* held at Zrich, Switzerland. during Sep 13 – Sep 15, 2006.

Participated in *The 26th Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS).* held at Indian Statistical Institute, Kolkata, India. during Dec 13 – Dec 15, 2006.

Sinha, Nita

Visited High Energy Accelerator Research Organization, KEK, Japan during Jun 5 – Jun 22, 2006.

Participated in *XVII DAE-BRNS High Energy Physics Symposium* held at IIT Kharagpur during Dec 11 – Dec 15, 2006. Delivered the invited plenary talk, "Frontiers in B Physics".

Participated in *Workshop on Phenomenology of Noncommutative field theories* held at IMSc during Dec 26 – Dec 28, 2006.

Sinha, Rahul

Visited High Energy Accelerator Research Organization, KEK, Japan, during Jun 5 – Sep 7, 2006. Visiting Professor

Visited Yukawa Institute for Theoretical Physics, Kyoto University, JAPAN during Jul 20 – Jul 23, 2006. Visit

Visited Department of Physics, Hiroshima University, JAPAN during Jul 24 – Jul 27, 2006. Gave talks entitled "Beauty, can thee help understand, why the Universe prefers matter?" and "Clean Signals of New Physics in B decays"

Visited Department of Physics, Tohoku University, JAPAN during Aug 29 – Aug 30, 2006. Gave a seminar entitled "Clean Signals of New Physics in B decays".

Participated in *Workshop on Phenomenology of Noncommutative field theories* held at IMSc during Dec 26 – Dec 28, 2006.

Sinha, Sitabhra

Participated in *Meeting on Systems Biology: New Initiatives and Perspectives* held at Manesar, Gurgaon during Apr 3 – Apr 5, 2006. Invited participant

Visited Saha Instiute of Nuclear Physics, Kolkata during Aug 7 – Aug 11, 2006. Talk on "Spiral Waves in the Brain"

Participated in *SFI International Fellows' Meeting* held at Santa Fe Institute, Santa Fe, USA during Sep 15 – Sep 19, 2006. Invited talk on "Are Complex Networks Stable ?"

Participated in *International Workshop on "Models of Brain and Mind"* held at Saha Institute of Nuclear Physics, Kolkata during Nov 20 – Nov 24, 2006. Invited talk on "Understanding the mind of a worm"

Participated in *2nd National Frontiers of Science (NatFoS) for Young Indian Scientists* held at Indian National Science Academy, New Delhi during Dec 3 – Dec 4, 2006. Invited talk on "Network Biology"

Participated in *2nd Indo-US Frontiers of Science (FOS) Symposium* held at National Academy of Sciences (NAS) Beckman Centre, Irvine, USA during Jan 17 – Jan 20, 2007. Invited talk on "Network Biology"

Visited University of California, Santa Cruz during Jan 25 – Feb 6, 2007. Talk on "Network biology" and collaborative research work on ecological networks

Participated in *Complex dynamics of physiological systems: From heart to brain* held at Presidency College, Kolkata during Feb 12 – Feb 14, 2007. Invited talk on "Spiral Waves in the Brain"

Participated in *Econophysics Sociophysics of Markets Networks* held at Saha Institute of Nuclear Physics, Kolkata during Mar 12 – Mar 15, 2007. Invited talks on "Collective behavior in the Indian market" and "Is inequality inevitable in organized societies ?"

Sinha, Sudeshna

Visited Biomedical Engineering Department, University of Florida, Gainesville during Apr 10 – Apr 24, 2006. Collaborative Research

Visited University of Tokyo during Apr 25 – Apr 30, 2006. Delivered 2 talks

Participated in *IEEE Asia-Pacific Conference on Circuits and Systems (APCCAS06)* held at Singapore during Dec 5 – Dec 7, 2006. Gave a talk

Visited University of Tokyo during Dec 8 – Dec 14, 2006. Delivered 2 talks

Sridhar, S.

Participated in *Workshop on Modelling Infectiopus Diseases* held at IMSc Chennai during Sep 4 – Sep 6, 2006.

Participated in *International Workshop on Complex Dynamics of Physiological Systems From Heart to Brain* held at Department of Physics, Presidency College Kolkota,India. during Feb 12 – Feb 14, 2007. I had presented a poster at the Workshop, titled "Eliminating spiral turbulence in cardiac models with low amplitude electrical stimulation"

Participated in *Workshop developing applications for Grid GARUDA, National Grid Computing Iniative.* held at C-DAC Bangalore during Mar 12 – Mar 13, 2007.

Srinivas, K.

Participated in *ICM* held at Madrid, Spain during Aug 22 – Aug 30, 2006.

Participated in *Analytic Number Theory* held at C.I.R.M, Luminy, France during Sep 11 – Sep 15, 2006. Gave an invited talk.

Participated in *International Conference in Number Theory* held at Vivekananda College, Chennai during Dec 25 – Dec 30, 2006. Gave an Invited talk

Participated in *International Conference in Number Theory and Cryptography* held at HRI, Allahabad during Feb 23 – Feb 27, 2007. Gave an invited talk.

Subrahmonian Moothathu, T.K.

Participated in *Instructional Workshop on Non-Commutative Geometry*

held at IMSc, Chennai during Jan 8 – Jan 19, 2007.

Subramanian, C. R.

Participated in *National Level Symposium on "Current Trends in Image Processing and Algorithms"* held at The American College, Madurai on Apr 22, 2006. Was a Resource Person and gave a talk on Approximation Algorithms.

Participated in *Information Security Education and Awareness (ISEA) Workshop* held at The Institute of Mathematical Sciences, Chennai. during May 15 – Jun 9, 2006. gave two talks on "Private Key Encryption"

Participated in *National Seminar on Graph Theory and Algorithms* held at Kongu Engineering College, Perundurai, Erode District during Mar 7 – Mar 9, 2007. Was a Resource Person and gave two talks on "Randomized Algorithms"

Participated in *National Conference on Analysis and Graph Theory* held at Department of Mathematics, Bharathidasan University, Trichy during Mar 9 – Mar 10, 2007. Was an Invited Speaker and gave a talk on "Chromatic Parameters : some recent developments"

Visited Department of Computer Science, Bharathidasan University, Trichy. on Mar 10, 2007. Gave two one hour talks on "Randomized estimation of network reliability"

Participated in *State Level Workshop on "Analysis of Algorithms"* held at Lady Doak College, Madurai during Mar 20 – Mar 21, 2007. Was a Resource Person and gave two talks on "Analysis of Algorithms"

Sunder, V. S.

Visited University of British Columbia during Sep 11 – Sep 16, 2006. Gave two lectures on *Planar Algebras and 1+1-dimensional TQFTs* at the Topology Seminar.

Participated in *Topics on von Neumann algebras* held at Banff International Research Station (BIRS), Banff, Canada during Sep 16 – Sep 21, 2006. Gave a lecture on *Kac algebras, planar algebras and quantum doubles*

Participated in *Non-Commutative Rings, Group Rings, Diagram Algebras, and Applications* held at Ramanujan Institute for Advanced Study in Mathematics , Chennai during Dec 18 – Dec 22, 2006. Gave a talk on *Temperley-Lieb algebras and Non-Crossing Partitions*

Visited Indian Institute of Technology, Kanpur during Dec 23 – Dec 25, 2006. Gave a a talk on the work of Paul Halmos as part of N Rama Rao Distinguished Lecture Series.

Visited Vivekananda College on Mar 30, 2007. Gave the 'Harish Chandra Memorial Lecture' on *When is a knot not the unknot?*

Vemparala, Satyavani

Participated in *Conference on "Nucleation, Aggregation and Growth"* held at Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India during Jan 29 – Jan 31, 2007.

Participated in *Symposium on Trends in Computational Materials Science* held at Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India during Feb 15 – Feb 17, 2007.

Participated in *Assembly, Organization and Propulsion in Complex Systems 2007* held at Indian Institute of Technology, Chennai, India during Feb 22 – Feb 24, 2007.

Vijayaraghavan, T. C.

Participated in *26th Conference on Foundations of Software Technology and Theoretical Computer Science.* held at Indian Statistical Institute, Kolkata, INDIA during Dec 13 – Dec 15, 2006.

Participated in *Workshop on Recent Advances in Approximation Algorithms* held at Indian Statistical Institute, Kolkata, INDIA on Dec 16, 2006.

Sridharan, Shrihari

Visited Indian Statistical Institute, Bangalore during Jun 1 – Jun 30, 2006.

Visited Indian Institute of Science, Bangalore during Jul 1 – Jul 31, 2006.

5.4 Visitors from Other Institutions

Name	Affiliation	Period of Visit
Binbu Anubha Bambha	University of Hyderabad, Hyderabad	19.04.06 – 02.05.06
Nemani V.Suryanarayana	Perimeter Institute Waterloo, Canada	23.04.06 – 26.04.06
Subrata Bal	Dublin Institute for Advanced Studies, Ireland	09.04.06 – 13.04.06
E.Harikumar	Institut0 De Fisica, Brazil	09.04.06 – 14.04.06
Anoreas Rosenschon	Suny Buffalo, U.S.A	29.03.06 – 01.04.06
Amit Ghosal	University of California, USA	08.05.06 – 10.05.06
Arghya Mandal	Chennai Mathematical Institute, Siruseri	01.05.06 – 14.05.06
Chandrashekar C.Madaiah	University of Oxford, U.K.	02.04.06 – 15.05.06
Bikash Chandra Paul	North Bengal University, Siliguri	10.05.06 – 16.05.06
Vincent Sacksteder	S.N.Bose Centre, Kolkatta	15.05.06 – 17.05.06
Anirbit Mukherjee	Chennai Mathematical Institute, Siruseri	05.05.06 – 26.05.06
Souvik Sur	CMI, Siruseri	03.05.06 – 30.05.06
Guruprasad Kar	ISI, Kolkatta	21.05.06 – 03.06.06

N.Mukunda	IISc, Bangalore	21.05.06 – 31.05.06
Siva Athreya	ISI, Bangalore	05.06.06 – 10.06.06
Ajay Patwarthan	St.Xaviers College, Mumbai	01.06.06 – 10.06.06
Vaishali H.Kamdi	University of Amaravati, Nagpur	24.05.06 – 12.06.06
Saroj R.Kumbhare	University of Amaravati, Nagpur	24.05.06 – 12.06.06
Ganesh R.	BITS, Pilani	04.01.06 – 16.06.06
Sandip Bhattacharya	Kolkatta	17.05.06 – 16.06.06
Gautham Sekar	BITS, Pilani	06.01.06 – 17.06.06
Rajdeep Niyogi	BITS, Pilani	28.05.06 – 30.06.06
Hemangee Kapoor	Dhirubhai Ambani Institute of Information Communication Technology, Gandhinagar	04.06.06 – 01.07.06
Kalpesh Kapoor	Dhirubhai Ambani Institute of Information Communication Technology, Gandhinagar	04.06.06 – 01.07.06
Vivek Dadu	IIT, Allahabad	27.01.06 – 28.06.06
Sunanda Banerjee	TIFR, Mumbai	04.07.06 – 05.07.06
Manoj Gopalakrishna	HRI, Allahabad	28.06.06 – 08.07.06
Jagannath Mahapatra	Agalpur P.S.College, Orissa	12.06.06 – 11.07.06

Mahendra Shinde	IIT, Mumbai	19.06.06 – 12.07.06
Gyan Prakash	HRI, Allahabad	21.06.06 – 15.07.06
A.P.Balachandran	Syracuse University, USA	10.07.06 – 15.07.06
Sachindeo Vaidya	IISc, Bangalore	09.07.06 – 16.07.06
S.D.Adhikari	HRI, Allahabad	12.07.06 – 17.07.06
David	University of Paris, Paris	12.07.06 – 17.07.06
Naveen Surendran	IISc, Bangalore	04.07.06 – 22.07.06
E.Tosatti	SISSA, Italy	21.07.06 – 24.07.06
S.Srinivasa Rao	IT University of Copenhagen, Denmark	14.07.06 – 20.07.06
Rajarshi Ray	SINP, Kolkatta	11.07.06 – 29.07.06
Arghya Mondal	CMI, Siruseri	14.07.06 – 01.08.06
Indiranil Biswas	TIFR, Mumbai	31.07.06 – 06.08.06
Joel Riou	University of Paris, Paris	04.08.06 – 07.08.06
Siddhartha Lal	ICTP, Italy	07.08.06 – 07.08.06
Debajyoti Gangopadhyay	Ananda College, Jharkhand	10.07.06 – 12.08.06
Roberto Car	Princeton University, USA	20.07.06 – 21.07.06

Naveen Surendran	IISc, Bangalore	31.07.06 – 11.08.06
R.Thangadurai	HRI, Allahabad	09.08.06 – 12.08.06
Manoj Prabhakar	University of Illinois, USA	16.08.06 – 18.08.06
Indrajit Mitra	SINP, Kolkatta	20.07.06 – 21.08.06
Amit Kumar Chattopadhyay	University of Padova, Italy	21.08.06 – 26.08.06
Uday Reddy	University of Birmingham, Birmingham	20.08.06 – 25.08.06
K.Varadarajan	University of Calgary, USA	31.07.06 – 31.08.06
M.Muthukumar	University of Messachesetts	17.08.06 – 27.08.06
Rudra Banerjee	University of Pune, Pune	19.08.06 – 30.08.06
Soumen Basak	Inter University Centre for Astronomy and Astrophysics, Pune	24.08.06 – 30.08.06
Tanusree Pal	HRI, Allahabad	04.07.06 – 01.09.06
Parthasarathi Majumdar	SINP, Kolkatta	27.08.06 – 01.09.06
Gianluca Galgagni	University of Sussex, UK	27.08.06 – 01.09.06
Krishnendu Sengupta	SINP, Kolkatta	03.09.06 – 09.09.06
Aditi Sen	ICFO, Spain	01.09.06 – 11.09.06

Ujjwal Sen	ICFO, Spain	01.09.06 – 11.09.06
Swarnendu Sarkar	IOP, Bhubaneswar	18.08.06 – 13.09.06
Gyan Prakash	HRI, Allahabad	03.09.06 – 25.09.06
Prof.Miodrag Mukhalijevic	Belgrade	11.09.06 – 13.09.06
Ahpisit Ungiktcanukit	Chalulangkorn University, Thailand	03.10.06 – 05.10.06
S.Neetu	National Institute of Oceanogrophy, Goa	06.10.06 – 15.10.06
I.Suresh	National Institute of Oceanogrophy, Goa	06.10.06 – 15.10.06
Prasanta Chatterjee	Visva Bharati University, West Bengal	13.10.06 – 20.10.06
Bodhisattwa Basu	Ramakrishnan Misson, Belurimath	26.09.06 – 24.10.06
Ashutosh Kumar Alok	IIT, Bombay, Mumbai	22.10.06 – 28.10.06
S.Umasankar	IIT Bombay, Mumbai	22.10.06 – 29.10.06
Ajay Patwardhan	St.Xaviers College, Mumbai	25.10.06 – 04.11.06
Parvati Shastri	University of Mumbai, Mumbai	24.10.06 – 05.11.06
Zachary Treisman	TIFR, Mumbai	12.11.06 – 19.11.06
Arup Kumar Pal	ISI, New Delhi	16.11.06 – 01.12.06

Rakesh Tibrewala	TIFR, Mumbai	01.11.06 – 02.12.06
Subroto Mukherjee	University of California, USA	27.11.06 – 28.11.06
Bruno Courcelle	LABRI, Universite Bordeaux-1	24.12.06 – 29.12.06
Arni S.R.Srinisava Rao	University of Oxford, UK	05.12.06 – 07.12.06
Arun Bansil	North Eastern University, Boston	01.12.06 – 02.12.06
A.P.Balachandran	Syracuse University, USA	10.12.06 – 11.12.06
Changchang Xi	Beijing Normal University, China	11.12.06 – 17.12.06
Pavol Hell	Simon Fraser University, Canada	12.12.06 – 14.12.06
Naveen Surendran	IISc, Bangalore	06.12.06 – 15.12.06
S.Chaturvedi	University of Hyderabad, Hyderabad	18.12.06 – 19.12.06
Michael R.Fellows	University of New Castle, Australia	18.12.06 – 29.12.06
Mayukh Nilay Khan	IIT, Kharagpur	02.12.06 – 24.12.06
Sanjay Kharche	University of Manchester, UK	20.12.06 – 22.12.06
Serge Gaspers	University of Bergen, Norway	21.12.06 – 25.12.06
Sunil Chandran.L	IISc, Bangalore	21.12.06 – 23.12.06
Arindam Mazumdar	IIT, Delhi	04.12.06 – 04.01.07

Nemani V.Suryanarayana	Imperial College, UK	02.01.06 – 06.01.06
Laxmi Parida	IBM Research, USA	28.12.06 – 31.12.06
Bruno Courcelle	Universite Bordeaux-1	24.12.06 – 28.12.06
Debajyoti Choudhury	University of Delhi, Delhi	25.12.06 – 28.12.06
Frances Rosamond	University of New Castle,Australia	18.12.06 – 29.12.06
R.Thangadurai	HRI, Allahabad	22.12.06 – 29.12.06
Jyoti Prasad Saha	Bankura Christian College, West Bengal	24.12.06 – 29.12.06
Jacobo Toran	University of Ulm	16.12.06 – 17.12.06
Manish Dev Shrimali	Dayanand College, Ajmir	02.10.06 – 07.10.06
Shivakumar Jolad	Pennsylvania State University, USA	04.01.07 – 05.01.07
Saket Saurabh	University of Begeen, Norway	21.12.06 – 04.01.07
S.D.Adhikari	HRI, Allahabad	24.12.06 – 14.01.07
Arika Jalan	MPI, Leipzig, Germany	03.01.07 – 05.01.07
Ram Kishore	INPE, S.J.Campus, Brazil	11.12.06 – 19.01.07
Srinath Babe	Concordia University, Monyteal	01.01.07 – 05.01.07

Conrad Burden	Australian National University, Australia	09.01.07 – 12.01.07
Ranjit Nair	CPFS, New Delhi	09.01.07 – 12.01.07
Madhav Ranganathan	CNRS, France	16.01.07 – 16.01.07
Joseph Halpern	Cornell University, USA	12.01.07 – 13.01.07
Francesca Borzumati	ICTP, Italy	25.12.06 – 31.01.07
Shrihari Gopalakrishna	Brookhaven National Lab, USA	05.02.07 – 05.02.07
A.M.M.Pruisken	University of Amsterdam, Netherlands	24.01.07 – 31.01.07
Smitha Vishveshwara	University of Illinois, USA	28.01.07 – 30.01.07
Satya Lokam	Microsoft Research, Bangalore	30.01.07 – 01.02.07
Amit Apte	Berkeley, California, USA	04.02.07 – 07.02.07
Subrata Pal	University of Hyderabad	31.01.07 – 02.02.07
N.V.Narindra Kumar	TIFR, Mumbai	17.01.07 – 09.02.07
Alain Pumir	Institut Non Limeaire de Nice, France	05.02.07 – 23.02.07
Jan Bakke	Norwegian University of Science, Trondheim	07.02.07 – 27.02.07
Leo Stodolsky	MPI, Germany	13.02.07 – 15.02.07

Govind S.Krishnasw	Utrecht University, Netherlands	14.02.07 – 20.02.07
Carlo Albert	ETH Zurich	28.01.07 – 04.02.07
Fontannaz	CHRS, France	15.02.07 – 27.02.07
Carlo Albert	ETH, France	14.02.07 – 20.02.07
Patrik Aurenche	LAPTH, France	22.02.07 – 08.03.07
Deshovillers Jean Marc	University of Bordeaux 2	28.02.07 – 03.03.07
Ignacio Pagonabarraga	University of Barcelona, Spain	21.02.07 – 02.03.07
Isaac Llopis	University of Barcelona, Spain	21.02.07 – 03.03.07
Padma Kumar P.	University of Illinois, USA	05.03.07 – 08.03.07
Pushan Majumdar	University of Muenster	05.03.07 – 06.03.07
Achamveedu Gopakumar	Max-Wien Platz, Germany	04.03.07 – 07.03.07
Arijit Bhattacharyay	Padova University	12.03.07 – 14.03.07
Martin Bosowalo	Pennsylvania State University, USA	11.03.07 – 14.03.07
Eugen Zalinescu	LORIA, France	17.03.07 – 30.03.07
M.S.Raghunathan	TIFR, Mumbai	30.01.07 – 11.02.07

Gnanasangeetha	Australian National University, Australia	26.02.07 – 19.03.07
Gyan Prakash	HRI, Allahabad	05.03.07 – 26.03.07
Johannes Koebler	Humboldt University, Berlin	03.03.07 – 29.03.07
T.V.Venkateshwaran	Vigyan Prasar, New Delhi	24.03.07 – 31.03.07
Manirul Ali	S.N.Bose National Institute, Kolkatta	04.02.07 – 14.03.07

Chapter 6

Infrastructure

6.1 Computer Facilities

The computing facility was enhanced by adding two rack servers based on AMD Opteron Dual Core running Sun Solaris and Linux O/Ss and two Apple Mac Pro workstations based on Intel Dual Core Xeon processors running Mac O/S. The WiFi facility was expanded to cover the entire campus.

- A new procedure(VPN) for accessing IMSc LAN from remote site was implemented.
- One 3500 lumens LCoS data projector was installed in the Ramanujan Auditorium.
- One Technical Assistant was appointed to handle the system services.

6.2 The Library

The Institute Library holds a total collection of 59534 books and bound periodicals as on March 31, 2007. This includes an addition of 3426 volumes during the current year April 2006 - March 2007. 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 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.

Library has added additional mobile racks to meet the growing needs of library space.

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:

R. Balasubramanian, IMSc
P. Sankaran, IMSc
Gyan Prakash
Surya Ramana

Kamal Lodaya, IMSc
Rahul Basu, IMSc
Piyush P Kurur

M.C. Joshi

T. Krishnan

M.G. Nadkarni
Michael Demuth
B.C. Chatterjee
Haestad

M.S. Narasimhan
K. R. Parthasarathy
S.H. Kulkarni
V.K. Aswal

DFG

ICTP

NBHM

DOOR Programme

COMPLEX SYSTEMS PROJECT

INO PROJECT