THE INSTITUTE OF MATHEMATICAL SCIENCES

C. I. T. Campus, Taramani,

Chennai - 600 113.

ANNUAL REPORT
(DETAILED)

Apr 2004 - Mar 2005

Foreword

I am pleased to present the progress made by the Institute during 2004-2005 in its many sub-disciplines and note the distinctive achievements of the members of the Institute.

As usual, 2004-2005 was an academically productive year in terms of scientific publications and scientific meetings.

This year saw an increase in the number of scientific meetings organized or co-sponsored by the Institute. The International conference, "Indocrypt-2004" was inaugurated by His excellency Dr. A. P. J. Kalam through video-conferencing. IMSc also held the "DAE Golden Jubilee Colloquium Series" to mark the 50th anniversary of DAE. In addition, the Institute conducted a "Workshop on Cryptography", "Perspectives in Nonlinear Dynamics" - a satellite meeting STATPHYS-22, "SERC Preparatory School on High Energy Physics", the "24th FSTTCS Conference", "Workshop on The Economy as a Complex System" and a "School on Parallel Computing and Clusters", an activity centered around the teraflop supercomputer, KABRU.

The Institute co-sponsored the conference on "Operator theory, quantum probability and noncommutative geometry", the "Symposium on Algebraic Groups in honour of Prof V. Lakshmibai" and the "Workshop on Theoretical High Energy Physics (THEP-I)".

The Subhashis Nag Memorial Lecture and The Institute Seminar Week are an annual feature of our activities. This year's Nag Memorial Lecture was delivered by Prof. Clifford Earle from Cornell University, Ithaca, New York.

The Institute has also participated in several national and international collaborative projects the details of which are given inside the report.

The Institute has become a part of Homi Bhabha National Institute. The Institute members have played a role as members of the Board of Studies in Mathematics and in Physics. The Institute members have also served as the members of the Sectional Committees of the Indian National Science Academy and the Fellowship Scrutinizing Committee of the National Academy of Sciences and Council Member of the Indian Academy of Sciences and the Scientific Committee of Indo-French Institute of Mathematics.

This report has been compiled through the efforts of a committee consisting of Drs. G. Date, Parameswaran Sankaran, C. R. Subramanian, and Mr. Paul Pandian (Librarian) together with secretarial assistance from Ms. Usha Devi. Mr. Manja (Registrar) assisted with the photographs as well as with the preparation of the summary version of this detailed report. I owe my gratitude to all of them.

I look forward to another year full of distinctive achievements for the Institute.

April, 2005 **R. Balasubramanian**

Contents

Chapter 1

The Institute

1.1   Board

Hon'ble Shri **C. Ve. Shanmugam**, Minister for Education, Government of Tamil Nadu, Fort St. George, Chennai 600 009
(**Chairman**)

Dr. **Anil Kakodkar**, Chairman, AEC & Secretary to Government of India, Department of Atomic Energy, CSM Marg, Mumbai 400 001
(**Vice-Chairman**)

Prof. **S. K. Joshi**, Honorary Scientist Emeritus CSIR, Vikram Sarabhai Professor, National Physical Laboratory, Dr. K. S. Krishnan Road, New Delhi 110 012
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Prof. **E. Balagurusamy**, Vice Chancellor, Anna University, Chennai 600 025.
(**Member**)

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

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

Prof. **C. S. Seshadri**, Director, Chennai Mathematical Institute, 92, G.N. Chetty Road, T. Nagar, Chennai 600 017
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1.2 Executive Council

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Prof. **C. S. Seshadri**, Director, Chennai Mathematical Institute, Chennai 600 017
(**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. Gnanadesikan**, I.A.S., Secretary to Government, Higher Education Department, Government of Tamil Nadu, Fort St. George, Chennai 600 009
(**Member**)

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

1.3 Faculty

Name	Userid	Tel. Ext.	Res. Phone No.

Mathematics

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Kesavan, S	kesh	273	2641 2839
Kodiyalam, Vijay	vijay	228	5205 4589
Krishna, M.	krishna	285	2449 1499
Nagaraj, D. S.	dsn	291	2442 1393
Paranjape, Kapil H.	kapil	218	2259 3192
Raghavan, K. N.	knr	255	2844 6319
Sankaran, P.	sankaran	221	2446 0909
Srinivas, K.	srini	244	2448 1256
Sunder, V. S.	sunder	206	2442 0082
Iyer, Jaya N.	jniyer	375	-
Prasad, Amritanshu	amri	213	-

Physics

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Balakrishnan, Radha [1]	radha	203	2257 0387
Baskaran, G.	baskaran	233	2451 0504
Basu, Rahul	rahul	284	2245 4794, 2245 3297
Date, G.	shyam	280	2245 0203
Govindarajan, Thupil R.	trg	281	2442 2715
Guruprasad Kar [2]	gkar	319	-
Hari Dass, N. D.	dass	275	2442 2767
Indumathi, D.	indu	225	2492 8138
Jagannathan, R.	jagan	219	2263 1638
Jayaraman, T.	jayaram	248	2492 9527
Kaul, R.	kaul	279	2445 3508
Majumdar, Parthasarathi [3]	partha	282	2448 0793
Menon, Gautam I.	menon	292	5546 8834, 2621 3024
Mishra, Ashok K.	mishra	283	2492 5444
Murthy, M. V. N.	murthy	227	2257 9342, 2257 0652
Parthasarathy, R.	sarathy	214	2223 2021
Rama, S. Kalyana	krama	293	2448 2696
Ray, Purusattam	ray	231	5215 8773
Digal, Sanatan [4]	digal	319	-
Sathiapalan, Balachandran	bala	278	5215 8742
Shankar, R.	shankar	235	2448 1914
Sharatchandra, H. S.	sharat	276	3091 5916

[1]Until 30.06.04 [2]Until 21.05.04 [3]Until 30.06.04
[4]From 13.12.04

Name	Userid	Tel. Ext.	Res. Phone No.
Siddharthan, Rahul	rsidd	215	-
Simon, R.	simon	232	2451 0280
Sinha, Rahul	sinha	290	2448 2190
Sinha, Sudeshna	sudeshna	216	2259 3192
Sinha, Sitabhra	sitabhra	342	2448 1487

Theoretical Computer Science

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Lodaya, Kamal	kamal	286	-
Mahajan, Meena B.	meena	247	2440 4396, 2440 4395
Raman, Venkatesh	vraman	243	2259 0374
Ramanujam, R.	jam	288	2492 8138
Subramanian, C.R.	crs	282	2448 3732

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Ravindra, Reddy	ravi	343	2492 7845

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Arangarajan, R.	arajan	297	2440 4795
Mohan, S.	mohan	300	2276 2805
Venkatesan, G.	gvenkat	240	-
Usha Devi, P.	usha	381	-

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Rajasekaran, G. *Senior Scientist, DAE-BRNS*	graj	230	2441 3395
Balakrishnan, Radha[1] *Emeritus scientist, CSIR*	radha	203	-
Sinha, Nita *Project Investigator, DST*	nita	246	-

1.7 Project Staff

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Srinivas, Shyam[3]	sshyam	326	-
Eswarakumar, P.	eswar	326	2448 3274
Bijilash, B. S. [4]	bijilash	326	-
Ghosh, Antina [5]	antina	328	-

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[1] From 20.12.04   [2] Until 04.03.05   [3] Until 31.07.04
[4] From 03.09.04   [5] From 22.02.05

Name	Userid	Tel. Ext.	Res. Phone No.

Mathematics

Name	Userid	Tel. Ext.	Res. Phone No.
Narasimhan, Anuradha	anuradha	258	-
Mukhopadhyaya, Anirban	anirban	296	-
Subramanian, Uma [1]	usubrama	258	-
Baoulina, Ioulia [2]	baoulina	324	-
Sridharan, Shrihari [3]	shrihari	258	-

Physics

Name	Userid	Tel. Ext.	Res. Phone No.
Bhattacharya, Sandip [4]	sandip	324	-
Gupta, Nayantara	nayan	328	-
Mitra, Indrajit [5]	indrajit	328	-
Roy, Anirban [6]	anirb	207	-
Ratnadeep, Roy [7]	ratnadeep	246	-
Sanjay, Siwach [8]	sanjay	295	-
Ratabole, Raghunath	raghu	327	-
De, Baskar	baskar	207	-
Das, Chittaranjan [9]	crdas	226	-
William Matlock, Peter [10]	pwm	365	-
Joseph, Toby [11]	toby	327	-
Sunil Kumar, V. [12]	vsunil	207	-

Theoretical Computer Science

Name	Userid	Tel. Ext.	Res. Phone No.
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Vijayakumar, S.	vjy	296	-
Majumdar, Kaushik [14]	kaushik	328	-
Charan Ghosh, Sasthi	sasthi	366	-

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[1] Until 09.11.2004   [2] From 20.09.2004   [3] From 12.11.2004
[4] Until 01.02.2005   [5] Until 15.10.2004   [6] Until 07.01.2005
[7] Until 28.01.2005   [8] Until 06.01.2005   [9] From 03.05.2004
[10] From 09.12.2004   [11] From 31.01.2005   [12] From 14.03.2005
[13] Until 10.01.2005   [14] From 26.10.2004

1.9 Ph.D. Students

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Mathematics

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Dey, Arijit	arijit	209	-
Gyan, Prakash	gyan	211	-
Kanhere, Aaloka	aaloka	289	-
Muthukumar, T.	tmk	287	-
Gautam, Sachin	sachin	223	-
Gupta, Ved Prakash	vpgupta	224	-
Sarkar, Swagata	swagata	294	-
Samuel, Preena	preena	376	-
Chattopadhyay, Pratyusha	pratyusha	376	-
Pal, Sarbeswar	spal	376	-

Physics

Name	Userid	Tel. Ext.	Res. Phone No.
Banerjee, Kinjal	kinjal	209	-
Basak, Soumen	soumen	344	-
Ezhuthachan, Bobby V. K.	bobby	334	-
Hossain, Golam Mortuza	golam	334	-
Karthik, G. V. S.	karthik	287	-
Kumar, Alok	alok	272	-
Lukose, Vinu	vinu	344	-
Saptarishi, Mandal	saptarshi	344	-
Mitra, Mithun Kumar	mithun	211	-
Rajesh, V.	chinta	289	-
Sarkar, Swarnendu	swarnen	209	-
Sharma, Chandradev	sharma	344	-
Solomon, Ivan J.	solomon	289	-
Misra, Basudha	basudha	294	-
Vallan, Bruno Cruz A.	bruno	223	-
Gopala Krishna, K.	gkrishna	294	-
Syed Mohammed Kamil	kamil	223	-
Pan, Raj Kumar	rajkp	211	-
Saket, Abhinav	abhinav	373	-
Sircar, Nilanjan	nilanjan	373	-
Bhowmick, Samrat	samr	373	-
Chakravarty, Gaurav	gaurav	373	-
Laddha, Alok	alokl	294	-
Pradeep Kanth, J. Maruthi	maruthi	299	-

Theoretical Computer Science

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Vijayaraghavan, T. C.	tcvijay	259	2466 0586
Sarma M. N., Jayalal	jayalal	224	-
Das, Bireswar	bireswar	211	-
Limaye, Nutan P.	nutan	294	-
Narayanan, N.	narayan	259	-
Sheerazuddin, S.	sheeraz	223	-
Sikdar, Somnath	somnath	272	-
Simon, Sunil Easaw	ssimon	224	-
Joglekar, Pushkar Shripad	pushkar	299	-
Sundararaman, Akshay	akshay	299	-
Raghavendra Rao, B.V.	bvrr	299	-
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Padmanabhan, T.

Parijatham, S.M.
Parthiban, V.
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Ramesh, M.
Ravichandran, N.
Ravindran, A.
Rizwan Shariff, H.
Sankaran, K.P.
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Chapter 2

Research and Teaching

2.1 Mathematics

2.1.1 Research Summary

Algebra

A simple proof was given to show that finite dimensional inductive algebras are trivial [**R2**].

A simple and important, but surprisingly overlooked problem is that of describing the space of double cosets with respect to upper triangular matrices in $GL_n(\mathbb{Z}/p^k\mathbb{Z})$. These cosets describe the possible relative positions of two full flags of free primitive submodules of $(\mathbb{Z}/p^n\mathbb{Z})^n$. In recent work by a member of this institute, it is found that in general the number of cosets depends on the p. An estimate for the growth of this number is obtained in the case $n = 3$. Those cases where the number does *not* depend on p are identified. Various invariants are defined and used. A final version of these results is in preparation.

Algebraic Geometry

It has been shown that there are no exotic prime Fano three folds of genus nine [**N2**]. Work is in progress about the prime Fano three folds of genus seven and eight.

The classical Pieri and Giambelli formulas together enable the computation of the structure constants of the multiplication with respect to the Schubert classes of the integral cohomology ring of the Grassmannian. An analogous Giambelli formula for the (torus) equivariant cohomology has been obtained. A closed-form determinantal formula for the restriction to a torus fixed point of an equivariant Schubert class has also been obtained.

Invariants of flat bundles in various cohomology theories was studied. In a joint work with I. Biswas, examples of families of moduli spaces whose associated Gauss-Manin systems have vanishing Chern classes in the rational Chow groups have been exhibited [**I1**].

The projectively flat bundles and the Verlinde bundles on the moduli space of curves arising from a family of moduli of vector bundles were studied. The action of the finite Heisenberg group on these bundles have been extended and a splitting of the bundles obtained. In an ongoing work, further information about the split components have been obtained [**I2**].

From the explicit zeta functions obtained for the projective non-singular curves $aY^e = bX^e + cZ^e$ ($e = l, 2l$, l an odd prime) defined over a certain class of finite fields, the class numbers for the function fields of these curves are explicitly determined. When the field of definition of the curve(s) is fixed, concrete information is obtained on the growth of class numbers for constant field extensions of the function field(s) of the curve(s). The Fermat curves are seen to correspond precisely to those curves among each class (for $e = l, 2l$) that are maximal or minimal over the field of definition [**A**].

Algebraic Number Theory

A lower bound for the number of real quadratic extensions of $\mathbb{Q}$ admitting an A_n extension has been obtained [**M3**]. The possibility of getting a good lower bound for the number of real quadratic fields whose class number is divisible by a given integer n is being explored.

Some special character sums over finite fields were investigated. In particular, the expressions for these sums in terms of Gauss and Jacobi sums have been obtained. As an application, the number of solutions of certain equations over finite fields has been determined explicitly [**Ba1**]–[**Ba5**].

Analytic Number Theory

Zero-density results for zeros of the symmetric-square L-functions associated to a holomorphic cuspform for the full modular group in the critical strip have been studied and some improvements have been obtained to the right of the critical strip.

The best known result on the difference between consecutive zeros of the Riemann zeta-function in the critical strip is due to H. E. Littlewood (1924). It has been shown that the same result holds for functions in the Selberg class.

Differential Equations

The Poincaré lemma which states that an irrotational vector field over a simply connected domain $\Omega \subset \mathbb{R}^N$ is the gradient of a scalar field, was proved in all space dimensions when the components of the vector field were distributions in $H^{-1}(\Omega)$ [**K2**]. A completely parallel theory was developed for matrix fields and was used to show that a symmetric matrix field with entries in $H^{-1}(\Omega)$ occurs as the deformation tensor of a displacement field if and only if the Saint Venant compatibility conditions are satisfied. The intimate connection between these results and a famous lemma of J. L. Lions and an inequality of Korn (used in linear elasticity) were brought out in this study.

Further progress was made in the study of the homogenization of low cost control problems. Improvements over earlier results in the case of controls from the positive cone in $L^2(\Omega)$ were obtained.

Financial Mathematics

Using the data from the National Stock Exchange work on finding structures in the financial markets was carried out. A possible relation between the volume traded and the volatility emerged from the study [**Kr**]. Work is in progress to test the statistical significance of the model found.

Mathematical Physics

Work was carried out towards a book on spectral theory [**K1**] as well as revising the lectures of K. R. Parthasarathy on the mathematical foundations of quantum mechanics [**K2**]. Application of a newly determined criteria for identification of spectrum of self-adjoint operators, to Schrödinger operators was explored.

A large deviation result for the periodic points of a hyperbolic rational map defined on the Riemann sphere is proved. This extends the well-known equidistribution result of Lyubich in this setting. Convergence results for more general weighted averages of orbital measures with respect to Hölder continuous functions are also considered [**Sr1**].

Almost sure invariance principles on the natural extensions of Julia sets for the function $-\log|T'|$ is established where T is a hyperbolic rational map. This implies a number of well-known corollaries including the weak invariance principles and law of iterated logarithms [**Sr2**].

Hyperbolic quadratic polynomials are considered to study ideas on the distribution of values of periodic orbits to the corresponding hyperbolic Julia sets and derive asymptotic results. The same result is later proved for pairs of points in the Julia set, complementing the central limit type results due to Lalley [**Sr3**].

Operator Algebras

Work was completed on a paper which established essentially a bijective correspondence between subfactor planar algebras, on the one hand, and unitary 1+1-dimensional TQFTs defined on a certain cobordism category [**Ko2**].

Subsequently, attempts are being made to show that the methods of the above paper yield an alternative construction of an invariant of 3 manifolds associated by G. Kuperberg for each involutive Hopf algebra. While it was seen that this 'alternative prescription' works for many examples - such as lens space, Poincare's homology sphere, etc. - efforts are still underway to discover the proof that it *always works*.

The expository article [**Su**] discusses questions around appropriate measurability, or otherwise, of Hamel bases for the real line over the field of rational numbers.

Representation Theory

The representation theory of a reductive group over a non-Archimedean local field can be broken up into two separate parts. The first is the classification of the irreducible *supercuspidal* representations of the group. The second is the understanding of the Jordan-Hölder

series of representations obtained from supercuspidal representations of lower rank groups by parabolic induction.

An extreme case of the latter problem is the study of the Jordan-Hölder series of a representation induced from an unramified character of a maximal split torus (called the *unramified principal series*). It can be shown that this problem can be studied entirely though the *Iwahori-Hecke algebra*. In particular, the irreducible representations that occur in the Jordan-Hölder series of the unramified principal series are naturally in bijective correspondence with irreducible modules for the Iwahori-Hecke algebra. Some of the basic techniques used in analysing modules for the Iwahori-Hecke algebra are illustrated in [**P1**]. Further results have been obtained relating the classical induction and Jacquet functors for the groups to tensoring and restriction operations on Iwahori-Hecke algebras and their parabolic subalgebras in the split case. A part of this work is an interpretation of Bernstein's description of the centre of the Iwahori-Hecke algebras as an analog of the Satake isomorphism in the context of spherical functions and the Harish-Chandra homomorphism in the context of the universal enveloping algebra of a real or complex Lie group. Since the natural setting for this problem is that of quasi-split groups, efforts are underway to generalize the results to that setting.

An analogous problem in the context of global function fields is the study of the irreducible discrete automorphic representations coming from the residues *unramified principal Eisenstein series*, in the sense explained by R. Langlands in his seminal article *On the functional equations satisfied by Eisenstien series*. A description of these representations in terms of data in the Langlands dual group is expected. An attempt is being made to attack this problem using the results on Iwahori-Hecke algebras in [**P1**]. This may provide a uniform way to deal with this problem without a case by case analysis. This work is still in its early stages.

Topology

Quasi-toric manifolds are a natural, topological generalization of toric varieties in algebraic geometry due to M. Davis and T. Januskiewicz. A description of the K-ring of a quasi-toric manifold in terms of generators and relations was obtained. As an application a similar description of the Grothendieck K-rings of Bott-Samelson varieties was obtained [**S5**].

An important problem in differential topology is to determine or estimate the maximum number, called the span, of everywhere linearly independent vector fields that a manifold admits. Using complex K-theory, upper bounds for the span of projective Stiefel manifolds were obtained [**S1**].

It was shown that a certain subgroup of the group of all piecewise linear homeomorphisms of the space of real numbers surjects onto the group of quasi-isometries of the group of reals with the standard metric. As a consequence it is shown that the group of quasi-isometries of the space of real numbers (or equivalently the group of integers) admits imbeddings of many interesting class of groups such as the free group of rank the continuum, the group of all periodic smooth diffeomorphisms of the reals, etc. [**S3**].

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

[**A**]
N. Anuradha.
Zeta function of the projective curve $aY^{2l} = bX^{2l} + cZ^{2l}$ over a class of finite fields, for odd primes l.
Proceedings Indian Academy of Sciences (Mathematical Sciences), **115(1)**, 1–14, 2005.

[**B1**]
R. Balasubramanian.
Omega results for the Riemann zeta function and the error terms in the summatory functions of arithmetic functions.
In *Oberwolfach conference, Germany*, Sep 2004.
(Submitted).

[**B2**]
R. Balasubramanian and Gyan Prakash.
Sum free sets in finite abelian groups.
2005.
NT/0502374 (Submitted).

[**Ba1**]
Ioulia Baoulina.
On the number of solutions of the equation $(x_1 + \ldots + x_n)^m = ax_1 \cdots x_n$ in a finite field.
Discrete Mathematics and Applications, **14(5)**, 501, 2004.

[**Ba2**]
Ioulia Baoulina.
On some equations over finite fields.
Journal de Théorie des Nombres de Bordeaux, 17(1), 2004.
(To be published).

[**Ba3**]
Ioulia Baoulina.
Generalizations of the Markoff-Hurwitz equations over finite fields.
Journal of Number Theory, 2004.
(Submitted).

[**Ba4**]
Ioulia Baoulina.
On the number of solutions of the equation $a_1 x_1^{m_1} + \ldots + a_n x_n^{m_n} = bx_1 \ldots x_n$ in a finite field.
Acta Applicandae Mathematicae, **85(1-3)**, 35, 2005.

[Ba5]
Ioulia Baoulina.
On a problem of Carlitz.
International Journal of Number Theory, 2005.
(Submitted).

[**I1**]
Indranil Biswas* and Jaya N. Iyer.
Vanishing of the Chern classes of de Rham bundles for some families of moduli spaces.
2004.
(Submitted).

[**I2**]
Jaya N. Iyer.
A decomposition of the Verlinde bundles over the moduli space of curves.
2004.
(Submitted).

[**K1**]
R. Bunoiu* and S. Kesavan.
Asymptotic behaviour of a Bingham fluid in thin layers.
J. Math. Anal. Appl., **293(2)**, 405, 2004.

[**K2**]
S. Kesavan.
On Poincaré's and J. L. Lions' lemmas.
C. R. Acad. Sci. Paris Ser. I, **340**, 27, 2005.

[**K3**]
S. Kesavan and T. Muthukumar.
Homogenization of an optimal control problem with state-constraints.
2004.
imsc/2004/12/39 (Submitted).

[**Ko1**]
Clare D'Cruz*, Vijay Kodiyalam, and Jugal K. Verma*.
Bounds on the a-invariant and reduction numbers of ideals.
Journal of Algebra, **274(2)**, 594, 2004.

[**Ko2**]
Vijay Kodiyalam, Vishwambhar Pati*, and V. S. Sunder.
Subfactors and 1+1-dimensional TQFTs.
2004.
(Submitted).

[Ko3]
Vijay Kodiyalam and K. N. Raghavan.
Picture invariants and the isomorphism problem for complex semisimple lie algebras.
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L. Gruson[*], F. Laytimi[*], and D. S. Nagaraj.
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2005.
(Submitted).

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Thomas J. Haines[*], Robert E. Kottwitz[*], and Amritanshu Prasad.
Iwahori-Hecke algebras.
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[P2]

Amritanshu Prasad.
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Journal of Algebra, **280**, 412, 2004.

[R1]

Sudhir R. Ghorpade[*] and K. N. Raghavan.
Hilbert functions of points on Schubert varieties in the symplectic Grassmannian.
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K. N. Raghavan.
Finite dimensional inductive algebras are trivial.
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(To be published).

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P. Sankaran and Peter Zvengrowski[*].
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In A. Adem, G. Pastor, and J. Gonzalez, editors, *Contemporary Mathematics, Proceedings of the conference on algebraic topology in honour of Samuel Gitler*. American Mathematical Society, Feb 2005.
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Bounded automorphisms and quasi-isometries of finitely generated groups.
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Mark Pollicott* and Shrihari Sridharan.
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Shrihari Sridharan.
Asymptotic results for hyperbolic quadratic polynomials.
Bulletin of the London Mathematical Society, 2005.
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M. G. Nadkarni* and V. S. Sunder.
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[**B**]
Sukumar Das Adhikari[*]**, R. Balasubramanian, and K. Srinivas**, editors.
Proceedings of Number Theory Conference, volume 1 of *Lecture Notes Series*.
Ramanujan Mathematical Society, Thiruchirapalli, Tamilnadu., 2005.

[**K1**]
M. Demuth[*] **and M. Krishna**.
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Progress in Mathematical Physics, Vol 44. Birkhauser, Boston, USA, 2005.
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[**K2**]
K. R. Parthasarathy[*]**, revised by K. R. Parthasarathy**[*] **and M. Krishna**
Lectures on the Mathematical Foundations of Quantum Mechanics.
Hindustan Book Agency, New Delhi, 2005.
(To be published).

2.2.1   Research Summary

Astro-particle Physics

The possibility of determining the Dirac/Majorana state of neutrino using ultra-high energy neutrinos from astrophysical sources has been explored. In particular, next generation large scale neutrino telescope Multi-OWL has been considered and the number of neutrino events expected to be detected there, depending on the Dirac or Majorana nature of neutrinos, has been calculated [**Gu2**].

In another work it has been investigated in detail whether Gamma Ray Bursts can explain the observed highest energy cosmic ray events on Earth. The TeV gamma ray luminosity of Gamma Ray Bursts as reported by MILAGRO experiment has been used to derive the extreme energy cosmic ray spectrum from these astrophysical objects. The derived cosmic ray spectrum from Gamma Ray Bursts above energy 10^{19} eV is found to be comparable with the cosmic ray data collected by HiRes experiment [**Gu1**].

Biological Physics

DNA in a cell comes in the form of long two-stranded molecules, with the two strands arranged in the double-helix form made famous by Watson and Crick. Recent important experiments quantify the ability of short DNA molecules to form closed loops, but the numbers disagree by a factor of more than a thousand with the predictions of simple theoretical models of DNA bending. It has been suggested that this discrepancy arises because of "bubbles", small regions where double-stranded DNA melts into two separated single strands; DNA is more easily bent in the vicinity of a bubble. Models which incorporate the physics of bubbles in DNA can be used to predict, among other things, the full distribution of the end-to-end vector of the DNA molecule, the optimal location of the bubble and the variation of the probability that a loop forms with the details of the DNA sequence. The interesting question of the relation between the extension of a short DNA molecule with the force which is applied to stretch it is also studied. The answer turns out to depend very much on how the experiment is done: for instance, one can get different answers depending on whether one pulls out the DNA to a fixed length and measures a restoring force or applies a fixed force and measures the degree of extension, an unusual but potentially testable prediction [**Me4**].

Molecular motors are protein molecules which move on the filaments which constitute the cytoskeleton of the cell. Putting molecular motors and cytoskeletal constituents (microtubules) together has been shown to yield a remarkable sequence of patterns as the motor density is varied. The modeling of these patterns has interested many physicists recently, as it appears to represent a new class of pattern formation problems which are intrinsically driven in character and which, further, involve vectorial quantities rather than scalar fields such as concentration variables. A detailed study of pattern formation in mixtures of molecular motors and micro-tubules has been performed. The analysis proposes new coarse-grained hydro-dynamical equations of motion for fields governing the local micro-tubule orientation,

as well as density fields for bound and free motors. The work generates *all* the disordered and relatively ordered states (lattice of vortices, lattices of asters and aster vortex mixtures) seen in experiments *in vitro* [**S**].

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 potentially fatal arrhythmia occurring in the ventricles is Ventricular Tachycardia (VT), an abnormally fast excitation, during which the heart can be activated as rapidly as 300 times per minute. For people in chronic risk of VT, the most common treatment is implanting an ICD, a device capable of detecting the onset of VT and giving a periodic sequence of low-amplitude electrical stimuli (pacing). However, the underlying mechanisms of the success and failure of pacing termination are not yet well-understood and, the algorithms currently used in such devices are often based on purely heuristic principles.

This problem was investigated in the context of a model of VT in a quasi-1D geometry that reproduces all the relevant features of clinical VT and is convenient to study computationally. The results [**Sinh1**] show that conduction inhomogeneities can be generated through the nonlinear dynamics of excitation wave propagation in otherwise homogeneous cardiac tissue, and that these inhomogeneities play a crucial role in the successful termination of VT by pacing. These results imply that the dynamical generation of transient heterogeneity could be a principal mechanism by which ICDs terminate VT.

DNA sequences are being examined using computational and statistical methods, to learn about gene regulation and regulatory site detection, phylogeny, homology detection etc [**Si**].

Classical and Quantum Gravity, Black Holes, Cosmology

It has been known for a while that in the framework of Loop Quantum Cosmology, the classically indicated singularity of the isotropic models is absent in the sense that the fundamental dynamical equation which is a difference equation does not break down and the non-trivial definition of inverse triad operator implies that curvatures/densities etc remain bounded. Furthermore, in the continuum approximation followed by WKB approximation (to order $\hbar^0$), the difference equation also goes over to a differential equation from which an effective classical Hamiltonian can be derived. This is useful because now the absence of singularity can be investigated in the more familiar framework of the Robertson-Walker geometries with only the Einstein dynamics being modified by quantum corrections.

Such an effective model for isotropic cosmology has been developed in two papers [**D3**, **Ba**]. The first one identifies a quantum contribution in the form of a potential term called *quantum geometry potential* as well as further modifications to the density and pressure of the matter (described by a Hamiltonian). The second work identifies the modifications of the kinetic term, leading to a *bound* on the rate of change of the scale factor, in terms of a discreteness parameter. The latter work also explicitly interprets these modifications as due to the discreteness of the underlying quantum geometry. The effective dynamics is also shown to be singularity free.

It follows from the negation of the singularity theorem, that the non-singularity implies a violation of the energy conditions which immediately implies a phase of accelerated expan-

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sion in the small volume regime. For the minimally coupled scalar matter with arbitrary positive semi-definite potential, it is shown that this accelerated phase is actually an *exponential* expansion, without any *fine-tuning* [**D4**]. Combining the generic behaviour of the matter Hamiltonian in the small volume regime with the behaviour of the quantum geometry potential, it is shown that there is always a *bounce* preventing the evolution to reach zero volume [**D5**].

Condensed Matter Physics

The unusual field dependence of the third moment of the field distribution function in the mixed phase of the high-T_c superconductor LSCO has been studied. The fact that the third moment turns negative is shown to be an indicator of strong three-body correlations - in the absence of long range order - in the vortex glass phase. The experimental data can be compared both to extensive numerical simulations and an analytic liquid-state theoretical study. The theoretical predictions tally well with the experimental data. This approach is unique in that it demonstrates the usefulness of local probes (the muon) in accessing space-averaged many particle correlations [**Me3**]. This analysis supplements recent work on flux-line systems which exhibit a vortex glass transition, in which direct observations are presented, for the first time, of the vortex line glass phase [**Me2**]. *This paper was identified as a Research Highlight in the Annual report (2004-2005) of the Institut Laue-Langevin.*

An extensive study of the properties of pancake vortices in layered superconductors near boundaries has been carried out and a density functional theory for such systems proposed. This is a new extension of density functional methods, in which it is shown that coupling a density functional calculation to a "substrate model" can yield far better results for the melting curve than DFT methods on their own. These studies indicate that the presence of a free surface always prevents super-heating of the solid, in agreement with recent experiment which see asymmetric hysteresis across the melting transition [**Me1**]. These calculations are currently being extended in several ways, principally through the development of a Landau theory based on DFT methods, calculations of the surface energy and width of the interface separating the bulk solid from the liquid on the surface and predictions for low-energy $\mu-$SR experiments which probe surface layers.

Several recent imaging experiments access the equilibrium density profiles of a mono-layer of interacting particles confined to a two-dimensional substrate. When these particles are in a fluid phase, such data can be shown to yield precise information regarding substrate disorder as reflected in one-point functions and two-point correlations of the fluid. Using Monte Carlo simulations and replica generalizations of liquid state theories, unusual two-point correlations of time-averaged density inhomogeneities induced by disorder are extracted. Correlation functions such as these have not hitherto been measured but should be experimentally accessible [**Me5**].

The spin and charge are decoupled in the orthofermi statistics. Consequently, a representation of spin operators in terms of creation and annihilation operators of orthofermions are much more complex compared to the usual representation of spin 1/2 fermions. The problem has been solved by providing the complete representation of spin operators. As an application of orthofermi statistics, the thermodynamics of infinite U Hubbard model has been studied and the known results in one dimension are obtained. Since the present approach

is valid in any dimension, it can be employed to ascertain the accuracy of the approximate solutions of Hubbard model [**Mi2**].

Electron transfer from a metal electrode to a solvated reactant via an adsorbate intermediate play an important role in the context of molecular electronic devices. This problem is tackled by employing a hybrid of Anderson and Hubbard Hamiltonians. The presumed random distribution of ad-species has been treated employing coherent-potential approximation. Both the reactant and adsorbate interact with the solvent, which is modeled as a bath of phonons with frequencies in the classical regime. Both the adiabatic and non-adiabatic potential energy surfaces are calculated, and their dependence on the adsorbate coverage is highlighted. The calculation of the potential energy surface for the excited state constitutes a new result. In the low coverage regime, the potential energy surfaces exhibit features similar to a bridge-assisted electron transfer reaction, whereas for higher coverages the surface resembles those for a direct heterogeneous transfer [**Mi5**].

A remarkable discovery of superconductivity in boron doped diamond was explained [**Bas1**] based on the author's earlier idea of Mott insulator-superconductor transition in an impurity band. The general mechanism was argued to suggest a new route to synthesize new high temperature superconducting materials.

A new set of X-Ray absorption studies on boron doped diamond was explained [**Bas2**] as a support for the model and mechanism of superconductivity presented in [**Bas1**].

A puzzling problem of the role of ice in stabilizing superconductivity in $Na_xCoO_{2\cdot y}H_2O$ was resolved and two effects were predicted [**Bas3**]. This effect, when observed, is likely to have device application in nano devices.

In spite of strong randomness superconductivity survives in $Na_xCoO_{2\cdot y}H_2O$, a new high T_c superconductor. It was shown that this is a strong indicator for the presence of a quantum protectorate from spin-charge decoupling physics [**Bas6**].

A detailed theory of spin-1 collective mode in graphite, predicted in 2003 by the author and Akbar Jafari, was developed further [**Bas5**]. This helps experimentalists to check our prediction by neutron scattering methods. The prediction of a spin-1 collective mode in graphite was further clarified in [**Bas4**].

Two spin based nano devices, one using Skyrmionic spinon and one using spin-1 collective mode in p-pi bonded organic molecules in tunnel junctions, were suggested in two conferences in Japan.

CP-Violation, Neutrinos and B-Physics

It is by now well established that neutrinos mix, have different masses and therefore oscillate. The oscillations parameters themselves, however, are not yet well determined. A question of fundamental importance is the ordering of the neutrinos masses, or the mass hierarchy. This study examines this explores the possibility of determining the mass hierarchy using a magnetized iron calorimeter (ICAL) detector. Such a detector has been proposed by the INO collaboration.

Because of the capacity to distinguish between positively and negatively charged particles

(muons in this case), such a detector offers the possibility of establishing the sign of the mass-squared differences, which is the parameter of interest in this study. It is found that a result of significance greater than 90% requires an exposure of 500 kton-years provided one of the mixing angles, which is not well determined, is at least 6 degrees or more [**I**].

A novel method of cleanly measuring the parameters of New Physics (NP) was proposed. It was shown that a study of the CP asymmetries in the decay mode $B \to (D^+D^-)_{\psi(3770)}K_S$ across the charmonium resonance $\psi(3770)$ provides a clean signal of new physics. This technique provides a method to determine the size and weak phase of new physics as well as the $B^0 - \bar{B}^0$ mixing phase β, without any theoretical uncertainties [**Sin3**].

Three other methods for measuring NP parameters were examined. The first uses a technique involving both $b \to s$ and $b \to d$ penguin B decays. Depending on which pair of decays is used, the theoretical error is in the range 5–15%. The second involves a comparison of $B \to \pi K$ and $B \to \pi\pi$ decays. Although the theoretical error is large ($\gtrsim 25\%$), this method can be used with presently-available data. The third is via a time-dependent angular analysis of $B \to VV$ decays. In this case, there is no theoretical error but the method applies only to those NP models whose weak phase is universal to all NP operators. A reliable identification of the NP will involve the measurement of the NP parameters in many different ways, and with as many B decay modes as possible, so that it will be important to use all of these methods [**Sin4**].

The analysis of $B \to J/\psi K_2^\star(1430)$ decay mode is complicated by the fact that close to the $J^{PC} = 2^{++}$ meson $K_2^\star(1430)$, there lie other $J^{PC} = 1^{--}$ and $J^{PC} = 0^{++}$ resonances, $K^\star(1410)$ and $K_0^\star(1430)$ respectively. It was shown how an angular analysis can be used to isolate the contributions from the different resonances and partial waves contributing to the final state $B \to J/\psi K_X$, where K_X could be any of the resonance $K_2^\star(1430)$, $K^\star(1410)$ or $K_0^\star(1430)$. For this purpose, the time integrated differential decay rate was studied. A time dependent angular asymmetry was also constructed which enables a clean measurement of the mixing phase β in the mode $B \to J/\psi K_2^\star(1430)$ alone, without contributions from the decay modes $B \to J/\psi K_2^\star(1430)$ or $B \to J/\psi K^\star(1410)$ [**Sh**].

An SO(10) grand unified theory is proposed with the special feature that all fermions acquire masses only via see-saw. This is achieved through a minimal Higgs sector of 210 and 16. However, the regular fermions in 16 are supplemented by a singlet per generation whose mass term breaks chiral symmetry, so that the fermions can get masses. Required neutrino masses with large mixing as well as leptogenesis are possible in this model [**R1**].

Threshold effects on the earlier RG analysis of neutrino masses and mixings are considered and it is shown that the sign and magnitude of these effects are such as to bring the earlier results into concordance with the latest neutrino data from KamLAND and SNO [**R3**].

Neutrino mixing angles are considered in the SO(10) GUT with the usual Higgs multiplets 10 and 126. The Dirac-neutrino Yukawa matrix in this model has a structure similar to that of the u quark. Using the empirically consistent u-quark mass matrix, the light neutrino mass matrix can be determined through type-I see-saw mechanism. The large mixing angles in the solar and atmospheric neutrino sectors with the small reactor neutrino angle as well as the hierarchy between the solar and atmospheric mass differences, come out naturally [**R2**].

The dual Meissner effect description of QCD in the confining region provides q^{-4} behaviour for the gluon propagator and involves the dual gluon mass m as a parameter. This is used in the Schwinger-Dyson equation for the quarks in the infrared region to exhibit chiral symmetry breaking for light quarks. Using the light quark condensate as input, the dual gluon mass is determined and its importance in showing the asymptotic free behaviour of the extrinsic curvature coupling in the rigid QCD string is discussed [**K**].

The Linux cluster built for Lattice Gauge Theory simulations, reached 1 Teraflop sustained performance on Oct 13, 2004. A whole family of parallel algorithms for very high accuracy studies of the quark-antiquark potential in d $= 4$ SU(3) qcd have been developed. The first results show that to a high accuracy this potential is described by a Nambu-Goto string.

Nonlinear Dynamics, Solitons and Chaos

The geometric phase associated with the time evolution of the wave function of a Bose-Einstein condensate in a double well trap is computed by using a model for tunneling between the wells. The importance of this phase in the context of some recent experiments is pointed out [**B3**].

Using the example of a classical, piece-wise linear driven damped oscillator exhibiting chaotic dynamics, the geometric phase associated with the various attractors of the system are found. This phase is shown to be resilient to fluctuations, responds to all bifurcations in the system, and also finds new transitions. A novel phenomenon of geometric localization is pointed out, which manifests itself as a significant deviation from planar dynamics over a short time interval [**B4**].

For the piece-wise linear, quantum, driven oscillator, the geometric phase associated with the wave function is computed. Preliminary results suggest that the classical geometric phase found earlier by us for this system, may be related to the difference between the geometric phases of two neighbouring eigenstates of the quantum system, pointing to a quantum-classical correspondence [**B1**, **B5**].

After a brief review of the phenomenon of anholonomy that gets associated with a static and a moving curve, the expressions for the respective geometric phases in the two cases are obtained and interpreted. A close connection between anholonomy and nonlinearity in a wide class of nonlinear systems is demonstrated [**B2**].

The effects of random non-local connections on networks of chaotic maps under threshold activated coupling was studied. In threshold regimes where a large number of unsynchronized attractors occur under regular connections, it was shown how non-local rewirings yield synchronized networks. Further the mean time to reach synchronization with respect to fraction of rewiring indicated an optimum degree of non-locality for which synchronization was most efficiently achieved [**Sinha3**].

A scheme of q-deformation of nonlinear maps has been introduced. As a specific example, a q-deformation procedure related to the Tsallis q-exponential function is applied to the logistic map. Compared to the canonical logistic map, the resulting family of q-logistic maps

is shown to have a wider spectrum of interesting behaviours, including the co-existence of attractors - a phenomenon rare in one-dimensional maps [**Ja1**, **Ja2**].

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 [**Sinh4**], was considered. The stability of such a system was examined in terms of the asymptotic fraction of nodes that persist in a non-zero state. Scaling results showed that the probability of survival in the steady state agrees remarkably well with the May-Wigner stability criterion derived from linear stability arguments. This suggests universality of the complexity-stability relation for random networks with respect to arbitrary global dynamics of the system. To further buttress the generality of the relation, non-random networks, in particular small-world networks [**Sinh2**], were looked at. The transition from stability to instability was observed to occur at a quantitatively identical value of the relevant network parameter, for networks ranging from a perfectly regular one arranged around a ring, through small-world networks, to totally random ones. Only the nature of the transition appeared to change with network structure, with the collapse to instability becoming more gradual as the network becomes more regular.

Perturbative QCD

A detailed phenomenological study of forward hadron (π^0) production in deep inelastic scattering is presented, with both the direct and the resolved contributions calculated to Next-to-Leading order (NLO) accuracy. A comparison of the theoretical predictions for the various distributions with the H1 data and a study of stability of the QCD predictions under changes of scales is the focus of this study. Very good overall description of the recent H1 data with the choice of scale $Q^2 + E_\perp^2$ is obtained, in contrast to the $(Q^2 + E_\perp^2)/2$ required earlier when the resolved contribution was included only at Leading Order (LO) accuracy. Here $E_\perp^2$ is the transverse momentum of the emitted pion. A more modest variation of the predictions, as the scale is changed from $(Q^2 + E_\perp^2)/2$ to $2(Q^2 + E_\perp^2)$ is noticed, as compared to the case where the resolved contribution was included only at LO accuracy. This variation is of the order of the rather large experimental errors. Unfortunately, this fact implies that perturbation theory does not give an unambiguous prediction for forward particle production in deep inelastic scattering. However, the overall success of perturbative QCD in explaining the small x_{Bj} data means that perhaps a full re-summation of the BFKL ladder is not called for. This study also implies the need for rather large resolved contributions to explain the data at low x_{Bj} even at somewhat larger Q^2 values [**Basu2**].

QFT, Topological QFT, Conformal Field Theory

It was shown that the logarithmic infrared divergences in electron self-energy and vertex function of massless QED in 2+1 dimensions can be removed at all orders of 1/N by an appropriate choice of a non-local gauge. Thus the infrared behaviour given by the leading order in 1/N is not modified by higher order corrections. The analysis gives a computational scheme for the Amati-Testa model, resulting in a non-trivial conformal invariant field theory

Theories with space-time non-commutativity were considered and novel features of such theories are pointed out [**Go1**, **Go2**]. Nonlinear sigma models in $2 + 1$ D in non-commutative space was considered and equivalence to fermionic theory pointed out [**Go3**].

Relativistic Heavy Ion Collisions

The rapidity spectra of the various secondary particles including heavy particles such as deuterons produced in $Pb + Pb$ collisions at CERN SPS-energies and in $Au + Au$ collisions at RHIC-BNL, have been analyzed in light of the constituent picture of the particles initiated by Eremin and Voloshin. It was confirmed that the constituent parton picture of the particles provides a better and more unified description of the rapidity-density yields for most of the secondaries produced in heavy ion interactions. The available data were described in terms of both the number of participant nucleons (N_{n-part}) and the constituent parton-numbers(represented by N_{q-part})of the nucleon(s) themselves. Besides, a table of relative probability versus N_{q-part} for PP collision was provided as predictions of the model used and these could serve in future as the model-testing elements and as a check for foundational ideas [**De2**].

The contrasting nature of the p_T-spectra measured in deuteron (D)-gold (Au) and gold (Au)-gold (Au) collisions, both performed at RHIC-BNL at $\sqrt{s_{NN}} = 200$ GeV, has been a stimulating and hot topic in the domain of high energy nuclear physics. Using the somewhat non-standard approach, called the Combinational Approach(CA), the latest observations on deuteron-gold collisions at $\sqrt{s_{NN}} = 200$ GeV at mid-rapidity and some other rapidity regions were successfully analyzed. In particular, the features of contrast for nuclear modification factor (NMF) in $Au - Au$ collisions at $\sqrt{s_{NN}} = 200$ GeV, and the hadronic ratios measured for only the $Au - Au$ collisions at $\sqrt{s_{NN}} = 200$ GeV were reproduced. Data on the similar ratios for $D - Au$ interactions are not yet available. Finally, the implications of the approach in terms of both data-interpretation and physical insights were precisely pointed out [**De1**].

The wide band of features of some of the most important observables on J/Ψ production in some particle-particle, particle-nucleus and nucleus-nucleus interactions at high energies were dealt with from the viewpoint of a non-standard approach which has no a priori QGP-tag but which can reproduce the proposed diagnostics of QGP in a considerable way. The study revealed that the J/Ψ production is neither suppressed nor enhanced; rather it exhibits, both in theoretical approach and in experimental measurements, a behaviour which is just as normal as many other secondaries, with only specificities of its own intrinsic quantum numbers and the very massive nature [**De3**].

Statistical Mechanics

With the aim to study universal persistence properties, persistence properties of various non-equilibrium systems were studied [**Ra1**].

A growth model where the occupation probability of a growth site depends directly to the number of occupied sites adjacent to the growth site, has been studied. The proportionality constant determines the growth form at criticality [**Ro**].

In order to understand how the precursor power-law development of ruptures gives rise to a rough fracture surface, the breakdown of heterogeneous materials under stress is studied [**Ra2**].

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. With this end, the popularity of movies was looked at by estimating the distributions of their gross earnings (opening and total) and their endurance in the box office [**Sinh3**]. The results obtained are consistent with a power-law dependence of the rank distribution of gross revenues for the most popular movies, with an exponent close to $-1/2$. This translates to a Pareto law for the income distribution of movies with a Pareto exponent of 2.

String Theory

The loop variable method has been extended to closed strings. The crucial ingredient is the Renormalization Group (RG) formulation in which holomorphic factorization is preserved. This is done by working in Lorentzian metric for the world sheet rather than the usual Euclidean metric. The results of Kawai, Lewellyn and Tye, where closed string amplitudes are written as sums of products of open string amplitudes can be used here [**Sat1**].

Once the RG is formulated in a way that preserves holomorphicity, one can apply the same techniques that were used for open strings in to obtain gauge invariant interacting equations for closed strings [**Sat2**].

A manifestly background independent formulation of string theory has been a rather elusive goal. The loop variable approach holds promise in this regard because it does not depend on world sheet symmetries for gauge invariance - gauge invariance is built into it as a space time property of the loop variables. The crucial issue is whether a sensible map from loop variables to space-time fields can be made. In the present work, it was shown that a general algorithm for defining gauge invariant and generally covariant equations exists for all the modes of the free open string. The main ingredient is the use of Riemann normal coordinates and a suitable modification of the naive map to space time fields that allows gauge transformations to be well defined for space time fields in curved space. As an example the spin 2 massive field equations in curved space was worked out. This result for massive fields in curved space is completely new and has not been seen in the literature. Results exist in the literature in AdS space for higher spin massless fields [**Sat3**].

Open-closed duality in string theory is one of the most intriguing aspects of string theory and underlies AdS/CFT duality. In flat space it is known that UV divergent open string loop amplitude can be understood as an infrared divergence in the closed string tree amplitude due to on-shell massless modes. In the present work this is investigated in flat space in the presence of $B_{\mu\nu}$ fields. The point of doing this is that some of the UV divergences (non-planar) are regulated by this and one can compare finite terms instead of comparing

divergences. A duality between a loop amplitude in a Yang Mills theory and a tree amplitude in a gravity theory is obtained, somewhat like the AdS/CFT duality. However the calculation is done in bosonic string theory where the equalities of amplitudes are not exact and needs to be extended to superstring theory where the equalities are exact. Another by product is that one can take the non commutative field theory limit of these amplitudes, where also there is a well known UV/IR mixing and hope to explain this in terms of massless modes that have been integrated out. In the present case this massless modes would be the massless modes of the dual closed string channel [**Sa2**].

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**]
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Geometric phase and classical-quantum correspondence.
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2.3.1 Research Summary

Algorithms and Data Structures

The problem of Optimal Block Sorting is known to be NP-hard and is known to have a polynomial-time 2-approximation algorithm. In [**M1**], the ideas from earlier works are improved upon to yield a combinatorial characterization of optimal block-sorting solutions. This characterization allows establishing that certain block moves are provably optimal and hence may be safely used in any heuristic. It also allows establishing that the block-sorting diameter for permutations in S_n is $n-1$, which is achieved only for the reverse permutation. Further, an optimum-preserving equivalence between block-sorting and the Common Substring Removal problem (CSR) – a natural combinatorial puzzle – is demonstrated. As a consequence, block sorting a permutation is as hard (or as easy) as sorting its inverse.

For planar graphs, counting the number of perfect matchings (and hence determining whether there exists a perfect matching) is known to be in NC. For planar bipartite graphs, finding a perfect matching (when one exists) can also be done in NC. However, in general planar graphs (when the bipartite condition is removed), no NC algorithm for constructing a perfect matching is known. In [**M2**], a relaxation of this problem is addressed. It is shown that if the input planar graph G has at least one perfect matching, then a vertex of the fractional matching polytope can be found in NC.

Motivated by the space-efficient representation of large and static XML documents, the practical performance of parenthesis representations is considered. A new $2n + o(n)$ bit representation of balanced parentheses is given. From a theoretical perspective, it is conceptually simpler, has a smaller $o(n)$ term and also a simple and uniform $O(n)$ time construction algorithm. The structure is also implemented and its practical performance is compared with an implementation of Jacobson's balanced parenthesis structure, looking both at memory usage and speed [**Ra1**].

A feedback vertex set (FVS) of an undirected graph is a set of vertices whose removal results in an acyclic graph. An improved algorithm is given for the parameterized complexity of the undirected feedback vertex set (UFVS) problem in [**Ra3**]. The new algorithm achieves an improvement in the running time (over the previous best result) by a factor larger than $(\log \log k)^k$ where k is the parameter of the problem. This improvement is based on a combinatorial lemma which states that an upper bound on the size of a minimum size FVS implies an upper bound on the length of a shortest cycle in graphs having minimum degree at least 3.

The parameterized complexities of weighted feedback arc and weighted feedback vertex set problems in tournaments are considered in [**Ra2**]. It is shown that if a subset F of arcs forms a minimal feedback arc set in a directed graph then the graph formed after reversing these arcs is acyclic. A subtournament on four vertices is presented whose absence makes these problems polynomial time solvable. These observations are used to give new improved algorithms for feedback arc and vertex set problems.

An algebraic framework has been developed for Petri nets yielding a Myhill-Nerode theorem for 1-safe nets. As an application, an alternative proof of the conflict-free case of Thiagarajan's conjecture is developed. A proof is also provided which generalizes the trace-labelled case.

In [**R1**], Lamport diagrams, presented as a sequence of *layers*, are considered. The layers themselves describe finite communication patterns and a diagram is obtained by sequential composition of such parallel processes. The logic is defined appropriately, with layer formulas describing communications within a layer, and temporal formulas describing the sequence of layers in the computation. When the number of events in layers is uniformly bounded and each layer is communication closed, one gets decidability. Alternatively, a stronger uniform bound on the so-called channel capacity also yields decidability.

In [**R2**], a subclass of security protocols referred to as *context-explicit protocols* are identified. For this subclass, it is shown that secrecy is decidable even in the presence of an unbounded set of nonces.

Computational Complexity

The computational complexity of the problem LCON of testing the feasibility of linear equations over integers modulo a composite number (given as part of the input by its prime factorization) is examined. In 1984, Cook and McKenzie gave an NC^3 algorithm for this problem. In [**A4**], it is shown that this problem can in fact be solved in randomized NC^2. More precisely, it is shown that LCON is in the nonuniform class L^{GapL}/poly. Combined with the hardness of LCON for L^{GapL}, this results in a fairly tight characterization of the complexity of LCON in terms of logspace counting classes. Also, the same upper bound results are shown to hold for the problem of testing the feasibility of linear equations over a finite ring with unity, where the ring is given as part of the input as a table.

Also, the complexity of *Bounded Color Multiplicity Graph Isomorphism* ($BCGI_b$) is studied. $BCGI_b$ is the Graph Isomorphism problem restricted to those inputs consisting of a pair of vertex-colored graphs such that the number of vertices of a given color in each input graph is bounded by a constant b. It is shown that $BCGI_b$ is in the logspace counting hierarchy. Combined with the fact that BCGI is logspace many-one hard for every set in the Mod_kL hierarchy for any constant k, this leads to a tight classification of BCGI using logspace-bounded counting classes. This work is reported in [**A3**].

Graph Theory and Combinatorics

A *proper* coloring of the edges of a graph is called *acyclic* if there is no two-colored cycle in G. The *acyclic chromatic index* of G, denoted $a'(G)$, is the least number of colors required for an acyclic edge coloring of G. The previous best bound on this number is $16\Delta(G)$ where $\Delta(G)$ denotes the maximum degree of G. This bound has been improved to 4.52Δ for all graphs whose girth (length of the shortest cycle) is at least 220 [**Mu**]. Also, an upper bound on $a'(G)$ which is a decreasing function of the girth is derived. In addition, some algorithmic aspects of obtaining an acyclic edge colouring are also being studied.

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 Piyush P. Kurur.
The complexity of computing units in a number field.
In Duncan Buell, editor, *In Proceedings of the Sixth Algorithmic Number Theory Symposium (2004), Vol. 3076, Lecture Notes in Computer Science, 72-86*, page 72. Springer Verlag, Jun 2004.

[**A2**]
V. Arvind and T. C. Vijayaraghavan.
Abelian permutation group problems and logspace counting classes.
In *Proceedings of the Nineteenth IEEE Conference on Computational Complexity (2004), Amherst, 204-214*, page 204. IEEE Computer Society, Jun 2004.

[**A3**]
V. Arvind, Piyush P. Kurur, and T. C. Vijayaraghavan.
Bounded color multiplicity graph isomorphism is in the #L hierarchy.
In *Proceedings of the 20th IEEE Conference on Computational Complexity (2005)*. IEEE Computer Society, Feb 2005.
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[**A4**]
V. Arvind and T. Vijayaraghavan.
The complexity of solving linear equations over a finite ring.
In Volker Diekert, editor, *In Proceedings of the 22nd Annual Symposium on Theoretical Aspects of Computer Science, Stuttgart, Germany, February 24-26, 2005, Vol. 3404, Lecture Notes in Computer Science, 472-484*, page 472. Springer Verlag, Feb 2005.

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V. Arvind, Piyush P. Kurur, and K. Parthasarathy*.
Nonstabilizer quantum codes from abelian subgroups of the error group.
Quantum Information and Computation. Rinton Press, 2004 (Also appeared in volume in honor of Prof. Holevo's 60th birthday. Rinton Press, New Jersey.), **4(6)**, 411, 2004.

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V. Arvind and J. Toran*.
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In *Proceedings of the Nineteenth IEEE Conference on Computational Complexity (2004), Amherst, 91-103*, page 91. IEEE Computer Society, 2004.

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Meena Mahajan, R. Rama*, and S. Vijayakumar.
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In Kyung-Yong Chwa and J. Ian Munro, editors, *Proceedings of the Tenth International Computing and Combinatorics Conference COCOON*, pages 33–42. Springer Lecture Notes in Computer Science Vol. 3106, Aug 2004.

[M2]
Raghav Kulkarni* and Meena Mahajan.
Seeking a vertex of the planar matching polytope in NC.
In S Albers and T Radzik, editors, *Proceedings of the European Symposium on Algorithms (ESA)*, pages 472–483. Springer Lecture Notes in Computer Science LNCS Series Volume 3221, Sep 2004.

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The combinatorial approach yields an NC algorithm for computing Pfaffians.
Discrete Applied Mathematics, **143(1)**, 1–16, 2004.

[Mu]
Rahul Muthu, N. Narayanan, and C.R. Subramanian.
Improved bounds on acyclic edge colouring.
In *Proceedings of GRAC0-2005 (Second Brazilian Symposium on Graphs, Algorithms and Combinatorics)*, Mar 2005.
Proceedings will appear in Electronic Notes in Discrete Mathematics. (To be published).

[R1]
B. Meenakshi* and R. Ramanujam.
Layered message passing systems.
Computer Languages, Systems & Structures, **30(3-4)**, 171, 2004.

[R2]
R. Ramanujam and S. P. Suresh*.
Decidability of secrecy for context-explicit security protocols.
Journal of Computer Security, **13(1)**, 135, 2005.

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Richard F. Geary*, Naila Rahman*, Rajeev Raman*, and Venkatesh Raman.
A simple optimal representation for balanced parentheses.
In S. Muthukrishnan S.C. Sahinalp and U. Dogrusoz, editors, *Fifteenth Annual Symposium on Combinatorial Pattern Matching (CPM-2004)*, page 159. Springer-Verlag, Jul 2004.

[**Ra2**]
Venkatesh Raman and Saket Saurabh.
Improved parameterized algorithms for feedback set problems in weighted tournaments.
In R Downey M Fellows and Frank Dehne, editors, *Proceedings of the First International Workshop on Parameterized and Exact Computation (IWPEC-2004)*. Springer Verlag Vol, Sep 2004.

[**Ra3**]
Venkatesh Raman, Saket Saurabh, and C. R. Subramanian.
Faster algorithms for feedback vertex set.
In *Proceedings of GRACO-2005 (Second Brazilian Symposium on Graphs, Algorithms and Combinatorics)*. Elsveir Publications, Mar 2005.
Published in *Electronic Notes in Discrete Mathematics*, **19**, 273-279, 2005.

[**S**]
L. S. Chandran∗**, Vadim V. Lozin**∗**, and C. R. Subramanian**.
Graphs of low chordality.
Discrete Mathematics and Theoretical Computer Science (DMTCS), **7(1)**, 25–36, 2005.

Books/Monographs Authored/Edited

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

[**L**]
Kamal Lodaya and Meena Mahajan, editors.
Proceedings of FSTTCS-2004 (24th International Conference on Foundations of Software Technology and Theoretical Computer Science), volume 3328 of *Lecture Notes in Computer Science*.
Springer Verlag, 2004.

2.4 Student Programmes

2.4.1 Degrees Awarded

Doctoral Degrees Awarded during 2004 − 2005

Mathematics

Name: **Ghosh, Shamindra K.**
Thesis Title: On Planar Algebras and Representations of the Annular Category over a Planar Algebra
Thesis Advisor: Sunder, V. S.
University: Indian Statistical Institute

Theoretical Computer Science

Name: **Suresh, S. P.**
Thesis Title: Foundations of Security Protocol Analysis
Thesis Advisor: Ramanujam, R.
University: University of Madras

Doctoral Theses Submitted during 2004 − 2005

Mathematics

Name: **Das, Paramita**
Thesis Title: Planar algebras and weak Hopf C^*-algebras
Thesis Advisor: Kodiyalam, Vijay
University: Indian Statistical Institute

Name: **Uma, V.**
Thesis Title: Topology of Toric Varieties
Thesis Advisor: Sankaran, Parameswaran
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

Mathematics

Name: **Bandopadhyaya, Pradipto**
Thesis Title: Exponents of class groups of quadratic function fields over finite fields
Thesis Advisor: Srinivas, K.
University: Bhoj Open University

Physics

Name: **Sharma, Chandradew**
Thesis Title: Angular Analysis of B decaying into Tensor, Vector and Scalar Modes.
Thesis Advisor: Sinha, Rahul
University: Anna University

Theoretical Computer Science

Name: **Sarma, Jayalal M.**
Thesis Title: Refining Randomness and Applications to Derandomization
Thesis Advisor: Mahajan, Meena B.
University: Anna University

Name: **Saurabh, Saket**
Thesis Title: A Study of Efficient Algorithms for Sampling Colourings
Thesis Advisor: Subramanian, C. R.
University: Bhoj Open University, Bhopal

2.4.2 Lecture Courses During 2004 – 2005.

The following **lecture courses** were offered during 2004 – 2005.

Course Title	Period	Lecturer
Mathematics		
Complex Analysis	Jan-Apr 2004	Prasad, Amritanshu
Functional Analysis	Jan-Apr 2004	Kesavan, S.
Algebra I	Aug-Nov 2004	Iyer, Jaya N.
Measure Theory	Aug-Dec 2004	Krishna, M.
Vertex Operator Algebras and the Monster	Aug-Nov 2004	Raghavan, K. N.
Real Semisimple Lie Groups	Aug-Nov 2004	Parthasarathy, R. (TIFR)
Harmonic Analysis (seminar-course)	Sep-Mar 2005	Prasad, Amritanshu
Differential Equations	Jan-Mar 2005	Krishna, M.
Functional Analysis	Jan-Mar 2005	Kesavan, S.
Topology-II	Jan-Mar 2005	Sankaran, Parameswaran
Physics		
Advanced Quantum Field Theory	Jan-Apr 2004	Sathiapalan, Balachandran
Condensed Matter Physics	Jan-May 2004	Menon, Gautam I.
Quantum Field theory I	Jan-May 2004	Govindarajan, T. R.
Statistical Mechanics	Mar-May 2004	Balakrishnan, Radha
Introduction to Modern Physics	May-May 2004	Baskaran, G.
Nonlinear Dynamics	Jun-Oct 2004	Sinha, Sitabhra
Advanced Particle Physics	Jul-Dec 2004	Sinha, Rahul
Advanced Condensed Matter Physics	Aug-Dec 2004	Menon, Gautam I.
Classical Dynamics	Aug-Dec 2004	Murthy, M.V.N.
General relativity	Aug-Dec 2004	Govindarajan, T. R.
Mathematical Physics	Aug-Dec 2004	Jagannathan, R.
Quantum Mechanics	Aug-Dec 2004	Mani, Harihara S.
Condensed Matter Physics	Jan-Mar 2005	Siddharthan, Rahul
Particle Physics.	Jan-Mar 2005	Parthasarathy, R.
Theoretical Computer Science		
Algebraic Computation	Jan-Apr 2004	Arvind, V.
Algorithms II	Jan-Apr 2004	Raman, Venkatesh
Distributed computing	Jan-May 2004	Ramanujam, R.
Introduction to Computational Complexity	Jan-May 2004	Mahajan, Meena B.
Mathematical logic	Jan-May 2004	Ramanujam, R.
Theory of computation II	Jan-May 2004	Lodaya, Kamal
Complexity II	Jul-Nov 2004	Mahajan, Meena B.

Algorithms	Aug-Nov 2004	Arvind, V.
Descriptive Complexity, Automata and Logic	Aug-Dec 2004	Ramanujam, R.
Discrete Mathematics	Aug-Dec 2004	Subramanian, C. R.
Programming languages	Aug-Dec 2004	Lodaya, Kamal
Randomized Algorithms	Aug-Dec 2004	Raman, Venkatesh

In addition, the following **lecture courses** were offered during 2004 – 2005 by IMSC faculty in the National Undergraduate programme of the Chennai Mathematical Institute.

Course Title	Period	Lecturer
Mathematics		
Calculus II	Jan-Apr 2004	Kesavan, S.
Analysis I	Aug-Dec 2004	Prasad, Amritanshu
Analysis-II	Jan-Mar 2005	Sankaran, Parameswaran
Physics		
Mathematical Physics	Aug-Dec 2004	Jagannathan, R.
Electromagnetic Theory II	Jan-Mar 2005	Mani, Harihara S.

2.4.3 Summer Students

Every summer, a small number of students from various institutes/universities come to our institute and work on some learning/research projects with some faculty member for a period of four to six weeks.The following students visited the institute during Apr, 2004 - Mar, 2005.

Student   Faculty

Mathematics

Dey, Debapratim, Birla Institute of Technology, Pilani	Srinivas, K.
Reddy, Raghu V., IIT, Madras	Sunder, V. S.
Roy, Indrava, IIT, Kharagpur	Sunder, V. S.

Physics

Mukerjee, Rick, Xavier's College, Mumbai	Balakrishnan, Radha
Majumdar, Devdutt, Physics Dept., Univ. of Pune	Basu, Rahul
Narayanan, A., Xavier's College	Govindarajan, T. R.
Joseph, Anosh, IIT, Madras	Hari Dass, N. D.
Das, Anirban, IIT, Kharagpur	Hari Dass, N. D.
Dhara, Chirag, St Xavier's College, Mumbai	Hari Dass, N. D.
Srivatsan, C.S., IIT, Kanpur	Murthy, M.V.N.
Arunkumar, Amuthan, IIT, Madras	Sinha, Sudeshna
Bijilash, B., IIT, Madras	Sinha, Sudeshna
Ghosh, Archisman, IIT, Kanpur	Sinha, Sudeshna

Theoretical Computer Science

LakshmiNarasimhan, S., PSG Tech, Coimbatore	Ramanujam, R.
Krishnamoorthy, Nithya, Crescent Engineering College	Ramanujam, R.
Mohapatra, Dushmant, IIT, Kharagpur	Ramanujam, R.

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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, 2004 - Mar, 2005.

Student	Faculty

Mathematics

Datta, Swarnendu, CMI	Prasad, Amritanshu

Physics

Krishnan, Madhavi, Anna University	Hari Dass, N. D.
Kumar, Pankaj, Birla Institute of Technology	Simon, R.
Mohan, Nikhil R., International School, Pune	Sinha, Sitabhra

2.4.5   Apalat Fellowship

In order to encourage bright B.Sc. students to take up Physics or Mathematics for their higher studies, the Institute is offering two fellowships, one in Mathematics and another in Physics for students studying in and around Chennai. This goes under the name of APALAT-IMSc scholarship. The scholarship amount is Rs. 1000 per month for 10 months of the academic year and is paid during their M.Sc. programme. Each student is expected to work under the guidance of a faculty member in the respective discipline of the Institute.

Heads of the Departments in Physics and Mathematics of various colleges in the city are contacted to suggest five bright students of B.Sc (third year) who are likely to join M.Sc programme in an institution in Chennai. Out of them, one student in each subject is selected through a written test followed by an interview. The successful students are encouraged to attend seminars in the Institute and to work under the supervision of a faculty member at IMSc, during the summer vacation. They are expected to show their progress in their regular M.Sc. course and if satisfied, the scholarship is extended to the second year of their M.Sc course.

During this academic year, the fellowship was awarded to Mr. Shiva Kumar Ramini of Indian Institute of Technology-Madras, in Physics.

Chapter 3

Other Professional Activities

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

Anuradha, N.

Reviewer of Mathematical Reviews, A.M.S.

Balakrishnan, Radha

Member of National Organising Committee for International Conference on Perspectives in Nonlinear Dynamics (Satellite meeting of STATPHYS 22) held at IMSc during Jul 12 – Jul 15, 2004.

Baoulina, Ioulia

Reviewer of Mathematical Reviews, AMS during Jul 2003 – Mar 2005.

Baskaran, G.

Member of the International Organising Committee for Workshop on Cobalt Oxide Superconductors held at International Frontier Center for Advanced Materials (IFCAM), Tohoku University, Sendai, Japan during May 20 – May 21, 2004.

Member of the International Organising Committee for Asia Pacific Workshop on Modern Trends in Condensed Matter Physics, Hongkong University of Science and Technology, Hongkong held at Hong Kong University of Science and Technology, Hong kong during Jun 21 – Jun 24, 2004. Delivered an invited talk on Theory of Superconductivity in Diamond.

Gave a popular lecture, in Tamil, on Tsunami, at IMSc on Jan 10, 2005. It described how a tsunami arises and how to safeguard oneself. This lecture was repeated to group of fishermen at Kalpakkam, elementary school teachers at Chengleput and Tsunami relieve workers at Chennai and was addressed to many other group of people at various places.

Basu, Rahul

Convener of Local Organising Committee for DAE Golden Jubilee Colloquium Series held at IMSc during Apr 1, 2004 – Mar 31, 2005.

Convener of Local Organising Committee for SERC Preparatory School in High Energy Physics 2004 held at IMSc during Sep 27 – Oct 16, 2004.

Date, G.

Member of The Council of the Indian Association for General Relativity and Gravitation.

Member of Scientific Organizing Committee for the 23rd meeting of the IAGRG during May – Dec, 2004.

Govindarajan, T. R.

Member of National Organising Committee for Workshop on Theoretical High Energy Physics (THEP-I) held at Indian Institute of Technology, Roorkee during Mar 16 – Mar 20, 2005.

Hari Dass, N. D.

Science Club at IIT, Madras on Aug 15, 2004. Lectured on how KABRU, the Linux super-computer was built at the Institute of Mathematical Sciences.

Science Club at IMSc on Nov 15, 2004. Lectured on Asymptotic Freedom for which the Physics Nobel Prize for 2004 was awarded.

Lectured at IGCAR IPA at IGCAR, Kalpakkam on Dec 10, 2004. Lectured on Hadronic Strings and the role of our KABRU in ultraprecise numerical simulations in this area.

Convener of Local Organising Committee for School on Parallel Computing and Clusters held at IMSc during Jan 7 – Jan 15, 2005.

Lectures to school children and college students at The School, KFI on Jan 15, 2005. Lectured on Einstein's work on Brownian Motion. Given numerous lectures to school children from all over Chennai through fora like the Children's club etc

Seminar on 2004 Nobel Prizes, at Chemistry department, IIT, Madras on Jan 10, 2005. Lectured on Asymptotic Freedom for which the Physics Nobel Prize was awarded.

Kesavan, S.

Member of National Board for Higher Mathematics

Member of Editorial Board, Journal of Analysis and Applications

Member of Apex Committe, National Undergraduate Programme, Chennai Mathematical Institute

Reviewer of Mathematical Reviews

Fellow of Forum d' Analystes

Member of Editorial Board, Journal of the Kerala Mathematical Association

Professor-in-charge of teaching Programme Implementation Committee, National Undergraduate Programme, Chennai Mathematical Institute during Aug 2004 – Mar 2005.

Member of Board of Studies in Mathematics, Homi Bhabha National Institute during Jan – Mar, 2005.

Krishna, M.

Member of National Organising Committee for Operator theory, quantum probability and noncommutative geometry held at Indian Statistical Institute, Calcutta during Dec 20 – Dec 23, 2004.

Lodaya, Kamal

Co-chair of Programme Committee, 24th FSTTCS Conference during Jan – Dec, 2004.

Convener of Local Organising Committee for 24th FSTTCS Conference held at IMSc during Dec 13 – Dec 18, 2004.

Mahajan, Meena B.

Co-Chair of Programme Committee, International Conference on Foundations of Software Technology and Theoretical Computer Science 2004 during Jan – Dec, 2004.

Member of Local Organising Committee for Foundations of Software Technology and Theoretical Computer Science held at IMSc during Dec 16 – Dec 18, 2004.

Mani, Harihara S.

Member of HRI council during Aug 2001 – Jul 2004.

Member of IOP council during Aug 2003 – Jul 2004.

Member of Council, Indian Institute of astrophysics during Aug 2003 – Jul 2004.

member of Council, National Academy of Sciences,Allahabad during Jan – Jul, 2004.

Menon, Gautam I.

Member of Local Organising Committee for IMSc Refresher Course in Physics for College Teachers held at IMSc during May 26 – Jun 15, 2004.

Murthy, M.V.N.

Member of Editorial Board, PRAMANA- journal of physics during Jan 2004 – Jan 2005.

Member of Editorial Board, PRAMANA- Journal of physics

Convener of Local Organising Committee for National Science Day held at IMSc on Feb 28, 2005.

Narayanan, N

Member of Local Organising Committee for FSTTCS 2004 held at IMSc during Dec 15 – Dec 18, 2004.

Prasad, Amritanshu

Talk to JBNST scholars at IMSc on Dec 13, 2004. Expository talk concerning p-adic numbers.

Raghavan, K. N.

Convener of National Organising Committee for Symposium on Algebraic Groups in honour of Professor V. Lakshmibai held at Chennai Mathematical Institute on Jan 8, 2005.

Rajasekaran, G.

Member of The Council and the Governing Board of IUCAA,Pune

Popular Lecture at Children's Club, Chennai on Jan 2, 2005. Gave a Lecture on "Einstein and A Century of Physics"

Popular article at The Hindu on Feb 7, 2005. Wrote an article on "Einstein and A Century of Physics", which was published in two parts in the Education Plus section of "The Hindu".

Popular Science Lecture at S R M Institute of Science and Technology, Kattankulathur on Feb 23, 2005. Gave a lecture on "Einstein and A Century of Physics" on the occasion of celebrating The World Year of Physics 2005

Popular Science Lecture at Tamil Nadu Veterinary and Animal Sciences University, Chennai on Feb 28, 2005. Delivered a Special Lecture on "Einstein and A Century of Physics" on the occasion of the National Science Day.

Raman, Venkatesh

Member of Council of Indian Association for Research in Computing Science during Dec 2002 – Mar 2005.

Member of Program Committee of the first International Workshop on Parameterized and Exact Computation (IWPEC) 2004. during Apr – Jun, 2004.

Member of Program Committee of Workshop on Algorithms and Data Structures (WADS) 2005 during Jan – Mar, 2005.

Ramanujam, R.

Member of Programme committee of FST&TCS 2004 during Jan – Dec, 2004.

Convener of Local Organising Committee for Institute Seminar Week 2005 held at IMSc during Mar 1 – Mar 4, 2005.

Sankaran, Parameswaran

Convener of Local Organising Committee for Subhashis Nag Memorial Endowment Lecture held at IMSc on Jan 10, 2005.

Sathiapalan, Balachandran

Member of National Organizing Committee for The Workshop in String Theory at Khajuraho during Oct – Dec, 2004.

Sinha, Sitabhra

Convener of Local Organising Committee for Workshop on The Economy as a Complex System held at IMSc during Dec 6 – Dec 7, 2004.

Invited speaker at St Xavier's College, Kolkata on Mar 15, 2005 on the occasion of Celebration of the World Year of Physics 2005.

Sinha, Sudeshna

Advisory Editor of AIP Journal "Chaos" during Aug 2002 – Mar 2005.

Member of National Organising Committee for Perspectives in Nonlinear Dynamics (Satellite meeting of STATPHYS-22) held at IMSc during Jul 12 – Jul 15, 2004.

Srinivas, K.

Convener of Local Organising Committee for Workshop on Cryptography held at IMSc during May 15 – Jun 12, 2004.

Member of Local Organising Committee for 5th International Conference on Cryptology in India (Indocrypt 05) held at IMSc during Dec 20 – Dec 22, 2004.

Subramanian, C. R.

Member of Programme Committee of the 24th International Conference on Foundations of Software Technology and Theoretical Computer Science (FST&TCS-04) during Apr – Dec, 2004.

Sunder, V. S.

Member of Editorial Board of the Proceedings of the Indian Academy of Sciences (Math. Sci.) during Aug 2001 – Mar 2005.

Member of Editorial Board of the 'Texts and Readings in Mathematics' (TRIM) series published by the Hindustan Book Agency during Aug 2001 – Mar 2005.

Member of Council of the Indian Academy of Sciences during Jan 2004 – Mar 2005.

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

Convener of Board of Studies for Mathematical Sciences, for proposed Homi Bhabha National Institute during Feb – Mar, 2005.

Chapter 4

Colloquia

4.1 Conferences/Workshops Held at IMSc

4.1.1 DAE Golden Jubilee Colloquium Series

On the occasion of the 50th anniversary of the Department of Atomic Energy, all DAE institutes were asked to organize a series of lectures by eminent scientists on topics of interest to the institute and to the DAE. These lectures formed the DAE Golden Jubilee lecture series and were coordinated by Rahul Basu. The following talks were organized by the Institute.

- **Sandip Trivedi**, TIFR, Mumbai
  De Sitter Vacua and the Emerging Landscape of String Theory

- **Bhaskar Ramamurthi**, IIT, Chennai
  Mobile Wireless Access – the Next Generation

- **R. Ramaswamy**, JNU, New Delhi
  Hunting the DNA – finding genes (and other things) in DNA sequences

- **Deepak Dhar**, TIFR, Mumbai
  Picocanonical Ensembles - the Physics of Glasses

- **Amitava Rauchaudhuri**, Calcutta University
  Neutrino Novelties – Pointers to New Physics

- **Suresh Lee**, IGCAR, Kalpakkam
  Nuclear Power – is it safe enough

- **Mohit Randeria**, TIFR, Mumbai
  High T_c superconductivity – recent progress and open questions

- **Ajay Sood**, IISc, Bangalore
  Nanotube Dynamo – Flow Induced Voltage Generation

- **Rohit Parikh**, City University of New York, USA
  Knowledge, Action and Public Action

- **Adi Shamir**, Weizmann Institute of Science, Israel
  Cryptography: State of the Science

4.1.2 Workshop on Cryptography

In summer 2004, IMSc has organized a workshop in Cryptography mainly for students from universities. About 35 students from all over the country were selected to participate in this activity. Four faculty members gave a series of lectures to give a basic introduction to the subject from different angles.

4.1.3 Perspectives in Nonlinear Dynamics (Satellite meeting of STATPHYS-22)

The conference *Perspectives in Nonlinear Dynamics (PNLD 2004)*, jointly organized by the Department of Physics, IIT Madras and IMSc, was held in Chennai between 12th and 15th July 2004. This conference was a satellite meeting to the STATPHYS-22 international conference on Statistical Physics, and it brought together leading researchers in nonlinear science from India and abroad. In all there were 120 participants, with 35 from outside India. The foreign participants were from as many as 14 different countries. Besides 26 invited talks, the conference had two parallel contributory sessions and two poster sessions.

4.1.4 SERC Preparatory School in High Energy Physics 2004

The SERC schools is a series of Preparatory and Advanced schools in High Energy Physics meant to provide a quick introduction to the material normally covered in a typical Graduate Program for Ph.D students. It has been funded continuously since the 1980's by the Department of Science and Technology (DST) and has been proved to be extremely successful. This SERC school was a preparatory school to which 37 students from all over India were admitted. The Director of the School was Rahul Basu. There were 12 lectures in each of the three courses, Quantum Field Theory, Particle Physics and Group Theory. The lecturers (and corresponding guest faculty or tutors) were Bala Sathiapalan (S. Kalyana Rama), D. Indumathi (H. S. Mani) and Sachideo Vaidya (T. R. Govindarajan) respectively. As always, each lecture was accompanied by an extensive problem solving tutorial session.

4.1.5 24th FSTTCS Conference - (FSTTCS 2004)

The annual FSTTCS conference is the longest running computer science conference in India, and is organized by the Indian Association for Research in Computing Science. The 24th conference was held in IMSc during 13–18 December.

The main conference was on 16–18 December. There were five invited plenary talks by Javier Esparza (Stuttgart), Piotr Indyk (MIT), Pavel Pevzner (UCSD), John Reynolds (Carnegie-Mellon) and Denis Thérien (McGill).

There were 38 contributed papers, chosen from 176 submissions after a rigorous refereeing process by a 24-strong international programme committee, which consulted 328 other referees from 23 countries. The committee was co-chaired by Kamal Lodaya and Meena Mahajan (IMSc). The proceedings were published by Springer as Volume 3328 of its Lecture Notes in Computer Science series.

A huge amount of work was organized in a web-based manner: paper submission, reviewing, committee discussion, registration and so on. The IMSc system administrators, G. Subramoniam and Raveendra Reddy, handled the software installation and took the brunt of the responsibility of ensuring that everything worked flawlessly.

A highlight of this year's conference was a special session in honour of Professor Rani Siromoney on her 75th birthday. R.K. Shyamasundar (TIFR) chaired the session, and Professor Siromoney's ex-students, Kamala Krithivasan (IIT Madras) and K.G. Subramanian (MCC), presented an outline of her work and influence in the theoretical computer science community in India and outside. Several eminent computer scientists also spoke on the occasion, which attracted around 250 participants.

The conference also had two pre-conference satellite workshops: on *Algorithms for dynamic data* on 13–14 December, coordinated by Pankaj Agarwal (Duke) and S. Muthukrishnan (Rutgers), and on *Logics for dynamic data* on 15 December, coordinated by Peter O'Hearn (Queen Mary) and Uday Reddy (Birmingham).

This was the largest FSTTCS ever with around 180 registered participants from 15 countries. The IMSc administration worked very hard to ensure the effective organization of the conference, and the entire computer science group in IMSc as well as the group at Chennai Mathematical Institute participated in what turned out be a very smooth collaboration.

4.1.6   5th International Conference on Cryptology in India (Indocrypt 2004)

The 5th International conference on Cryptology in India (Indocrypt 2004) was jointly organized by IMSc and SETS, Chennai. About 120 delegates participated in this event out of which 40 were foreign delegates. His excellency Dr. A.P.J. Abdul Kalam inaugurated the conference through video conferencing.

The pre-conference tutorials were given by Profs. Bimal Roy, Kumar Murty, Anish mathuria and Kapali Vishwanathan. Profs. Collin Boyd and Amit Sahai delivered invited talks followed by paper presentations by about 30 delegates. The proceedings were published by Springer as Lecture Notes in Computer Science, volume 3348.

4.1.7   Workshop on The Economy as a Complex System

It focused on the study of the economy as a complex system, which views economic and financial phenomena as emerging from the interactions of individual agents whose behavior is constantly evolving to adapt their strategies and actions to the changing circumstances. The workshop brought together active researchers working in economics, finance, physics and mathematics to achieve an understanding of the general principles underlying the complex

systems approach to studying economic and financial phenomena. Eleven speakers from various places in India gave invited talks at the workshop which was also well-attended by IMSc members. Following is the list of speakers:

- **Bikas K. Chakrabarti**, SINP, Kolkata

- **Sanjay Jain**, Delhi University, Delhi

- **Krishna Maddaly**, IMSc, Chennai

- **T. P. Madhusoodanan**, IFMR, Chennai

- **P. Muruganandam**, Bharatidasan University, Trichy

- **U. Shankar**, MSE, Chennai

- **S. K. Shanthi**, IFMR, Chennai

- **Sitabhra Sinha**, IMSc, Chennai

- **E. Somanathan**, ISI, Delhi

- **S. Subramanian**, MIDS, Chennai

- **Brinda Vishwanathan**, MSE, Chennai

4.1.8 Subhashis Nag Memorial Endowment Lecture

The third Subhashis Nag Memorial Endowment Lecture for the year 2004-05 was delivered by Professor Clifford Earle, Cornell University, Ithaca, New York, USA. Professor Earle was in residence at the Institute from the 6th to the 18th January, 2005. Besides his Endowment lecture on "Variation of conformal invariants under holomorphic motions," Professor Earle gave five lectures on "Barycentric extensions of circle homeomorphisms — how to use and compute." There were participants from IIT-Madras, TIFR, Mumbai, IISc, Bangalore, and HRI, Allahabad, besides members of IMSc.

4.1.9 School on Parallel Computing and Clusters.

The School was conducted in cooperation with HRI. Lectures were held on core subjects like MPI, OpenMP, Mosix, Parallel Libraries as well as on Hardware for clusters, Installation Tools and Management Tools and Grid Technologies. There were talks on application areas of N-Body simulations, Lattice Gauge Theories, Electronic Structure Calculations, Bioinformatics, Computational Geophysics, Weather Forecasting and Cosmological Models. List of speakers included R. Ramanujam(IMSc), N. D. Hari Dass(IMSc), J. S. Bagla(HRI), Dilip Angom(PRL), M. R. Rajagopalan(CDAC), N. S. Phillip(St Thomas College), R. Kalmady(BARC), Mitesh Agarwal(Sun), N. Sakthivel(IPR), M. C. Sinha(IMS, Retd), Rahul Sidharthan(IMSc), Prasenjit Sen(HRI), H. K. Jassal(HRI), S. Verma(NGRI) and Sambath Narayanan(Sun). There were about 60 participants from all over India. In

addition to the lectures by invited speakers, 8 presentations were made by the participants and there was a panel discussion on "High Performance Computing and Disaster Management". All the course materials as well as the presentations made are available at www.imsc.res.in/~parapp .

4.1.10 National Science Day

The National Science Day (NSD) in the year 2005 at IMSc was devoted to a celebration of the World Year of Physics.

The World Year of Physics 2005 is an international celebration of physics. Events throughout the year will highlight the vitality of physics and will commemorate the pioneering ideas of Albert Einstein put forward in 1905. In IMSc, the NSD was used to provide a forum that would bring the excitement of physics to the public in the World Year of Physics. The National Science Day at IMSc was observed with a series of public lectures and special **quiz** programs reflecting on Einstein's fundamental contributions in the year 1905 and their impact on the development of physics for a century.

After the welcome address by the Director, Prof. R. Balasubramanian followed by opening remarks by Prof. G. Baskaran, the three revolutionary contributions of Einstein were discussed:

- **V. Balakrishnan**, IIT Madras
  From Brownian motion to fractal flights

- **R. Simon**, IMSc
  Einstein, Light Quanta and the development of Quantum theory

- **Sunil Mukhi**, TIFR, Mumbai
  Unveiling the special Theory of Relativity

One of the main attractions of NSD was the *Special Science Quiz*. A total of 35 teams of two members each from various colleges and institutions, took part in the quiz. Of these 6 teams made it to the final round which was conducted by Mr. Samanth Subramanian, a freelance journalist. The winners were a team from Chennai Mathematical Institute. The prizes were in the form of gift vouchers from the Landmark book store.

4.1.11 Institute Seminar Week 2005

The Institute Seminar Week (ISW) was held from March 1 to 4, 2005, from 10 AM to 1 PM on each day. The seminar coordinators were Kapil Paranjape (Mathematics), Kalyana Rama (Theoretical Physics) and R. Ramanujam (Theoretical Computer Science). There were 24 talks, of 25 minutes duration each. Speakers presented their work and described some problems of current research interest. The following is the list of seminars at ISW 2005.

- **Radha Balakrishnan**
  Anholonomy of phase space trajectories and applications

- **G. Baskaran**
  Wave propagation in random media in 2-dimensions: application of some concepts to Tsunami

- **Ghanshyam Date**
  Early universe and Quantum Gravity

- **D. Indumathi**
  Mass hierarchy of neutrinos

- **Jaya N. Iyer**
  Flat bundles in Algebraic Geometry

- **R. Jagannathan**
  q-Deformed logistic map

- **G. V. S. Karthik**
  Regularisation using the proper time method

- **Piyush P. Karur**
  Bounded Colour Multiplicity Graph Isomorphism is in the #L Hierarchy

- **Kamal Lodaya**
  Looking back at process algebra

- **H. S. Mani**
  Transverse polarization in Hadron Physics

- **Peter Matlock**
  AdS/CFT and the pp-wave limit in String Theory

- **Kaushik Majumdar**
  A mathematical model of the nascent cyclone

- **T. Muthukumar**
  Homogenization in perforated domains

- **Anuradha Narasimhan**
  Constructing error-correcting codes from curves over finite fields

- **N. Narayanan**
  Acyclic edge colouring of graphs

- **Raj Kumar Pan**
  Structure and stability of modular networks with hierarchy

- **Amritanshu Prasad**
  Reduction of matrices with entries in the integers modulo a prime power

- **G. Rajasekaran**
  Strange mixing behaviour of neutrinos

- **Parameswaran Sankaran**
  The vector field problem

- **H. S. Sharatchandra**
  Infrared behaviour of massless QCD in d=3 to all orders

- **Rahul Siddharthan**
  Genome research and computational biology

- **Rahul Sinha**
  Beauty mesons: Novel ways to learn physics

- **Sitabhra Sinha**
  And negativity does pull you through: Controlling cardiac chaos with alternating stimuli

- **S. Vijayakumar**
  Block Sorting: Combinatorics and Computation

4.2.1 Operator theory, quantum probability and noncommutative geometry

This was a conference organized in honour of Professor K. B. Sinha on his sixtieth birthday. There was participation by scientists from all over the world who spoke in the areas where Professor Sinha works actively. These areas include Quantum Probability, Operator theory and Non-commutative geometry as the title of the conference suggests.

4.2.2 Symposium on Algebraic Groups in honour of Professor V. Lakshmibai

The Symposium was held in honour of Professor V. Lakshmibai on the occasion of her sixtieth birthday. She is one of the founders of "standard monomial theory" and continues to be a major contributor to it. There were two talks about her work and five research talks.

4.2.3 Workshop on Theoretical High Energy Physics (THEP-I)

IMSc co-sponsored the first workshop on Theoretical High Energy Physics (THEP-I) organized by the Physics Department of the Indian Institute of Technology at Roorkee. The meeting was held at IIT Roorkee during March 16-20, 2005 and was attended by about 50 participants from all over the country. Several IMSc members gave invited talks at the meeting. The meeting was well appreciated by the participants with a suggestion to follow up with another similar meeting in couple of years time. Given below is the list of speakers and topics.

- **D. P. Roy**, TIFR, Mumbai
  Solar and Atmospheric ν Oscillations

- **U. Sarkar**, PRL, Ahmedabad
  New Physics from Extra Dimensions

- **P. Pal**, SINP, Kolkata
  Neutrinos in Magnetic Fields

- **P. Roy**, TIFR, Mumbai
  Aspects of Split SUSY

- **C. S. Aulakh**, Univ. of Chandigarh, Chandigarh
  Progress in MSGUT

- **R. Gopakumar**, HRI, Allahabad
  From Gauge Theory to Gravity

- **E. J. Chun**, KIAS, Seoul, Korea
  Neutrino Mass and EDMs in Seesaw Mechanism

- **S. Gupta**, TIFR, Mumbai
  Matter

- **V. Ravindran**, HRI, Allahabad
  QCD Results for Higgs Physics at LHC

- **M. Sami**, IUCAA, Pune
  Quintessential Inflation

- **U. Yajnik**, IIT, Mumbai
  Inflation and dark Energy: Prospects for Unification

- **P. Mitra**, SINP, Kolkata
  Strong CP Problem

- **S. D. Joglekar**, IIT, Kanpur
  Some General Results for Non-covariant Gauges;
  Causality Violations in Non-Local QFT

- **H. S. Sharatchandra**, IMSc, Chennai
  Infrared Behaviour of Massless QED to all orders in $\frac{1}{N}$ and $2 < D < 4$

- **J. Maharana**, IOP, Bhubaneshwar
  Aspects of String Cosmology

- **P. Majumdar**, SINP, Kolkata
  Quantum Spacetime and Thermal Fluctuations: Black Hole Entropy

- **G. Date**, IMSc, Chennai
  Loop Quantum Cosmology

- **S. Govindarajan**, IIT, Chennai
  Derived Categories-I

- **K. Ray**, IACS, Kolkata
  Derived Categories-II

- **B. Ghosh**, North Bengal university, Siliguri
  Electroweak Phase Transition with LHC Higgs

- **A. Chatterjee**, SINP, Kolkata
  Electromagnetic and Gravitational Interactions of the Kalb-Ramond Field in the RS-I Model

- **T. R. Govindarajan**, IMSc, Chennai
  New Developments in Space-time Non-commutative Geometry

- **P. Matlock**, IMSc, Chennai
  AdS/CFT and the pp-wave Limit

- **N. Sahu**, IIT, Mumbai
  Heavy ν Mass Hierarchy from Leptogenesis in L-R-symmetric Models with CP Violations

- **A. Franzen**, IIT, Roorkee
  Uplifting the Iwasawa

- **L. Goerlich**, TIFR, Mumbai
  Gaugino Condensation and Non-perturbative Superpotentials in Flux Compactifications

- **D. S. Kulshreshtha**, Delhi University, Delhi
  D-brane Action and Constraint Quantization

- **P. Jain**, IIT, Kanpur
  Is there a Preferred Direction in the Universe?

- **R. P. Malik**, SNBCBS, Kolkata
  Recent Developments in BRST Approach to gauge Theories

4.3 Seminars

Date	Speaker Affiliation	Title
07-04-2004	Sandeep Krishna NCBS, Bangalore	Formation and Growth of Autocatalytic Sets in an Evolving Network Model
07-04-2004	Shankar P. Das JNU, New Delhi	Optimum Vacancy Concentration in a Crystal
07-04-2004	Amritanshu Prasad IMSc	The Plancharel Formula for Spherical Functions
08-04-2004	Parameswaran Sankaran IMSc	Decisions Problems in Group Theory
08-04-2004	Swagata Sarkar IMSc	Sard's Theorem
08-04-2004	Sachin Gautham IMSc	Schubert Calculus
15-04-2004	Amritanshu Prasad IMSc	On the spectral decomposition of automorphic forms
20-04-2004	Guruprasad Kar IMSc	How Quantum Mechanics is Mysterious (i) Foundational Aspect
21-04-2004	Surajit Sengupta SNBNCBS, Kolkata	Classical Physics at nanoscales
21-04-2004	Amritanshu Prasad IMSc	The Plancharel formula for spherical functions (contd.)
22-04-2004	A. Rosenschon SUNY, Buffalo	2-torsion algebraic K-theory
23-04-2004	Guruprasad Kar IMSc	How Quantum Mechanics is Mysterious (ii) Information Theoretic Aspect

27-04-2004	Swapan Majhi RRI, Allahabad	QCD Corrections to Resonant Sneutrino/Slepton Production at Hadron Collider
30-04-2004	A. Vaidyanathan MIDS, Chennai	Interlinking of Rivers
30-04-2004	Abhishek Dhar RRI, Bangalore	A Discussion of Some New Fluctuation Theorems in Non-equilibrium Physics
06-05-2004	B. Sandip IMSc	Aspects of Mirror symmetry
12-05-2004	Deepak Dhar TIFR, Mumbai	Picocanonical Ensembles: The Physics of Glasses
18-05-2004	Amitava Raychaudhuri University of Calcutta	Pentaquark States
19-05-2004	Amitava Raychaudhuri University of Calcutta	Neutrino Novelties: Pointers to New Physics
02-06-2004	Gautam Sengupta IIT, Kanpur	Godel Universe, Time Machines and String Theory
09-06-2004	S. M. Lee IGCAR, Kalpakkam	Nuclear Power: Is it Safe Enough?
10-06-2004	Alok Kumar IMSc	Spontaneous Chiral Symmetry Breaking (SCSB) in Quark Confinement
11-06-2004	Kamal Lodaya IMSc	Algebraic recognizability of graph languages
11-06-2004	Manu Mathur SNBNCBS, Kolkata	Harmonic Oscillator Prepotential Formulation of Lattice Gauge Theories
16-06-2004	S. G. Rajeev University of Rochester	Matrix Models and Spin Chains
23-06-2004	S. G. Rajeev University of Rochester	Non-Commutative Entropy

30-06-2004	P. Majumdar IMSc	Universal Canonical Black Hole Entropy
01-07-2004	Indu Satija George mason University, USA	Metal Insulator Transition in Incommensurate Lattices
01-07-2004	P. Majumdar IMSc and SINP, Kolkata	Parity Violating Axion-Photon Interactions and CMB Anisotropy in a Braneworld Scenario
02-07-2004	P. K. Mohanty Weizman Institute, Israel	Synchronization of Coupled Chaotic Maps
13-07-2004	Ramesh Anishetty IMSc	Baryons and Pentaquarks in Terms of Mesons
16-07-2004	Mohua Banerjee IIT, Kanpur	A Logic for Rough Truth
19-07-2004	Vijay Shenoy IISc, Bangalore	Pattern Formation in Soft Thin Films
20-07-2004	Prashanth Jaikumar McGill University Montreal, Canada	Distinguishing Bare Quark Stars from Neutron Stars
20-07-2004	Gunter Schütz Institüt für Festkörperforschung, Jülich, Germany	Spontaneous Symmetry Breaking in Driven Systems
21-07-2004	Mohit Randeria TIFR, Mumbai	High T_c Superconductivity: Recent Progress and Open Questions
21-07-2004	P.S. Thiagarajan National University, Singapore	Lazy Rectangular Hybrid Automata
22-07-2004	G. Baskaran IMSc	Theory of Superconductivity in Doped Diamond
23-07-2004	Swapan Mandal Vishwabharati University, Shantiniketan	Quantum Driven Oscillator with Time Dependent Mass and Frequency
29-07-2004	Abhik Basu Hahn Meitner Institute, Berlin	Novel Universality Classes of a Coupled Driven Diffusive System

02-08-2004	G. Shivashankar NCBS, Bangalore	Probing nanometer scale fluidity of nucleosomes and its impact on gene regulation
03-08-2004	M. Muthukumar University of Massachussetts, Amherst	How classical strings organize
04-08-2004	Ravi Kannan Yale University	Randomized Algorithms in Linear Algebra
05-08-2004	Uma Iyer SUNY, Potsdam	Volichenko Differential Operators
11-08-2004	Natarajan Shankar Computer Science Lab, SRI	Modular Proof Engines
13-08-2004	Hari Balakrishnan Massachusetts Institute of Technology	Distributed Hash Tables
16-08-2004	Soumitra Sengupta IACS, Kolkata	Cosmological Implications of a Kalb-Ramond Background in a Randall-Sundrum Braneworld
17-08-2004	V. M. Datar BARC, Trombay	Astrophysical S17(0) from the d(7Be,8B)n reaction at Ecm=4.5 MeV
23-08-2004	Satya V. Lokam University of Michigan, Ann Arbor	Communication Complexity, Locally Decodable Codes, and Private Information Retrieval.
25-08-2004	V. S. Lakshmanan University of British Columbia	On Testing Satisfiability of Tree Pattern Queries
26-08-2004	P. K. Kabir University of Virginia, Charlottesville, VA, USA	Marginal Notes on Reactions Involving Neutrinos (For Non-specialists)
14-09-2004	Shrirang Deshingekar Dept. of Math., Appl. Math. and Astronomy, University of South Africa, Pretoria	New approach to calculating the News

14-09-2004	P. Madhusudan University of Pennsylvania	Verifying programs against pushdown specifications
15-09-2004	Asmita Mukherjee University of Dortmund, Germany	Double Transverse Spin Asymmetries at Next-to-Leading Order in QCD
20-09-2004	Tulsi Dass CMI, Chennai	Understanding Quantum mechanics (Histories, Decoherence, Measurements and All That)
21-09-2004	Prasanta Kumar Tripathy TIFR, Mumbai	Flux Compactifications in String Theory
22-09-2004	B. Ananthanarayan CTS, IISc, Bangalore	Low Energy Strong Interactions as High Precision
21-09-2004	Prasanta Kumar Tripathy TIFR, Mumbai	Flux Compactifications in String Theory
22-09-2004	B. Ananthanarayan CTS, IISc, Bangalore	Low Energy Strong Interactions as High Precision
28-09-2004	Subinay Dasgupta, Dept. of Physics, Calcutta University	Two Small World Networks
29-09-2004	Markus Brede CSIRO centre for Complex Systems, Canberra, Australia	Growing Robust Networks
04-10-2004	Syed Mohammed Kamil IMSc	Introduction to the Bethe Ansatz
04-10-2004	Raj Kumar Pan IMSc	The Geometry of Soft Matter
04-10-2004	A. Vallan Bruno Cruz IMSc	Wilson Renormalization and Critical Phenomena
06-10-2004	Sonali Tamhankar Kentucky University, USA	Charmonium Spectrum from Quenched QCD with Overlap Fermions

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06-10-2004	Raj Kumar Pan IMSc	Geometry of soft matter
07-10-2004	S. P. Suresh CMI, Chennai	Pramanya – classical Indian theories of knowledge
07-10-2004	A. Vallan Bruno Cruz IMSc	The Wilson renormalisation group
08-10-2004	Syed Mohammad Kamil IMSc	An introduction to the Bethe Ansatz
13-10-2004	Saumen Datta University Bielefeld, Germany	Charmonia in a Deconfined Gluonic Plasma
14-10-2004	N. S. Narayanaswamy IIT, Chennai	First Fit is 8 Competitive For Online Interval Colouring
20-10-2004	Ajay Sood IISc, Bangalore	Nanotube Dynamo: Flow Induced Voltage Generation
21-10-2004	V. Uma IMSc	K-theory of quasi-toric manifolds
21-10-2004	Kamal Lodaya IMSc	Sigma-algebras for Petri Nets
21-10-2004	A. Subrahmanyam IIT, Chennai	The Physics and Technology of Thin Films - A Physicists Perspective
25-10-2004	Partha Guha SNBNCBS, Kolkata	Hamiltonian flows on Infinite Dimensional Groups and Integrable Systems
26-10-2004	Pankaj Jain IIT, Kanpur	The Dynamical Mixing of Light and Pseudoscalar Fields
28-10-2004	K. V. Subrahmanyam CMI, Chennai	Smooth analysis of algorithms
03-11-2004	N. D. Hari Dass IMSc	Resurrecting the QCD string

04-11-2004	Saket Saurabh IMSc	Parameterized Complexity, Simple Flows and Odd Cycle Transversals
05-11-2004	Madan Rao RRI, Bangalore	Active organisation at the surface of living cells
17-11-2004	Rahul Siddharthan IMSc	Understanding "junk DNA"
18-11-2004	Bharat Adsul CMI, Chennai	Cascade products of distributed automata
18-11-2004	Ved Prakash Gupta IMSc	Immersions of projective space
18-11-2004	Sachin Gautam IMSc	Intersection Cohomology
18-11-2004	Pratyusha Chattopadhyay IMSc	On the geometric form of Noether normalization.
18-11-2004	Preena Samuel IMSc	Representations of a semi-direct product
18-11-2004	D. H. J. Cho RRI, Bangalore	Stationary Kaluza-Klein states in Minisuperspace Framework
19-11-2004	K. Santosh Kumar IMSc	Quantum Field theory with string tension
24-11-2004	Rishi Raj CMI, Chennai	Character Formulas and localization of integrals
24-11-2004	Nutan Limaye IMSc	Characterizations of LogCFL.
25-11-2004	R. Parthasarathy TIFR, Mumbai	Coherent families of modules for G_2
25-11-2004	Swagata Sarkar IMSc	Differentiable structures on S^7
25-11-2004	Sarbeswar Pal IMSc	On the Grothendieck group

25-11-2004	B. Ravindran IIT, Chennai	Perspectives on Reinforcement learning machine learning.
25-11-2004	Tanaya Bhattacharyya SINP, Kolkata	Quantum soliton states of derivative nonlinear Schrodinger (DNLS) model
25-11-2004	Raj Kumar Pan IMSc	The structure and function of complex networks
26-11-2004	Syed Mohammed Kamil IMSc	Linear and nonlinear rheology of wormlike micelles
26-11-2004	V. Sunil Kumar IOP, Bhubaneswar	Skyrmion formation with a nonzero chemical potential
26-11-2004	A. Bruno Vallan Cruz IMSc	Solitons in polyacetylene
01-12-2004	Sanjay Siwach, IMSc	Black Holes as seen by String theory
02-12-2004	Jayalal Sarma IMSc	Solving big mazes using small space (SL = L)
03-12-2004	Larisa Laperashvili, ITEP, Moscow, Russia	Multiple Point Principle and phase transition in gauge theories
06-12-2004	Raju Venugopalan, Brookhaven Natĺ Lab, USA	Terrestrial Mini-Bang: Transmuting a Color Glass Condensate into Quark Gluon Plasma at RHIC
08-12-2004	Sheerazuddin IMSc	Separation Logic: A Logic for Shared Mutable Data Structures
08-12-2004	Larisa Laperashvili, ITEP, Moscow, Russia	The fundamental weak scales hierarchy in the Standard model
09-12-2004	Kaushik Majumdar IMSc	Dynamical Computation - Part I: Computation over rings and topological complexity
09-12-2004	Sameer Murthy ASICTP, Trieste, Italy	Open string field theory of $d \leq 2$ strings

20-12-2004	Vijay Kumar IMR, Tohoku University, Sendai	Permanent Electric Dipole moments and ferro-electricity in homonuclear clusters
23-12-2004	N. V. Vinodchandran University of Nebraska-Lincoln, USA	Average to Worst-case Complexity via Derandomization
27-12-2004	Sanghamitra Bandyopadhyay ISI, Kolkata	Evolutionary Approach to Molecule Design Using Variable Length Representation
29-12-2004	Amitava Datta Jadavpur University	New Upper Bounds on the Masses of Supersymmetric Particles
30-12-2004	V. Srinivas TIFR, Mumbai	Diophantine Equations
31-12-2004	T. R. Ramadas ICTP, Trieste	Geometry of the WZW model and the norm of generalized theta functions
03-01-2005	Kavita Jain, Universitat Essen, Germany	Adaptive evolution via Punctuated Dynamics
04-01-2005	Chinmay Das, University of Leeds, Leeds, UK	Computational Linear Rheology of Branched Polymers
04-01-2005	Anjan Kundu SINP, Kolkata	Mixed integrable systems induced by the unifying Yang-Baxter algebra
05-01-2005	Andreas Nyffeler, ETH, Zurich	Muon g-2 in the Standard Model and beyond
06-01-2005	V. Ravindran, HRI, Allahabad	Two loop correction to Higgs production at LHC
07-01-2005	Clifford Earle SUNY, Stonybrook	Barycentric extensions of Circle homeomorphisms
07-01-2005	C. S. Rajan TIFR	Congruences for rational points on varieties over finite fields
10-01-2005	G. Baskaran IMSc	Tsunami and Earth Quakes - some facts

11-01-2005	M. S. Narasimhan IMSc	An analogue of Borel-Weil-Bott theorem for discrete series.
11-01-2005	R. Shankar IMSc	Tsunami
12-01-2005	V. Suneeta, University of Alberta, Canada	Ricci flows and string theory
12-01-2005	Janaki Balakrishnan, Max Planck Institute, Leipzig, Germany	Self-tuning to the Hopf bifurcation in fluctuating systems
18-01-2005	V. Lakshmibai North Eastern University	Invariant Theory and Toric Degenerations
20-01-2005	O. W. Greenberg, University of Maryland, USA	Why is CPT CPT?
24-01-2005	M. S. Raghunathan TIFR, Mumbai	Some topics in Differential Topology
28-01-2005	M. K. Parida North Eastern Hill University, Shillong	Low-Energy SUSY Vs. Split-Supersymmetry: Phenomenology and Grand Unification
28-01-2005	T. C. Vijayaraghavan IMSc	Solving Linear Equations over a Finite Ring
29-01-2005	Pervez Hoodbhoy, Quaid-E-Azam University, Islamabad	Science and Reason in the Age of Unreason
01-02-2005	Advaith Siddharthan Columbia University	Summarizing news reports - A statistical account of words, meaning, information and knowledge
02-02-2005	Sanatan Digal IMSc	Simultaneous critical behavior of Interacting fields
07-02-2005	Abhishek Chaudhuri, SNBNCBS, Kolkata	Sound Absorption at Solid-Liquid Interfaces: Novel Phenomena at the Nanoscale

08-02-2005	G. Harder MPI, Bonn	Galois Representations attached to Automorphic Forms II
09-02-2005	G. Harder MPI, Bonn	Galois Representations attached to Automorphic Forms III
09-02-2005	Gautam I. Menon IMSc	What Lies Beneath: The Structure of Fluids in Disordered Backgrounds
10-02-2005	G. Harder MPI, Bonn	Congruences between Hecke eigenvalues of Siegel and elliptic modular forms
10-02-2005	Sumedha TIFR, Mumbai	Efficiency of a Monte-Carlo algorithm for Linear and Branched polymers
11-02-2005	H. Takata IMSc	Interaction between two spherical D2-branes with distance in SU(2) group manifold in bosonic string theory
17-02-2005	Furio Honsell Universitá di Udine, Italy.	Coalgebraic Description of Binary Methods
21-02-2005	Dibyendu Das IIT, Mumbai	Glassy dynamics near non-disordered critical points
22-02-2005	Somdatta Sinha, Centre for Cellular and Molecular Biology, Hyderabad	Spatiotemporal description of Malaria prevalence in India
23-02-2005	Amol Dighe TIFR, Mumbai	Supernova neutrinos for neutrino mixing and SN astrophysics
25-02-2005	G. Athithan Centre for Artificial Intelligence and Robotics, Bangalore	A neurobiologically plausible model of human memory and its extensions to the case of human language
03-03-2005	Olivier Ramare University of Lille1, France	Almost periodicity of some error terms in prime number theory
04-03-2005	Subhendra Mohanty, PRL, Ahmedabad	Neutrinos and the Cosmic Microwave Background Anisotropy

07-03-2005	R. Rangarajan PRL, Ahmedabad	Baryogenesis in the Early Universe
09-03-2005	K. Srinivasa Rao IMSc (Formerly of)	Life and works of Srinivasa Ramanujan - a CD presentation
09-03-2005	S. Dattagupta, SNBNCBS, Kolkata	Magnetic Nano Particle System: A protocol for Memory
10-03-2005	Thomas Lux Department of Economics, University of Kiel, Germany	Agent-Based Models of Financial Markets and the Stylized Facts
10-03-2005	R. Simon IMSc	Some Issues arising in Quantum Information Theory
11-03-2005	Thomas Lux Department of Economics, University of Kiel, Germany	The Markov-Switching Multi-Fractal Model of Asset Returns: Its Estimation and Its Use for Forecasting of Volatility
14-03-2005	S. Rajesh Cochin University of Science and Technology	Synchronization of Chaos in Semiconductor Lasers: Certain Practical Considerations
16-03-2005	Prabhu Ramachandran, Aerospace Dept., IIT, Chennai	Vortex methods for 2D incompressible fluid flow simulations
17-03-2005	Jyoti Prasad Saha, Jadavpur University, Kolkata	Indirect Constraints on Supersymmetry
17-03-2005	Herve Queffelec University of Lille, France.	The selector method of H. Cramer: applications to Harmonic analysis
22-03-2005	Johannes Koebler Humboldt University Berlin	Complexity of testing isomorphism for restricted graph classes
22-03-2005	Pushan Majumdar University Graz, Austria	Dynamical chiral fermions on the lattice
23-03-2005	Chandra Chekuri Bell Labs, New Jersey	New Algorithms and Insights for Routing Problems

23-03-2005	N. D. Hari Dass, IMSc	The significance of Einstein's work on Brownian Motion
29-03-2005	A. S. Sampangiraj, JNCASR, Bangalore	The glass transition and liquid-gas spinodal boundaries of metastable liquids
30-03-2005	S. Goswami HRI, Allahabad	Global Analysis of Neutrino Oscillation

Chapter 5

External Interactions

5.1 Collaborative Projects with Other Institutions

5.1.1 Analytic and Combinatorial Number Theory

Analytic and Combinatorial Number Theory, is a project under the Indo-French Center for Promotion of Advanced Research and has a tenure from September 2003 to August 2006. The Principal Investigators under this project are Profs. R. Balasubramanaian and G. Bhowmik of Lille. Under this project work is in progress to obtain good error terms to certain summatory functions of arithmetical functions arising from group theory, to give a generalization of Erdos-Ginzburg-Ziv theorem to an abelian group.

5.1.2 Classical and Quantum Complexity of Graph Isomorphism and Related Problems.

This a joint Indo-German project funded by the DST for the Indian side and the DAAD for the German side to support exchange visits during the period June 2004 to June 2006. The broad aim of the project is a study of both algorithmic and complexity-theoretic aspects of the Graph Isomorphism problem and other related questions. There are three members from the Indian side and three from the German side participating in the project (one faculty member and two students from each side). So far five exchange visits in all have been undertaken in the first year of the project.

5.1.3 Novel Materials for applications in Molecular Electronics and Energy Storage Devices

DRDO has sanctioned in 2002 a project on Novel Materials for Applications in Molecular Electronics and Energy Storage Devices. The project team consists of A.K. Mishra (IMSc), Sheela Berchmans (CECRI), and V. Yeganaraman (CECRI). The project duration is for three years.

5.1.4 Numerical Simulations of the QCD-string

In collaboration with Dr Pushan Majumdar of University of Graz a systematic investigation of strings in d=4 su(3) qcd has been initiated. Much of the year was spent on developing and perfecting a whole suite of sophisticated parallel codes. From November 2004 production runs are going on continuously and first results strongly suggesting a Nambu-Goto string have recently emerged.

5.1.5 Spectral Theory of Schrödinger Operators.

This is the continuation of the project started two years ago with grants from DFG, Germany and DST/INSA, INDIA. The project is for doing research in the area of random Schrödinger operators. The principal investigator from India is M Krishna of IMSc and from the German side the investigators are Prof M Demuth, Technical University of Clausthal and Prof W Kirsch, Ruhr-University, Bochum. As part of the project Dr Eckhard Giere visited IMSc for a couple of weeks this year in addition to the visits of Prof M Demuth to IMSc. A book on the "Determining Spectra in Quantum Theory" written by M Demuth and M Krishna formed part of the project. There is ongoing research to determine spectra using the new criteria developed recently.

5.1.6 Studies in Quantum Statistics

An Indo-US Collaboration project on "Studies in Quantum Statistics", involving Institute of Mathematical Sciences (India) and University of Maryland (USA), has been approved. The project team consists of A.K. Mishra (IMSc) and Prof. O.W. Greenberg (Maryland Univ.). The project duration is for three years and it commenced from May 2002.

5.2   Institute Associateships

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

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

Given below is the list of Associates visited the institute and the corresponding period of stay during this academic year :

M. K. Parida
Dept. of Physics, North Eastern Hill Univ., Shillong
24.12.2004 to 06.02.2005

S. N. Pandey
Dept. of Physics, Sant Longowal Inst. of Engg. and Technology
27.12.2004 to 08.01.2005

B. Palanivel
Dept. of Physics, Pondicherry Engg. College, Pondicherry
03.12.2004 to 23.12.2004

Mohua Banerjee
Dept. of Mathematics, IIT Kanpur
07.07.2004 to 30.07.2004

R. Paulraja
Dept. of Mathematics, Annamalai Univ., Annamalainagar
06.05.2004 to 20.06.2004

Anuradha, N.

Participated in *Workshop on Cryptography* held at IMSc, Chennai during Jun 14 – Jul 10, 2004.

Balakrishnan, Radha

Visited Abdus Salam International Centre for Theoretical Physics, Trieste, Italy during May 6 – Jun 4, 2004 as a Visiting Scientist.

Participated in *International Conference on Perspectives in Nonlinear Dynamics (Satellite Meeting of STATPHYS 22)* held at IMSc and IIT, Chennai during Jul 12 – Jul 15, 2004. Gave an invited talk on "Nonlinear Elastodynamics in Biopolymers".

Visited George Mason University, Fairfax, Virginia, USA during Oct 7 – Oct 28, 2004 for research collaboration. Gave a seminar on "Solitons in Biopolymers".

Visited S. V. S. University, Tirupati, India during Dec 26 – Dec 29, 2004. Gave lectures on "Solitons and Applications" under the UGC/DSA programme.

Visited Centre for Nonlinear Dynamics, Bharatidasan University, Tiruchirapalli during Mar 30 – Mar 31, 2005 under TPSC. Gave a colloquium on *Geometry and Nonlinearity: Some Applications in Physics* .

Balasubramanian, R.

Visited University of Bordeaux during Sep 6 – Sep 14, 2004.

Participated in *journ'ees Dress* held at University of Bordeaux during Sep 16 – Sep 17, 2004. Gave a lecture on "Sumfree sets in Abelian groups".

Visited University of Lille during Oct 7 – Oct 13, 2004.

Visited University of Bordeaux during Oct 14 – Oct 24, 2004.

Participated in *The theory of Riemann zeta and allied functions* held at oberwolfach during Oct 19 – Oct 25, 2004.

Participated in *Symposium on Mathematical Sciences (in memory of HansRaj Gupta)* held at Chandigarh during Nov 19 – Nov 20, 2004. Gave a lecture on "Partition Functions".

Participated in *Workshop on Discrete Mathematics* held at Calcutta university during Mar 20 – Mar 21, 2005. Gave two lectures on "Cryptology".

Baoulina, Ioulia

Participated in *JSTOR Training Workshop* held at IMSc during Nov 2 – Nov 3, 2004.

Baskaran, G.

Visited International Frontier Center for Advanced Materials (IFCAM) Institute for Materials Research (IMR), Tohoku University, Sendai, Japan during Apr 1 – Jun 30, 2004 as a IFCAM Visiting Professor.

Participated in *JST CREST Meeting at Tokyo on "Nano Science"* held at Tokyo on Apr 5, 2004. Gave an invited talk.

Visited Department of Physics, Tokyo University, Tokyo, Japan during May 3 – May 4, 2004. Gave a talk.

Visited Super Diamond Group AIST, Tsukuba, Japan during May 5 – May 6, 2004. Gave a talk.

Visited Department of Physics, Hokkoido University, Sapporo, Japan during May 27 – May 29, 2004. Gave two talks.

Visited Osaka University, Osaka, Japan during Jun 2 – Jun 4, 2004. Gave talks.

Participated in *Asia Pacific Conference on Modern Trends in Condensed Matter Physics* held at Hong Kong University of Science and Technology, Hong Kong during Jun 21 – Jun 24, 2004. Gave an invited talk.

Visited Department of Physics, Tokyo Univeristy, Tokyo during Aug 15 – Aug 26, 2004. Gave talks and conducted discussions.

Participated in *JST CREST Conference on Nanoscience* held at Atami, Japan during Aug 19 – Aug 20, 2004. Gave an invited talk.

Participated in *Advances in Condensed Matter Physics* held at Kakatiya University, Warangal during Sep 20 – Sep 22, 2004. Gave two invited talks and a Conference Summary talk.

Visited Sai Ram College of Engineering on Oct 19, 2004. Gave a talk on "Excitements in Physics".

Visited International Frontier Center for Advanced Materials(IFCAM), Institute for Materials Research (IMR), Tohoku University, Sendai, Japan during Oct 24 – Dec 24, 2004.

IFCAM Visiting Professor. Gave Two talks.

Visited Yukawa Institute for Theoretical Physics, Kyoto University, Kyoto, Japan during Nov 1 – Nov 5, 2004. Gave a talk on "Strongly Correlated Electron Systems".

Visited National Institute for Materials Science, Tsukuba, Japan during Nov 17 – Nov 18, 2004. Gave a talk.

Participated in *International Conference on Transition Metal Oxides* held at Institute for Materials Research, Tohoku University, Sendai, Japan during Nov 22 – Nov 24, 2004. Gave an invited talk.

Participated in *International Conference on Molecular Electronics* held at Akiu, Sendai, Japan during Nov 28 – Nov 30, 2004. Gave an invited talk.

Participated in *JST CREST Meeting on Organic Superconductors* held at International Conference Hall, Osaka, Japan during Dec 8 – Dec 9, 2004. Gave an invited talk.

Visited TIFR, Mumbai during Jan 17 – Jan 18, 2005. Gave a talk.

Basu, Rahul

Participated in *Vth Rencontres du Vietnam 2004* held at Hanoi, Vietnam during Aug 5 – Aug 11, 2004. Gave a talk on "An NLO calculation of the electroproduction of large-$E_{\perp}$ hadrons".

Visited IIT, Guwahati during Aug 22 – Aug 24, 2004 under TPSC.

Visited Physics Department, Tezpur University on Aug 25, 2004 under TPSC.

Visited Physics Department, Guwahati University on Aug 26, 2004 under TPSC.

Visited Physics Department, IIT Kanpur during Aug 31 – Sep 2, 2004 as a Thesis Examiner.

Participated in *XVI DAE Symposium in High Energy Physics* held at SINP, Kolkata during Nov 29 – Dec 3, 2004.

Date, G.

Participated in *Kodaikanal Summer School* held at Kodaikanal Observatory, Kodaikanal during Jun 28 – Jun 30, 2004. Gave a course of six lectures on the "Physics of the Cosmos".

Visited Albert Einstein Institute, Potsdam during Sep 20 – Oct 31, 2004 for research collaboration. Gave a seminar on "Effective Classical Description from Loop Quantum Cosmology".

Visited Institute for Gravitational Physics and Geometry, Pennsylvania State University, State College during Nov 1 – Nov 21, 2004 for research collaboration. Gave a seminar on "Effective Hamiltonian for Isotropic LQC and its Applications".

Visited Yang Institute for Theoretical Physics, Stony Brook on Nov 22, 2004. Gave a seminar on "Quantum Resolution of Cosmological Singularities".

Visited Albert Einstein Institute, Potsdam during Nov 27 – Dec 14, 2004 for research collaboration.

Visited Vivekananda College, Chennai during Feb 9 – Feb 10, 2005. Gave two talks on "Our Universe: What we know and How" to the undergraduate students of the physics department under the 'Dr. T.S. Ramadurai Endowment' programme of the college.

Visited Harishchandra Research Institute, Allahabad during Mar 7 – Mar 14, 2005. Gave a colloquium titled "Quantum Resolution of Cosmological Singularities" and a seminar on "Implications of Loop Quantum Cosmology for the early isotropic universe".

Participated in *Theoretical High Energy Physics (THEP-I)* held at IIT, Roorkee during Mar 16 – Mar 20, 2005. Gave an invited talk on "Loop Quantum Cosmology".

Govindarajan, T. R.

Visited SISSA, Trieste during Oct 15 – Oct 25, 2004 to attend a Workshop and for collaborations.

Participated in *Workshop on Noncommutative manifolds* held at Trieste, Italy during Oct 18 – Oct 22, 2004. Gave an invited talk on "Space-time Non-commutativity and Unitary quantum physics".

Visited AEI, Potsdam, Germany during Oct 26 – Nov 23, 2004 for research collaborations and seminar.

Participated in *Higher dimensional QHE, Chern-Simons theory and noncommutative geometry in condensed matter physics and field theory* held at ICTP, Trieste, Italy during Mar 1 – Mar 4, 2005. Gave an invited talk on "Unitary quantum physics and Quantised evolutions with Space-time Noncommutativity".

Visited INFN, University of Naples, Italy during Mar 5 – Mar 10, 2005 for research and seminar.

Participated in *Theoretical High Energy Physics - I* held at IIT, Roorkee during Mar 15 – Mar 20, 2005. Gave an invited talk on "New Developments in Space-time Non-commutative Geometry".

Gupta, Nayantara

Visited School on "Physics with cosmic accelerators" at Bad Honnef, Germany during Jul 5 – Jul 16, 2004. Gave a talk on "Prospect of determining the Dirac/Majorana state of neutrino by Multi-OWL experiment".

Visited TIFR, Mumbai during Feb 7 – Feb 11, 2005. Gave a seminar on "Gamma Ray Bursts and Ultrahigh Energy Cosmic Rays".

Hari Dass, N. D.

Participated in *Perspectives in Particle Physics and Cosmology* held at Physical Research Laboratory, Ahmedabad during Apr 1 – Apr 3, 2004. Gave an invited talk on "Cosmic Microwave Background".

Participated in *International Conference on High Energy Physics(ICHEP'04)* held at Beijing, China during Aug 16 – Aug 22, 2004. Gave a talk in the Computational Quantum Field Theory session.

Visited Institute of High Energy Physics, Academica Sinica, Beijing during Aug 20 – Aug 22, 2004. Gave a seminar on "Issues in Quark Confinement".

Visited National Geophysical Research Institute, Hyderabad during Nov 22 – Nov 26, 2004. Gave three lectures on i) "Why Parallel Computing", ii) "Efficiency Issues in Cluster Computing" and iii) "KABRU- Teraflop Linux Cluster at IMSc".

Participated in *Research Trends in Practice and Theory of Information Technology(Naval Research Board)* held at Cochin during Jan 10 – Jan 11, 2005. Gave an Invited talk on "KABRU and Lattice Gauge Theory".

Participated in *Workshop on Effective Theories of Strong Interactions* held at SINP, Kolkata during Feb 1 – Feb 5, 2005. Gave three lectures on "Perspectives in Chiral Symmetry".

Hossain, Golam Mortuza

Participated in *Kodaikanal Summer School* held at Kodaikanal Observatory, IIA during Jun 28 – Jun 30, 2004. Tutor for the course "Physics of the Cosmos".

Visited Max-Planck-Institut für Gravitationsphysik, Albert-Einstein-Institut, Germany during Sep 3 – Oct 29, 2004. Gave a talk, on "Getting Inflation: The Loopy Way".

Participated in *23rd IAGRG conference and symposium on Recent Trends in General Relativity, Cosmology and Astrophysics* held at University of Rajasthan, Jaipur during Dec 7 – Dec 10, 2004. Gave an invited talk on "Loop Quantum Cosmology".

Ivan, Solomon J.

Participated in *School and Workshop on Quantum Entanglement, Decoherence, Information, and Geometrical Phases in Complex Systems* held at The Abdus Salam International Centre For Theoretical Physics, Trieste, Italy during Nov 1 – Nov 12, 2004.

Participated in *Ninth Discussion Meeting on a Frontier Area of Research in Physics* held at Centre For Learning, Varadanahalli during Jan 3 – Jan 7, 2005.

Jagannathan, R.

Participated in *Conference on Perspectives in Nonlinear Dynamics (PNLD-2004)* held at IMSc and IIT, Chennai during Jul 12 – Jul 15, 2004. Gave a talk on "q-Deformed Nonlinear Maps" based on a paper with Sudeshna Sinha.

Participated in *Highlights in Theoretical Physics (VS62) in honour of Professor V. Srinivasan* held at School of Physics, University of Hyderabad during Sep 17 – Sep 18, 2004. Gave an invited talk on "Some aspects of q-deformation in mathematics and physics".

Jayalal Sarma, M. N.

Participated in *Workshop on Algorithms for Dynamic Data* held at IMSc, during Dec 13 – Dec 14, 2004.

Participated in *FSTTCS 2004* held at IMSc, during Dec 16 – Dec 18, 2004.

Kanhere, Aaloka V.

Participated in *School on Commutative Algebra and Interactions with Algebraic Geometry and Combinatorics* held at The Abdus Salam international center for theoretical physics (ICTP), Italy during May 24 – Jun 11, 2004.

Kesavan, S.

Visited City University of Hong Kong during Oct 4 – Nov 12, 2004 as a Visiting Professor. Delivered a colloquium talk.

Participated in *Recent Trends in Nonlinear Analysis and its Applications* held at IIT, Mumbai during Dec 11 – Dec 13, 2004. Gave an invited talk.

Participated in *UGC Sponsored National Seminar on Recent Trends in Nonlinear Differential Equations* held at Sri G. V. G. Visalakshi College for Women, Udumalpet during Dec 22 – Dec 23, 2004. Gave an invited talk.

Visited IIT, Mumbai during Jan 11 – Jan 13, 2005. Delivered a series of three lectures.

Participated in *Joint Indo-French Workshop on Partial Differential Equations and Applications* held at IISc, Bangalore during Feb 7 – Feb 12, 2005. Delivered an invited talk.

Visited IIT, Chennai on Feb 18, 2005. Delivered a colloquium talk.

Visited IIT, Chennai on Feb 26, 2005. Delivered the Guest Lecture in their Annual Mathematics Festival "Forays 2005".

Participated in *XII Ramanujan Symposium on Recent Trends in Analysis* held at Ramanujan Institute for Advanced Study in Mathematics, University of Madras, Chennai during Mar 2 – Mar 4, 2005. Delivered an invited talk.

Participated in *National Conference on Partial Differential Equations and Applications* held at Bharatiar University, Coimbatore, Tamil Nadu during Mar 10 – Mar 11, 2005. Delivered an invited talk.

Kodiyalam, Vijay

Visited Indian Statistical Institute, Bangalore Centre during May 1, 2004 – Mar 31, 2005. Was on a sabbatical and taught an undergraduate "Algebra course".

Krishna, M.

Participated in *Economy as a complex system* held at IMSc, Chennai during Dec 6 – Dec 7, 2004. Gave a talk on "Finding order in the stock markets".

Participated in *Operator theory, Quantum probability and Noncommutative geometry* held at Indian Statistical Institute, Kolkata during Dec 20 – Dec 23, 2004. Gave a talk on "New criteria for spectrum".

Visited Indian Statistical Institute, New Delhi during Jan 16 – Jan 20, 2005. Gave two talks on "Spectral Theory of Jacobi Operators" and "Inverse spectral theory of Jacobi Operators".

Lodaya, Kamal

Visited IISc, Bangalore on Apr 12, 2004. Gave a talk on "Infinite state Automata".

Participated in *UGC Refresher Workshop in Computer science* held at Madras University during Jul 22 – Jul 23, 2004. Gave a mini-course on "Parsing".

Participated in *Calcutta Logic Circle Workshop* held at University of Calcutta during Oct 13 – Oct 15, 2004. Gave a talk on "Hypercomputation".

Visited DAIICT Gandhinagar on Jan 15, 2005. Gave a talk on "A syntax for Petri nets".

Participated in *Workshop on Knowledge and Software Engineering* held at TIFR, Mumbai during Jan 19 – Jan 21, 2005. Gave a talk on "A logic for user-controlled web navigation".

Participated in *CIMPA School on Security for computer systems and networks* held at IISc, Bangalore during Jan 25 – Jan 27, 2005.

Visited IISc, Bangalore on Mar 3, 2005. Gave a talk on "An introduction to Concurrency via Process Algebra".

Visited University of Calcutta on Mar 12, 2005. Gave a talk on "Petri nets and linear logic".

Participated in *National seminar on Current developments on applications of mathematics* held at Viswabharati University, Santiniketan on Mar 13, 2005. Gave a talk on "Parsing as calculation".

Mahajan, Meena B.

Visited Sree Sastha Institute of Engineering and Technology during Jul 13 – Jul 14, 2004. Lectured in the SSIET-IARCS short-term training course for teachers on Data Structures and Algorithms.

Participated in *Indo-German Workshop on Algorithms* held at IISc, Bangalore during Oct 8 – Oct 11, 2004. Gave a talk titled "Sorting via strip moves".

Participated in *Workshop on Algorithms for Dynamic Data* held at IMSc during Dec 13 – Dec 14, 2004.

Participated in *FSTTCS 2004* held at IMSc during Dec 16 – Dec 18, 2004.

Invited speaker at Nehru Science Centre, Mumbai on Dec 22, 2004. Delivered a talk to the participants of "Anveshan - The Children's Festival" organised on the occasion of the Silver Jubilee of the Children's Science Park. Participated in the valedictory function of the Anveshan.

Mani, Harihara S.

Participated in the *Refresher Course for College Teachers* during July 2004, as a resource faculty. Gave a course on "Quantum Mechanics".

Visited S N Bose National Center For Basic Sciences during Jul 22 – Jul 28, 2004. Gave four lectures on Path Integral Method in Quantum Mechanics.

Visited Calcutta University on Jul 28, 2004. Gave a talk on "Dirac/majorana Nature of Neutrinos - detection through Multi-Owl".

Visited Harish-Chandra Research Institute, Allahabad on Jul 30, 2004. Gave a talk on "Dirac/Majorana Nature - detection through Multi-Owl".

Participated in the *SERC Preparatory School in High Energy Physics* during Sept. 2004, as a guest faculty and conducted tutorials for the "Particle Physics" course.

Visited University of Hyderabad during Sep 17 – Sep 18, 2004. Gave a talk on "Understanding Fano Resonance" on the occasion of Prof V. Srinvasan's sixtieth Birthday.

Visited S N Bose National Centre for Basic Sciences, Kolkata during Jan 1 – Jan 4, 2005. Gave an invited Talk on "Photoelectric Effect" on the occasion of celebration of the year of Physics.

Visited University of Allahabad on Feb 14, 2005. Gave a talk on "Understanding Fano Resonance through Toy Models".

Menon, Gautam I.

Participated in *Statphys 22: The 22nd International Conference on Statistical Physics* held at J N Tata Auditorium, IISc, Bangalore during Jul 4 – Jul 9, 2004. Presented a Contributed talk on "Self-organized Pattern Formation in Motor-Microtubule Mixtures".

Participated in *Pattern Formation in Non-Equilibrium Systems: Satellite to Statphys 22* held at S N Bose National Centre for Basic Sciences, Kolkata during Jul 12 – Jul 15, 2004. Gave an Invited talk on "Pattern Formation in Motor - Microtubule Mixtures".

Visited IISc, Bangalore during Sep 3 – Sep 7, 2004.

Visited TIFR, Mumbai during Sep 7 – Sep 16, 2004. Delivered a seminar on "Pattern Formation in Motor-Microtubule Mixtures".

Visited The Jawaharlal Nehru Centre for Advanced Scientific Research on Sep 7, 2004. Presented a seminar on "Local Structure in Vortex Glass Phases".

Participated in *Second Indian Symposium of the Protein Society* held at IIT, Mumbai during Sep 27 – Sep 30, 2004. Gave an invited talk on "Pattern Formation in Motor Microtubule Mixtures".

Participated in *Tutorial Session, 10th International Vortex Workshop* held at TIFR, Mumbai during Jan 7 – Jan 9, 2005. Gave two invited lectures at the Tutorial Session, on "The Peak Effect" (January 7) and "Probes of Vortex Structure and Correlations using neutron scattering, muon-spin rotation, NMR and magnetic decoration" (January 8).

Participated in *First Indo-U.S. Workshop on Frontiers of Science* held at J N Tata Auditorium, IISc, Bangalore during Jan 9 – Jan 11, 2005. Invited Participant. Presented a poster on "Probing many Particle Correlations using Muons".

Participated in *10^{t}h International Vortex Workshop* held at TIFR, Mumbai during Jan 9 – Jan 14, 2005. Chaired the session on "Nanostructured Superconductors".

Participated in *IISc-ESPRC Workshop on Life Science Interface* held at IISc, Bangalore on Jan 11, 2005.

Mishra, Ashok K.

Visited Central Electrochemical Researh Institute, Karaikudi during Aug 16 – Aug 18, 2004. Delivered an invited talk on "Adsorption of a Copper Layer on Gold(111) Electrode: Electronic Structure and Metal-Insulator Transition".

Visited Department of Chemistry, IIT, Mumbai during Oct 12 – Oct 13, 2004. Delivered a talk on "Mott-Hubbard Metal-Insulator Transition at an Electrochemical Interface".

Visited Department of Physics, Elementary Particle Theory Group, University of Maryland during Oct 18 – Nov 19, 2004. Collaboarated with Prof. O.W. Greenberg on the Pathintegral approch to parafields quantization.

Visited Prof. D. Waldeck at the department of Chemistry, University of Pittsburgh during Oct 25 – Oct 26, 2004. Delivered a talk on "Metal-Insulator Transition at an Electrochemisorbed Layer".

Visited BARC, Mumbai during Dec 22 – Dec 23, 2004. Delivered a talk on "Metal-Insulator Transition in Adsorbed Monolayer".

Participated in *DAE Solid State Physics Symposium* held at Guru Nanak Dev University, Amritsar during Dec 26 – Dec 30, 2004. Delivered a talk on Metal-Insulator Transition at an Electrochemical Interface. Chaired a five member committee 'Best Poster Award Committee'.

Visited Regional Research Laboratory, Bhopal during Jan 25 – Jan 28, 2005. Delivered a talk on "Phase Transition in a Layer Adsorbed on a Metal Surface".

Visited IIT, Roorkee during Jan 31 – Feb 4, 2005. Delivered talks on "Infinite U Hubbard Model, Spin Charge Decoupling and Orthofermi Statistics", and "Electronic Structure and Metal-Insulator Transition in a Layer Adsorbed on a Metal Electrode".

Visited Central Electrochemical Research Institute, Karaikudi during Feb 21 – Feb 24, 2005. Participated in the progress review meeting of DRDO-sponsored project on "Novel materials for applications in Molecular Electronics and Energy Storage Devices".

Mukhopadhyay, Anirban

Visited Harish-Chandra Research Institute during Feb 1 – Mar 3, 2005. Attended a lecture series on the large sieve by O. Ramare.

Murthy, M. V. N.

Visited IoP, Bhubaneswar during Aug 2 – Aug 4, 2004. (i) Delivered the DAE-Golden Jubilee Colloquium "The big world of small Neutrinos: Introduction to INO".

(ii) Seminar on "Physicist's view of number partitions".

Participated in *70th Annual Meeting of the Indian Academy Sciences* held at Banaras Hindu University, Varanasi during Nov 25 – Nov 27, 2004. Presented a lecture on "Fractional exclusion statistics: A generalized Pauli principle".

Participated in *XVI DAE-BRNS High Energy Physics Symposium* held at SINP, Kolkata during Nov 29 – Dec 3, 2004. Presented a paper entitled "A question of hierarchy: matter effects with atmospheric neutrinos and antineutrinos".

Muthu, Rahul

Participated in *FSTTCS 2004* held at IMsc during Dec 16 – Dec 18, 2004.

Muthukumar, T.

Participated in *Indo-UK Study Group Meeting on Industrial Problems 2004* held at IIT, Mumbai during Dec 6 – Dec 10, 2004. A problem presented by the Reserve Bank of India in the meet was solved under some constraints and submitted to RBI as an article titled "Modeling Lending Rates of Commercial Banks in India".

Participated in *Conference on Recent Trends in Nonlinear Analysis and its Application* held at IIT, Mumbai during Dec 11 – Dec 13, 2004. Participated and delivered a talk titled "Homogenization of control problems via Γ-convergence".

Participated in *Workshop on Scientific Computation, Numerical Analysis and Applications* held at Department of Mathematics, IISc, Bangalore during Jan 24 – Feb 4, 2005.

Participated in *Joint Indo-French workshop on Partial Differential Equations and Applications* held at Department of Mathematics and TIFR Centre, IISc, Bangalore during Feb 7 – Feb 12, 2005.

Narayanan, N

Participated in *Workshop on Algorithms for Dynamic Data* held at IMSc during Dec 13 – Dec 14, 2004.

Participated in *Workshop on Logics for Dynamic Data* held at IMSc on Dec 15, 2004.

Participated in *FSTTCS 2004* held at IMSc, during Dec 16 – Dec 18, 2004.

Participated in *Pre-conference tutorials -INDOCRYPT 2004* held at IMSc during Dec 18 – Dec 19, 2004.

Participated in *INDOCRYPT 2004* held at IMSc during Dec 20 – Dec 22, 2004.

Nagaraj, D. S.

Visited University of Lille, France during May 3 – Jul 29, 2004. CNRS Fellow. Gave a seminar on "Parabolic bundles as Ramified G-bundles".

Visited University of Essen, Germany during Jul 5 – Jul 10, 2004. Gave a talk on "Ramified G-bundles".

Visited Harish-Chandra Research Institute during Dec 19 – Dec 27, 2004.

Visited University of Lille, France during Feb 6 – Feb 27, 2005. Gave a talk titled "On prime Fano three folds".

Prasad, Amritanshu

Visited TIFR, Mumbai during May 25 – Aug 2, 2004. Collaborative work with Uri Onn and Leonid Vasserstein.

Participated in *the International Conference on Harmonic Analysis and Quantum Groups* held at Department of Mathematics, Cochin University of Science and Technology during Jan 3 – Jan 8, 2005. Results on Harmonic Analysis on Iwahori-Hecke algebras were presented.

Raghavan, K. N.

Visited International Centre for Theoretical Physics during May 15 – Jul 31, 2004.

Participated in *School on Commutative Algebra and Interactions with Algebraic Geometry and Combinatorics* held at International Centre for Theoretical Physics during May 24 – Jun 11, 2004.

Visited Department of Mathematics, University of Genova during Jul 20 – Jul 23, 2004. Gave a talk titled "Hilbert functions of local rings of Schubert varieties in the Lagrangian Grassmannian".

Visited Indian Statistical Institute, Bangalore during Oct 4 – Oct 8, 2004.

Participated in *Harmonic Analysis and Quantum Groups* held at Cochin University of Science and Technology, Cochin during Jan 5 – Jan 6, 2005. Gave a talk titled "Towards an equivariant Schubert calculus".

Participated in *Symposium on Algebraic Groups in honour of Professor V. Lakshmibai* held at Chennai Mathematical Institute on Jan 8, 2005. Gave a talk on "Towards an equivariant Schubert calculus".

Rajasekaran, G.

Visited BARC, Mumbai during Apr 1 – Apr 2, 2004. Participated in the Vision Meeting and served as a Mentor.

Visited SINP, Kolkata on Apr 15, 2004. Participated in the INO Meeting.

Visited University of California, Riverside, USA during May 1 – Jun 30, 2004 for collaborative research in Neutrino Physics.

Visited Inter-University Centre for Astronomy and Astrophysics, Pune during Jul 8 – Jul 11, 2004. Gave a Colloquium on "Recent Discoveries in Neutrino Physics".

Visited SN Bose National Centre for Basic Sciences, Kolkata during Aug 8 – Aug 13, 2004. Gave the 4th C K Majumdar Memorial Lecture and three more lectures on "Is there a Final Theory?", "Neutrino Physics and INO".

Participated in the Conference on "Highlights in Theoretical Physics" held at Hyderabad University during 17-18 Sept 2004. Gave a talk on "Induced QCD and Induced Gravity".

Visited Chennai Mathematical Institute during Oct 15 – Oct 29, 2004. Gave a series of 4 lectures on "An Overview of Physics" at an elementary level.

Visited Delhi University during Nov 15 – Nov 17, 2004. Gave two lectures on "Recent Discoveries in Neutrino Physics" and "INO".

Visited Panjab University, Chandigarh during Nov 18 – Nov 20, 2004. Gave two lectures on "Recent Discoveries in Neutrino Physics and INO".

Participated in *16th DAE-HEP Symposium* held at SINP, Kolkata during Nov 29 – Dec 3, 2004. Chaired a Session and talked on "The Vision of INO".

Visited Inter-University Centre for Astronomy and Astrophysics during Dec 28 – Dec 30, 2004.

Visited Dept of Nuclear Physics, University of Madras during Feb 2 – Feb 3, 2005. Gave two talks on "Neutrino Physics" and "INO" under the auspices of the Tamil Nadu Academy of Sciences.

Participated in *5th International Conference on the Physics and Astrophysics of Quark Gluon Plasma and the Bikash Fest* held at SINP, Kolkata during Feb 7 – Feb 12, 2005. Gave a talk on "The Indian Neutrino Programme".

Visited Bharathidasan University, Tiruchirapalli during Mar 2 – Mar 3, 2005. Gave the Special Lecture on "Einstein and A Century of Physics" on the occasion of the Celebration of The National Science Day and The World Year of Physics. Gave a lecture on "Is there a Final Theory?".

Participated in *National Workshop on Double Beta Decay* held at IIT, Kharagpur on Mar 13, 2005. Gave the Keynote Address on Neutrino Physics and the Importance of Double Beta Decay Experiments. Participated in the panel discussion on the methodology for pursuing these experiments at INO.

Raman, Venkatesh

Participated in *Workshop on Algorithms for Dynamic Data* held at Chennai during Dec 14 – Dec 15, 2004.

Participated in *FSTTCS 2004* held at IMSc during Dec 16 – Dec 18, 2004.

Ramanujam, R.

Participated in *UGC Refresher course* held at University of Madras during 4Jul 19 – Jul 22, 2004. Gave a course of six lectures on "Distributed Systems".

Visited IGCAR, Kalpakkam on Aug 5, 2004. Gave a lecture on "Games and Computations".

Visited University of Hyderabad on Sep 24, 2004. Gave a lecture on "Reasoning about games".

Visited Janaki MGR College for women on Sep 29, 2004. Gave a lecture on "Cake cutting problem".

Visited SSN College of Engineering, Chennai on Oct 21, 2004. Gave a lecture on "Automata theory and verification".

Participated in *International Conference on Distributed Computing and Internet Technology* held at Bhubaneswar during Dec 21 – Dec 24, 2004. Gave a tutorial on "Security Protocols".

Participated in *Conference on Philosophy of Science* held at Santiniketan during Dec 27 – Dec 29, 2004. Gave a lecture on "A science of the artificial".

Participated in *First International Conference on Logic and Applications* held at IIT, Mumbai during Jan 8 – Jan 13, 2005. Gave the closing lecture.

Ray, Purusattam

Participated in *14th International Workshop on Computational Mechanics of Materials* held at Goa, India during Sep 23 – Sep 25, 2004. Gave an invited talk on "Breakdown of heterogeneous materials".

Visited IoP, Bhubaneswar during Jan 11 – Jan 15, 2005. Gave a talk on "Persistence in coarsening systems".

Visited Guwahati University, Guwahati on Jan 16, 2005. Gave a talk titled "Statistical physics of growth and patterns".

Visited IIT, Guwahati during Jan 17 – Jan 21, 2005. Gave a talk on "Persistence phenomena in coarsening systems".

Participated in *International workshop on quantum annealing and other optimization methods* held at SINP, Kolkata during Mar 2 – Mar 5, 2005. Chaired a session

Visited IIT, Kharagpur on Mar 7, 2005. Gave a talk on "Persistence in non-equilibrium systems".

Sankaran, Parameswaran

Visited International Centre for Theoretical Physics, Trieste, Italy during Jun 10 – Jul 23, 2004.

Participated in *XIV Brazilian Topology Meet* held at University of Campinas, Brazil during Jul 26 – Jul 30, 2004. Gave an advanced mini-course of four lectures on "Hyperbolic Groups".

Visited University of Sao Paulo, Brazil during Jul 31 – Aug 6, 2004. Gave a talk on "Coincidence theorem for holomorphic maps to G/P".

Visited Sri Venkateswara University, Tirupati during Sep 20 – Sep 22, 2004. Gave three talks on "Geometry and topology of surfaces".

Visited Sri Padmavati Mahila University, Tirupati on Sep 21, 2004. Gave a talk on "Topological methods in group theory".

Visited Mohanlal Sukhadiya University, Udaipur during Oct 25 – Oct 27, 2004. Gave three lectures on "Quaternion Algebras".

Visited University of Kerala, Tiruvananthapuram during Nov 15 – Nov 17, 2004. Gave three lectures on "Symmetric functions and Young diagrams".

Visited Ramanujan Institute for Advanced Studies in Mathematics, University of Madras, during Nov 29 – Nov 30, 2004. Gave four lectures on "Groups, graphs, and the Laplacian".

Visited Banaras Hindu University, Varanasi during Jan 31 – Feb 3, 2005. Gave three lectures on "Paradoxical decomposition, invariant measures, and amenability".

Sathiapalan, Balachandran

Participated in *SERC Preparatory School in HEP* held at IMSc, during Nov 8 – Nov 29, 2004. Gave lectures on "Field Theory".

Participated in *Workshop in String theory* held at Khajuraho, Madhya Pradesh during Dec 15 – Dec 23, 2004.

Saurabh, Saket

Participated in *5th Max-Planck Advanced Course on the Foundations of Computer Science* held at Saarbrucken, Germany at MPII during Sep 6 – Sep 10, 2004. Gave a talk on "Information Retrieval Theory".

Participated in *International Workshop on Parameterized and Exact Computation (IWPEC)* held at Bergen, Norway during Sep 14 – Sep 17, 2004.

Participated in *FSTTCS 2004* held at IMSc, during Dec 16 – Dec 18, 2004.

Sharatchandra, H. S.

Participated in *Highlights in Theoretical Physics (VS 62)* held at University of Hyderabad during Sep 17 – Sep 18, 2004. Gave an invited Talk on "Infrared behaviour of massless QED in 2+1-dimensions".

Participated in *Theoretical High Energy Physics -I (THEP-I)* held at IIT, Roorkee during Mar 16 – Mar 20, 2005. Gave an invited talk on "Infrared behaviour of massless QED in $2 < d < 4$".

Visited Cornell University, Ithaca, NY, USA and The Rockefeller University, New York, USA during Apr 1 – Aug 20, 2004 for continuation of postdoctoral work on biological sequence analysis / regulatory genomics.

Visited IISc, Bangalore and National Centre for Biological Sciences, Bangalore during Nov 22 – Nov 25, 2004. Gave seminars at both institutes, and discussed research possibilities.

Visited IISc, Bangalore, and National Centre for Biological Sciences, Bangalore during Dec 13 – Dec 17, 2004 for Continuation of research discussions on earlier visit.

Visited Centre for DNA fingerprinting and diagnostics, Hyderabad during Jan 3 – Jan 4, 2005. Gave a seminar on "Phylogibbs: a Gibbs sampler incorporating phylogenetic information", discussed research with Dr Akash Ranjan and his group.

Participated in *Workshop on "Parallel computing and applications"* held at IMSc, during Jan 7 – Jan 14, 2005. Gave a talk on "Bioinformatics".

Participated in *Life Science Interface Workshop* held at IISc, Bangalore during Jan 10 – Jan 11, 2005. Gave a talk on "Computational approaches to DNA sequence analysis".

Participated in *Mahabaleshwar Seminar on evolution of development mechanisms* held at Mahabaleshwar during Jan 21 – Jan 26, 2005. Participated in all sessions.

Sikdar, Somnath

Participated in *Workshop on Algorithms for Dynamic Data* held at IMSc during Dec 13 – Dec 14, 2004.

Participated in *Workshop on Logics for Dynamic Data* held at IMSc on Dec 15, 2004.

Participated in *FSTTCS 2004* held at IMSc during Dec 16 – Dec 18, 2004.

Participated in *INDOCRYPT 2004* held at IMSc during Dec 20 – Dec 22, 2004.

Simon, R.

Participated in *L.A. Meera Memorial Trust Discussion meeting on Some Aspects of Quantum Mechanics* held at Varanahalli during Jan 3 – Jan 7, 2005. Gave a set of three lectures on "Quantum Information Theory".

Sinha, Nita

Visited California Institute of Technology, Pasadena, USA during May 18 – May 30, 2004 for collaboration.

Visited National Taiwan University, Taipei, Taiwan during Jun 9 – Jun 18, 2004. Delivered a seminar, "Measuring weak phases from $B \rightarrow VV$ decays".

Sinha, Rahul

Visited California Institute of Technology, Pasadena, USA during May 18 – May 30, 2004. Collaboration and delivered a seminar entitled "Weak phase measurements and New Physics signals using $B \rightarrow VV$".

Visited National Taiwan University, Taipei, Taiwan during Jun 6 – Jul 6, 2004. Collaboration and also delivered two seminars entitled "Introduction to $B \rightarrow VV$ decays" and "New Physics signals using $B \rightarrow VV$".

Sinha, Sitabhra

Visited BARC, Mumbai during Apr 7 – Apr 9, 2004. Gave talks on "Sudden cardiac death: A problem in physics" and "Are complex systems unstable ?".

Participated in *STATPHYS 22: 22nd International Conference on Statistical Physics* held at Indian Institute of Science, Bangalore during Jul 4 – Jul 9, 2004. Talk on "Self-organised pattern formation in a model of collective choice dynamics".

Participated in *PNLD-2004: Conference on Perspectives in Nonlinear Dynamics* held at IMSc, during Jul 12 – Jul 15, 2004. Gave a talk on "Dynamics, disorder and death".

Visited Santa Fe Institute, USA during Jul 27 – Aug 31, 2004. Gave talks on "Free to Choose? The Dynamics of Collective Choice" and "Are complex networks unstable?".

Participated in *The Third Nikkei Econophysics Symposium: Practical Fruits of Econophysics* held at Nihon Keizai Shimbun, Tokyo, Japan during Nov 9 – Nov 11, 2004. Gave a talk on "Emergence of two-phase behavior in markets through interaction and learning in agents with bounded rationality".

Participated in *Indo-US Frontiers of Science Symposium* held at IISc, Bangalore during Jan 9 – Jan 11, 2005 as an invited participant and presented poster on "Are complex systems unstable ?".

Participated in *International Workshop on Econophysics of Wealth Distributions* held at SINP, Kolkata during Mar 15 – Mar 19, 2005. Gave invited talks on "The Rich Are Different!: Pareto-like power law distributions from wealth dependent asymmetric interactions in

asset exchange models" and "Blockbusters, Bombs and Sleepers: The income distribution of movies".

Participated in *Colloquium on Language and Mind* held at Central Institute of Indian Languages, Mysore during Mar 30 – Mar 31, 2005. Invited talk on "Self-organized pattern formation in language and mind: Emergence of structures in complex (adaptive) systems".

Sinha, Sudeshna

Participated in *Perspectives in Nonlinear Dynamics (Satellite meeting of STATPHYS-22)* held at IMSc and IIT, Chennai during Jul 12 – Jul 15, 2004 as an invited speaker.

Participated in *First SERC School on Nonlinear Dynamics* held at PRL, Ahmedabad during Nov 28 – Dec 18, 2004 as an invited speaker.

Participated in *Theoretical Chemistry Symposium* held at BARC, Mumbai during Dec 9 – Dec 12, 2004 as an invited speaker.

Participated in *National Conference on Control and Dynamical Systems* held at IIT, Mumbai during Jan 27 – Jan 28, 2005 as a plenary speaker.

Srinivas, K.

Visited Laboratoire A2X, University of Bordeaux, France during Sep 6 – Oct 6, 2004. Gave two seminar talks, pursued collaborative research.

Participated in *Conference in honour of Professor Francois Dress* held at Laboratoire A2X, University of Bordeaux 1, France during Sep 13 – Sep 19, 2004. Delivered an invited talk on "The gap between Zeros of Epstein's Zeta function on the critical line".

Visited Laboratoire AGAT, University of Lille, France during Oct 7 – Oct 13, 2004. Gave a seminar talk titled "Exponential sums and the zeros of zeta-functions".

Visited University of Marseilles, France during Oct 14 – Oct 20, 2004. Delivered a seminar talk.

Visited University of Genova, Italy during Oct 21 – Oct 27, 2004. Gave a seminar talk and pursued the ongoing research work with Prof. Alberto Perelli on the Selberg class of functions.

Visited University of Parma, Italy during Oct 28 – Oct 31, 2004. Delivered a seminar talk in the mathematics department.

Visited University of Roma, Italy during Nov 1 – Nov 4, 2004.

Subramanian, C. R.

Visited Department of Mathematics, IIT, Chennai. on Apr 8, 2004. Gave a talk on "Tight Upper Bounds on List Chromatic Numbers".

Visited Department of Mathematics, Annamalai University, Chidambaram, during Apr 15 – Apr 16, 2004. Invited Speaker at the Ramanujan Memorial Seminar. Gave a talk on "Chromatic parameters and bounds on them".

Visited Siddaganga Institute of Technology, Tumkur, Karnataka during Aug 23 – Aug 28, 2004. Gave a mini-course on "Randomized Algorithms".

Participated in *National Seminar on Algebra, Number Theory and Applications to Coding and Cryptanalysis* held at Little Flower College, Guruvayoor, during Sep 16 – Sep 18, 2004. Gave an invited lecture on "Probabilistic arguments in number theory".

Participated in *Workshop on Algorithms for Dynamic Data* held at IMSc during Dec 13 – Dec 14, 2004.

Participated in *24th International Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2004)* held at IMSc, during Dec 16 – Dec 18, 2004.

Participated in *UGC Sponsored Seminar on "Applications of Graph Theory"* held at

Yadava College, Madurai during Feb 10 – Feb 11, 2005. Gave two invited lectures on "Treewidth of a graph : Theory and Algorithms".

Sunder, V. S.

Visited New Zealand Institute for Mathematics and its Applications, Auckland during Apr 5 – Apr 25, 2004. Research collaboration. Gave two lectures on "Subfactor Planar Algebras and 1+1-dimensional unitry TQFTs".

Visited University of Canterbury, Christchurch during Apr 26 – Apr 30, 2004. Gave a talk on "Unitary invariants of tensors".

Visited University of New South Wales, Sydney during May 3 – May 28, 2004. Research Collaboration. Gave a lecture on "A complete family of numerical invariants for subfactors".

Visited University of Newcastle during May 20 – May 21, 2004. Gave a talk on "Complete family of numerical invariants for a subfactor".

Visited The University of Iowa during Aug 15 – Dec 22, 2004. Taught two undergraduate courses and gave a series of lectures on "Planar algebras and TQFTs".

Visited Indiana University during Sep 16 – Sep 19, 2004. Gave a colloquium talk on "Numerical invariants for subfactors".

Visited University of Chicago during Oct 21 – Oct 23, 2004. Gave a lecture on "Subfactor Planar Algebras and 1+1-dimensional TQFTs".

Visited Drake University on Oct 30, 2004. Gave a lecture on "A complete family of numerical invariants for a subfactor" at the Iowa-Nebraska Functional Analysis Seminar

Visited University of New Hampshire during Nov 21 – Nov 22, 2004. Gave a talk on "Subfactor planar algebras and 1+1-dimensional unitry TQFTs".

Visited Indian Statistical Institute, Bangalore during Jan 24 – Jan 28, 2005. This visit was primarily for continuing research collaboration with Vijay Kodiyalam. Gave a colloquium lecture on "The Banach-Tarski alternative" on Jan 27, 2005.

Visited IIT, Chennai on Feb 11, 2005. Gave a lecture on "Banach-Tarski paradox and amenability" at the Mathematics Department.

Participated in *XII Ramanujan Symposium on Recent Trends in Analysis* held at Ramanujan Institute during Mar 2 – Mar 4, 2005. Gave invited lecture on "The Table-tennis Lemma - a version".

Visited Shree Chandraprabhu Jain College, Minjur on Mar 24, 2005. Gave a lecture on "Braid Groups".

Sridharan, Shrihari

Participated in *Applications of Dynamical Systems to Number Theory* held at University of Hyderabad during Jan 7 – Jan 9, 2005. Gave a talk on "Two different generalisations of Lyubich".

Visited IIT, Chennai on Jan 20, 2005. Gave a lecture on "Large Deviation Results for Periodic Points of a Rational Map".

5.4   Visitors from Other Institutions

Name	Affiliation	Period of Visit
Sandeep Krishna	NCBS, Bangalore	04.04.04 – 11.04.04
S. P. Das	School of Physical Sciences, J.N.U., New Delhi	06.04.04 – 07.04.04
Surajit Sengupta	SNBNCBS, Kolkata	18.04.04 – 24.04.04
Ankush Sengupta	SNBNCBS, Kolkata	12.04.04 – 26.04.04
V. Subrahmanyam	IIT, Kanpur	01.01.04 – 28.04.04
Abhishek Dhar	Raman Research Inst., Bangalore	29.04.04 – 30.04.04
Swapan Majhi	Harish Chandra Research Inst., Allahabad	23.04.04 – 03.05.04
Andreas Rosenschon	State Univ. of New York, Buffalo, USA	07.04.04 – 04.05.04
Deepak Dhar	TIFR, Mumbai	11.05.04 – 13.05.04
Alok Laddha	Raman Research Inst., Bangalore	15.04.04 – 30.04.04
P. K. Sanjay	L.B.S. College of Engg., Kerala	17.04.04 – 28.05.04
Anuradha Misra	Univ. of Mumbai, Mumbai	26.04.04 – 15.05.04
Amitava Raychaudhuri	Univ. of Calcutta, Kolkata	17.05.04 – 20.05.04

Ajay Patwardhan	St. Xavier's College, Mumbai	16.05.04 – 05.06.04, 25.10.04 – 08.11.04
S. M. Lee	IGCAR, Kalpakkam	09.06.04
Anilesh Mohari	SNBNCBS, Kolkata	07.06.04 – 14.06.04
Y. V. Rama Narasimhan	Chennai Mathematical Inst., Chennai	12.05.04 – 15.07.04
Sudhir Kumar	Chennai Mathematical Inst., Chennai	12.05.04 – 16.07.04
Gautam Sengupta	IIT, Kanpur	22.05.04 – 26.06.04
S. G. Rajeev	Univ. of Rochester, Rochester	02.06.04 – 24.06.04
Vikram Rentala	IIT-Bombay, Mumbai	07.06.04 – 29.06.04
P. M. Gade	Univ. of Pune, Pune	21.06.04 – 29.06.04
S. Srinivasa Rao	Univ. of Waterloo, Canada	27.06.04 – 10.07.04
Parthasarathi Majumdar	SINP, Kolkata	28.06.04 – 06.07.04
Pradeep Kumar Mohanty	Weizmann Inst. of Sciences, Israel	01.07.04 – 03.07.04
Indubala Satija	George Mason Univ., USA	01.07.04 – 05.07.04
Anandaswarup Gadde	The Univ. of Melbourne, Australia	04.07.04 – 10.07.04
Pumir Alain	Institut Non Lineaire de Nice, France	11.07.04 – 20.07.04

Alexander Pisarchik	CIO, León, Mexico	10.07.04 – 18.07.04
William L. Ditto	Univ. of Florida	10.07.04 – 17.07.04
Jennifer Simonotto	Univ. of Florida	10.07.04 – 17.07.04
Gunter Schutz	Institut for Festkorperforschung, Germany	18.07.04 – 20.07.04
Mohit Randeria	TIFR, Mumbai	20.07.04 – 23.07.04
Prashanth Jaikumar	McGill Univ., Canada	20.07.04 – 25.07.04
V. S. Lakshmanan	Univ. of British Columbia, Canada	25.07.04 – 27.08.04
Abhik Basu	Hein-Meitner Inst., Germany	29.07.04 – 30.07.04
G. V. Shivshankar	NCBS, TIFR, Bangalore	01.08.04 – 03.08.04
Uma N. Iyer	State Univ. of New York	01.08.04 – 05.08.04
A. P. Balachandran	Syracuse Univ., New York	01.08.04 – 07.08.04, 12.12.04 – 18.12.04, 03.01.05 – 16.01.05
Soumitra Sengupta	IACS, Kolkata	15.08.04 – 19.08.04
C. V. K. Baba	TIFR, Mumbai	16.08.04 – 22.08.04, 17.02.05 – 26.02.05, 27.03.05 – 31.03.05
V. S. Narasimhan	TIFR, Mumbai	16.08.04 – 23.08.04
Gautami Bhowmick	Univ. of Lille, France	17.08.04 – 28.08.04

P. K. Kabir	Univ. of Virginia, USA	19.08.04 – 26.08.04
Animesh Sharma	INFOSYS, Bangalore	20.08.04 – 27.08.04
Sameen Ahmed Khan	Middle East College of Information Technology, Oman	23.08.04 – 30.08.04
Michael Demuth	Technical Univ. of Clausthal, Germany	27.08.04 – 31.08.04
K. B. Sinha	Indian Statistical Inst., Kolkata	30.08.04 – 01.09.04
Jung Hun Han	Mysore Univ., Mysore	30.08.04 – 01.10.04
C. M. Chandrashekar	Univ. of Oxford, UK	31.08.04 – 01.09.04
David Sinnou	Univ. Paris, France	31.08.04 – 04.09.04
Shrirang S. Deshingkar	Univ. of South Africa, South Africa	13.09.04 – 15.09.04
Jovan Golic	Telecom Italia Lab, Italy	14.09.04 – 15.09.04
Subinay Dasgupta	Univ. of Calcutta, Kolkata	27.09.04 – 01.10.04
Sonali Tamhankar	Univ. of Kentucky	04.10.04 – 07.10.04
Sachin Vaidya	IISc, Bangalore	11.10.04 – 15.10.04
Rahul Pandit	IISc, Bangalore	14.10.04 – 15.10.04
Saumen Datta	Univ. Bielefeld, Germany	10.10.04 – 16.10.04

Ajay Sood	IISc., Bangalore	20.10.04
Partha Guha	SNBNCBS, Kolkata	22.10.04 – 23.10.04
Demian Hyunjai Cho	Raman Research Inst., Bangalore	15.11.04 – 19.11.04
Santosh Kumar K.	Kuvempu Univ., Shumuga	18.11.04 – 20.11.04
V. Sunil Kumar	Inst. of Physics, Bhubaneshwar	22.11.04 – 27.11.04
R. Parthasarathy	TIFR, Mumbai	05.08.04 – 04.12.04
Sameer Murthy	ICTP, Italy	08.12.04 – 14.12.04
Ram Kishore	Inst. National De Pesquisas Espaciais, Brazil	08.12.04 – 06.03.05
Sachin Vaidya	IISc, Bangalore	12.12.04 – 18.12.04
Vijay Kumar	Tohuku Univ., Sendai	13.12.04 – 28.12.04
S. Chaturvedi	Univ. of Hyderabad, Hyderabad	14.12.04 – 15.12.04
Olaf Beyersdroff	Humboldt Univ., Berlin	14.12.04 – 23.12.04
Vinod Chandran Variyam	Univ. of Nebraska, USA	19.12.04 – 24.12.04
S. Venkatesh	Univ. of Victoria, Canada	21.12.04 – 28.12.04
V. Srinivas	TIFR, Mumbai	19.12.04 – 04.01.05

Sanghamitra Bandopadhyay	Indian Statistical Inst., Kolkata	26.12.04 – 27.12.04
Rick Mukherjee	St. Xavier's College, Mumbai	30.12.04 – 03.01.05
S. D. Adhikari	Harish-Chandra Research Inst., Allahabad	26.12.05 – 12.01.05, 16.03.05 – 18.03.05
Kavita Jain	Univ. of Cologne, Germany	02.01.05 – 04.01.05
Anjan Kundu	SINP, Kolkata	02.01.05 – 06.01.05
V. Ravindran	Harish-Chandra Research Inst., Allahabad	03.01.05 – 07.01.05
Nyffeler Andreas	ETH, Zurich	03.01.05 – 07.01.05
Chinmay Das	Univ. of Leeds, UK	03.01.05 – 06.01.05
O. W. Greenberg	Univ. of Maryland, USA	04.01.05 – 24.01.05
C. S. Rajan	TIFR, Mumbai	07.01.05 – 09.01.05
C. Musili	Aryabhata Univ., Hyderabad	07.01.05 – 11.01.05
Janaki Balakrishnan	Max-Planck Inst., Germany	12.01.05
Vibhor Bhatt	Punjab Univ., Chandigarh	13.12.04 – 12.01.05
M. S. Narasimhan	TIFR Centre, Bangalore	10.01.05 – 17.01.05, 06.02.05 – 13.02.05
Kamales Kar	SINP, Kolkata	13.01.05 – 28.01.05

Shahjahan T.K.	IISc, Bangalore	18.01.05 – 28.01.05
Indrajit Mitra	SINP, Kolkata	16.01.05 – 31.01.05
Justin David	ICTP, Italy	02.01.05 – 04.01.05
Arati B. Khairnar	TIFR, Mumbai	06.02.05 – 12.02.05
Amala Bhave	TIFR, Mumbai	06.02.05 – 12.02.05
Aribam Chandrakant Sharma	TIFR, Mumbai	06.02.05 – 12.02.05
Deshouillers Jean-Marc	Universite Bordeaux, France	08.02.05 – 10.02.05
Michel Fontannaz	LPT, Univ. Paris XI, France	07.02.05 – 16.02.05
Rohini Godbole	IISc, Bangalore	08.02.05 – 11.02.05
Sujatha R.	TIFR, Mumbai	06.02.05 – 11.02.05
Hiroyuki Takata	Inst. of Physics, Bhubaneshwar	15.01.05 – 14.02.05
Parimala R.	TIFR, Mumbai	06.02.05 – 12.02.05
Utpal Sarkar	PRL, Ahmedabad	12.02.05 – 15.02.05
Alessandro Zaccagnini	Univ. of Parma, Italy	14.02.05 – 20.02.05
Umasankar S.	IIT-Bombay, Mumbai	18.02.05 – 21.02.05
Somdatta Sinha	CCMB, Hyderabad	21.02.05 – 24.02.05

Olivier Ramare	Univ. of Lille, France	22.02.05 – 05.03.05
Patrick Aurenche	LAPTH, France	12.02.05 – 02.03.05
G. Athithan	Centre for Artificial Intelligence and Robotics, Bangalore	24.02.05 – 26.02.05
Dinakar Ramakrishnan	California Inst. of Technology	21.02.05 – 28.02.05
Eckhard Giere	Technical Univ. Clausthal, Germany	21.02.05 – 09.03.05
Rajat Bhaduri	McMaster Univ., Hamilton, Canada	01.03.05 – 07.03.05
Johannes Kobler	Humbolt Univ., Berlin	05.03.05 – 25.03.05
Thomas Lux	Univ. of Kiel, Germany	08.03.05 – 13.03.05
S. Rajesh	CUSAT, Kochi	13.03.05 – 16.03.05
Jyoti Prasad Saha	Jadavpur Univ., Kolkata	13.03.05 – 19.03.05
Pushan Majumdar	Univ. of Graz, Austria	13.03.05 – 25.03.05
Herve Queffelec	Univ. of Lille	27.02.05 – 26.03.05
Bikash Ch. Paul	North Bengal Univ.	23.03.05
Srikanth Sastry	JNCASR, Bangalore	28.03.05 – 30.03.05
S. S. Ashwin	JNCASR, Bangalore	28.03.05 – 30.03.05

Chapter 6

Infrastructure

6.1 Computer Facilities

Ehnancement of Computer Facility during 2004-2005:

As part of the Institute's commitment towards high quality computing environment, facilities were upgraded through Sun Blade 2500 servers, laptops for general use, expanded WiFi facilities, extending of local area networking to Guest House Complex as well as creating additional computing facilities for visitors and new JRFs.

KABRU - The Linux Cluster under ILGTI Project:

The major target for the project, namely, full integration and commissioning of the 144-node Linux cluster supercomputer, was achieved on Apr 13, 2004. After benchmarking it was entered in the Top 500 Supercomputers of the world competition and it was placed at the 257th position. In October it reached its top performance of 1.002 Teraflops and again made it to the Top 500 list in Nov 2004. Major codes for production runs in Lattice Gauge Theory were achieved during Apr 2004 – Oct 2004. Since then the cluster is fully operational in QCD simulations. By the end of March 2004 first physics results from KABRU have come out showing that the qcd theory produces a Nambu-Goto string between quarks and antiquarks.

A very successful School/Workshop on *Parallel Computing and Clusters* was held at IMSc during Jan 2005. All together 60 participants from all over India came and actually gained hands-on experience in parallel computing.

Whenever time was available, cluster has been used by IGCAR scientists for weather prediction and scientists at IMSc have tested the machine for bioinformatics and cardiac modeling.

Hundreds of students from colleges all over the country have visited IMSc for lecture cum demo on clusters.

6.2 The Library

The Institute Library holds a total collection of 54184 books and bound periodicals as on March 31, 2005. This includes an addition of 3625 volumes during the current year April 2004 - March 2005. The library subscribes to about 331 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 2500+ online journals from major publishers such as Elsevier, American Mathematical Society, American Physical Society, Springer Verlag, World Scientific, Institute of Physics, etc.

Library also has access to Nature online, ACM Digital Library & JSTOR Full digital archive. It has also perpetual online access to backfile collection of journals from Elsevier in the areas of Mathematics, physics and computer science under the DAE Consortium.

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 .

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: