INSTITUTE OF MATHEMATICAL SCIENCES

Annual Report
1984-1985

Madras-600 113
India

The Institute of Mathematical Sciences

Annual Report
1984-1985

Madras-600 113, India

INTRODUCTION

The Primary activity of the Institute - viz. Creative research in Mathematical Sciences in pursuit of the aims and objectives of the Institute - continued uninterrupted with seminars as well as series of lectures both by the faculty members of the Institute and by visiting Scientists.

In February 1984, Prof.G.Rajasekaran(Professor of Physics, University of Madras) joined the Institute as its Joint Director.

Prof.E.C.G.Sudarshan(Professor of Physics, University of Texas at Austin, Texas, U.S.A.) took charge as the Director of the Institute in March 1984.

Mr.G.Sethuraman, assumed charge as the Registrar of the Institute on deputation from the Department of Atomic Energy, Government of India, in March 1985.

The Board of Governors of the Institute has been reconstituted, in October 1983, wi h Dr.R.Ramanna Chairman of the Atomic Energy Commission and Secretary to the Department of Atomic Energy, himself as a Member, with the tacit understanding and approval of the highest authorities intthe country to upgrade and nurture the Institute to flourish as a National Centre of Excellence in Mathematical Sciences. Hon'ble Thiru C.Aranganayakam, Minister for Education, the Chairman of the Board and Mr.T.D.Sundar Raj, I.A.S., Commissioner and Secretary to Government, Education Department, are the representatives of the Government of Tamil Nadu. Besides the Director of the Institute, who is an Ex-Officio member of the

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Board, the other members are: Mr.S.Rajgopal, Additional Secretary, Department of Atomic Energy, as the representatives of the Government of India, and Prof.K.R.Unni as a representative of the Academic Council of the Institute. After Prof.E.C.G.Sudarshan took charge as the Director of the Institute, the Board met on August 13, 1984 and December 18, 1984.

An allround expansion has been initiated by Professor E.C.G.Sudarshan, from the middle of 1984, with increased aid from the Department of Atomic Energy, Government of India and the Government of Tamil Nadu. Additional land (2.5 Acres) opposite to the existing premises of the Institute in the Central Institutes of Technology Campus, has been allotted for the construction of a Guest House-cum-Student Hostel Complex, by the Government of Tamil Nadu. Four identical houses in a single compound have been rented, in the interim period from August 1984, two to serve as the Guest Houses, one as a student Hostel, and the other as a residence for the Director, in Besant Nagar, about 5 Kms. from the Institute.

Professor C.S.Seshadri (Senior Professor of Mathematics, Tata Institute of Fundamental Research, Bombay) is at the Institute from June 1984.

A search is now on to recruit new talent at the Faculty and the student levels from all parts of the country. Advertisements in all leading daily news papers were given and written and oral tests were conducted in July and October 1984, for the Junior Research Fellowships of the Institute.

Of the 90 students (41 for Mathematics and 49 for Physics) who appeared for these tests, 7 students (3 for Mathematics and 4 for Physics) have been selected. The Junior Research Fellowship amount has been increased to Rs.1,000/- per month from October 1984.

Among the Visiting scientists to the Institute during 1984 were: Prof.John Thompson, Fields Medalist, Cambridge University, England, who visited the Institute and gave two seminars of Finite Simple + Groups, in August 1984. Prof.S.Chandrasekar, Nobel Laureate and distinguished Service Professor at the University of Chicago, visited the Institute on November 2, 1984 and had a discussion with the academic group. Prof.T.Regge, University of Torino, Italy, visited the Institute on December 1 and gave a seminar on Group Manifold Approach.

An Honorary Degree of Science(Engineering) was conferred upon Prof.E.C.G.Sudarshan by the Faculty of Engineering of the Chalmers University of Technology, Gothenburg, Sweden, on May 25, 1984.

During the year seven faculty members and three students participated in ten International Conferences. Participation in five International Conferences was made possible with travel support from the Institute, while one faculty member obtained travel support from the Department of Science and Technology, Government of India, and another obtained support from the Indian National Science Academy-Royal Society of London exchange scientist programme(for 3 weeks). Also,

four faculty members participated in four National Conferences within the Country.

To this Institute devoted to theoretical studies in Mathematical Sciences, the Library is the vital organ, catering to the needs of not only the members of the Institute but also those belonging to other Institutions in the city of Madras. The Library continued to expand with the addition of books and journals and at the end of March 1985, the total number of volumes in the Library is approximately 20,000. Besides the 90 International Journals on Mathematics and Physical Sciences which are subscribed for by the Institute, the Library is continuing to get 55 journals and Lecture Notes from leading research centres throughout the world, in exchange to the I.M.Sc.(Institute of Mathematical Sciences) Reports. A salient and attractive feature of this library is that the books and journals are always available for reference due to its non-lending character. A preprint collection is maintained in the Library in order to facilitate a rapid exchange of ideas with Scientists at other leading research institutions like the Institute of Physics, PRL, SINP, Bhabha Atomic Research Centre, Madras University, Indian Institutes of Technology, TIFR, CERN, ICTP, LBL, SLAC, NORDITA, etc. On an average about 150 preprints are received every month. Recently, subscription to a few important daily newspapers has been initiated.

Madras-600 113
March 31, 1985

E.C.G.SUDARSHAN
Director

AIMS AND OBJECTIVES

1. To create and provide an atmosphere and environment suitable for creative work and the pursuit of knowledge and advanced learning in the mathematical sciences for their own sake.
2. To promote and conduct research and original investigation of fundamental sciences in general with particular emphasis on Mathematics and Theoretical Physics.
3. To foster a rigorous mathematical discipline, to stimulate a zest for creative work and cultivate a spirit of intellectual collaboration among academic workers in fundamental sciences with particular emphasis on Mathematics and Theoretical Physics.
4. To arrange lectures, meetings, seminars and symposia in pursuance of its academic work for the diffusion of scientific knowledge.
5. To invite scientists in India and abroad actively engaged in creative work to deliverylectures and participate in academic activity.

Ph.D.PROGRAMME

Facilities are available for postgraduate students to work for a Ph.D. degree under the guidance of the academic staff of the Institute in various faculties. Post doctoral and Junior research fellowships are awarded by the Institute.

The Standing Committee of the Inter-University Board of India and Ceylonaat its meeting held in February 28, 1967 adopted a resolution recognising the Institute as a suitable centre for research work. In view of the above resolution the Institute

is now recognised by various Indian Universities as a centre for research for the Doctorate Degree in Theoretical Physics and Mathematics.

PATRON:

Mr.C.SUBRAMANIAM

BOARD OF GOVERNORS

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Minister for Education
Government of Tamil Nadu

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Chairman, Atomic Energy Commission and Secretary
Department of Atomic Energy
Government of India

Mr.T.D.Sundar Raj, I.A.S.
Commissioner and Secretary to Government
Education Department
Government of Tamil Nadu

Mr.S.Rajgopal
Additional Secretary to Government of India
Department of Atomic Energy

Prof.E.C.G.Sudarshan
Director
The Institute of Mathematical Sciences

Prof.K.R.Unni
The Institute of Mathematical Sciences

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Director
The Institute of Mathematical Sciences

Mr.T.A.Lakshminarayanan
Controller
Bhabha Atomic Research Centre

FACULTY MEMBERS

Director

Prof.Sudarshan, E.C.G.	(Physics)

Joint Director

Prof.Rajasekaran,G.	(Physics)

Senior Professor

Seshadri,C.S.[o]	(Mathematics)

Professors

Ran	Ranganathan, N.R.	(Physics)
	Santhanam,T.S.	(Physics)
	Unni, K.R.	(Mathematics)
	Vasudevan, R.	(Physics)

Associate Professors

Alladi, Krishnaswami	(Mathematics)
Mariwalla, K.H.	(Physics)
Parthasarathy, R.	(Physics)
Radhakrishnan, V.	(Physics)
Shivamoggi, B.K.	(Physics)
Sridhar, R.	(Physics)
Srinivasa Rao, K.	(Physics)

Readers

Balasubramanian, R[o]	(Mathematics)
Jagannathan, R.	(Physics)

Assistant Professor

Joshipura, A.S.	(Physics)

Research Fellows

Senior Research Fellow[+]

Shanthi, A.	(Physics)
Venkata Satyanarayana, M.	(Physics)

Junior Research Fellows

Adhikari, S.D.	(Mathematics)
Anthony, Anand, J.	(Mathematics)
Balaji, V.*	(Mathematics)
Madivanane, S.***	(Physics)
Prem Kumar Yesudian, C.	(Physics)
Radhakrishna Nair, B.S.	(Physics)
Rajeswari, V.	(Physics)
Shaji, N.	(Physics)
Salai Dhavakodi, T.	(Mathematics)

Teacher Research Fellow

Srinivasan, J.**	(Physics)

°Service on loanffrom Tata Institute of Fundamental Research, Bombay.

+CSIR, Government of India

*National Board for Higher Mathematics Fellow

**Part-time scholar, Department of Physics, A.M.Jain College, Madras.

***Till February 1985

RESEARCH WORK

The research carried out at the Institute of Mathematical Sciences has been broadly classified into various branches of Theoretical Physics and Mathematics. In this report, summaries of completed work which has been published in Journals in 1984-85 or which has been submitted for publication is presented. Some of the research work has been presented at national and international conferences in the form of invited talks or contributed papers. Lists of publications in journals and in conference proceedings are presented.

ELEMENTARY PARTICLE PHYSICS

The recent single-tag two-photon experiments at PETRA and the issue of quark charges

The recent PLUTO data of single tag 2-photon experiments indicating noticeable excess over the QCD prediction, have been analysed. It has been found that this excess and its Q^2 dependence can be attributed to the presence of a colour-octet component in the electromagnetic current, thus signalling broken colour, provided the gluonmass parameter lies in the range of 150-350 MeV

(R.M.Godbole*, T.Jayaraman*, J.C. Pati*, G.Rajasekaran and S.D.Rindani*, Phys. Lett. 142B(1984) 91)

Decays of weak bosons in the broken colour model

Electroweak effects in electron-positron annihilation at high energies are studied in the model of integrally charged quarks (ICQ) with broken colour symmetry. Angular asymmetries as well as other phenomenological parameters are worked out,

for possible confrontation with experiment.

(S.Lakshmibala*, G.Rajasekaran and S.D.Rindani*, 24(1985)423). Pramana.

Ontthe classical solutions of SO(3) Gauge theory and 't Hooft-Polyakov Monopole

It has been shown that the ansatz for the asymptotic($r\to\infty$) gauge fields by 't Hooft in the study of monopoles in SO(3) electroweak theory is not unique

(R.Parthasarathy, T.S.Santhanam and K.H.Mariwalla, Pramana 24(1985) 457.

Supersymmetric SU(2) Gauge theory in a Non-abelian background field

A constant non-Abelian ansatz for the background field in a Yang-Mills theory has been used to calculate the quantum one-loop corrections to the effective energy density in a super-symmetric SU(2) gauge theory including matter fields. It is shown that there is a genuine reduction in the number of fermion flavours on going from ordinary to supersymmetric SU(2) theory. The supersymmetric SU(2) can accommodate only 6 fermion flavours. This reduction is due to the combined effect of supersymmetry and asymptotic freedom. Numerical values for the bag constant are obtained in a supersymmetric model. These are found to be in better agreement with the MIT values than a model based on ordinary SU(2) gauge theory.

(R.Parthasarathy, submitted to Phys. Rev. D)

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*External Collaborator.

Classical fields with vanishing colour currents

It is shown that there are no non-trivial c-number solutions to models of colour confinement based on the constraint of vanishing quark currents, for colour SU(n) groups with n≠3.
(G.Rajasekaran, V.Srinivasan* and M.S.Sriram*, 24(1985)435)

NUCLEAR PHYSICS

Recoil Polarization of $^{12}C(1^+, T=1;\ 15.1\ MeV)$ in Neutrino neutral current interactions

Cohen-Kurath wave functions have been used to obtain the numerical values of the average recoil polarization of $^{12}C^*(1^+, T=1;\ 15.1\ MeV)$ excited in neutrino neutral current interactions in ^{12}C. It is found to be insensitive to the choice of the nuclear wave functions
(R.Parthasarathy and C.Premkumar Yesudian, Phys. Lett. 153B (1985) 124).

Neutral Current induced neutrino reactions in ^{12}C

The differential and total cross sections for the nuclear reaction.

$$\nu_\mu + {}^{12}C(g.s) \rightarrow \nu_\mu + {}^{12}C^*(1^+, T=1;\ 15.1\ MeV)$$

are investigated for values of $50 < E_\nu < 300$ MeV. An effective Humiltonian for the above nuclear reaction is constructed from the neutrino-quark neutral-current weak interaction, by first constructing the neutrino-nucleon neutral current interaction and then using the impulse approximation along with the non-relativistic reduction procedure. The Weinberg-Salam model is the basis of the calculations. Detailed

expressions for the differential cross-sections have been derived including the nucleon momentum-dependent terms and the numerical results obtained using the general 1p-shell wave functions of Cohen and Kurath. The sensitivity of the total cross sections to the nuclear models and the Weinberg angle have been studied. The corresponding anti-neutrino reaction is also investigated. The ratio $R(\sigma_T^{\nu} - \sigma_T^{\bar{\nu}}) / (\sigma_T^{\nu} + \sigma_T^{\bar{\nu}})$ is found to be independent of the nuclear wave functions but very much sensitive to the Weinberg angle. Thus, this observable can be used to determine the free parameter Θ_W in a nuclear reaction, thereby complimenting the studies involving free nucleons. The recoil polarisation of the final nucleus $^{12}C^*(1^+;T=1,\ 15.1\ MeV)$ and its importance has also been studied.

(R.Parthasarathy and C.Premkumar Yesudian, Annals of Physics 161(1985) 337).

CONDENSED MATTER

On the Frohlich Decomposition and the condensate fraction in He 11

The method of extracting the Bose-Einstein condensate fraction in He 11 within the Frohlich decomposition scheme is revisited and a new simple formula for determining this fraction has been derived. Possible experimental and theoretical implications have been discussed.

(H.B.Ghassib* and R.Sridhar, Phys. Letters 100A(1984) 198)

Remarks on duality transformations in lattice spin systems

This contribution deals with the τ-continuum limit of anisotropic plane Ising lattice in arriving at the quantum dual Hamiltonian by a route different to that of Fradkin and Sussikind. One sees the necessity of effecting the exchange of coupling strengths in duality transformations. Construction prescribed by Savit's procedure to arrive at classical dual is also seen to imply this. Implication of this exchange feature is also discussed.

(N.R.Ranganathanaand R.Vasudevan, J. Phys. A: Math. Gen. 17(1984) 1143)

A New derivation of the structure factor and excitation spectrum of liquid He 11

Some results have been obtained on the basis of the assumption that single and two particle states saturate the frequency moment sum rules of $S(k,\omega)$. The method has been generalised to get a coupled set of integral equations so that the structure factor and the single particle excitation energy can be determined in a self-consistent manner.

(R.Sridhar and A.Shanthi, LT-17, Eds.U.Eckern, A.Schmid, W.Weber and H.Wuhl, Elsevier Science Publishers(1984) 1203)

A unified description of the representations of the graded lie Algebra Gs1(2)

Indecomposable representations of the graded Lie algebra Gs1(2) have been analyzed in detail. The study of the irreducible representations (finite-and infinite-dimensional) have been shown to be intimately related to the study of these indecomposable representations.

(Bruno Gruber*, T.S.Santhanam and Raj Wilson*, J.Math. Phys. 25(1984) 1253)

On projective representations of finite Abelian groups

A simple procedure of obtaining all the inequivalentiirreducible projective matrix representations of any finite Abelian group has been given.

(R.Jagannathan, to appear in Proceedings of the IV Number Theory Conference, Institute of Mathematical Sciences, Madras, Ed.K.Alladi, Lecture Notes in Mathematics, Springer-Verlag, 1984)

Indecomposable representations of some Lie and graded Lie Algebras

The study of the representations in the space of universal enveloping algebra reveals that the irreducible representations of Lie or graded Lie algebras appear as representations induced on the quotient space of indecomposable. representations. This aspect has been demonstrated in the case of the algebra of parabose oscillators-a prototype version of a graded Lie algebra. A unified treatment of the representations of Gs1(2) is also given.

(T.S.Santhanam, Lecture Notes in Physics, Springer-Verlag,1984)

Indecomposable representations of the graded Lie Algebra OSPL(2,1)

Representations of the graded Lie algebra Ospl (2,1) have been studied in the space of its universal enveloping algebra. Extremal vectors have been explicitly constructed and a study of the invariant subspaces made.

(T.S.Santhanam and S.Madivanane, Proc. of the International Conference on Differential Geometric methods in theoretical Physics, 1984, to appear)

A note on the relation between q-algebras without interaction and Weyl commutation relations

It has been shown that the quantum mechanics defined by Kuryshkin's q-algebras without interaction is the same quantum mechanics in finite dimensions of Santhanam.

(S.Madivanane and M.Venkata Satyanarayana, Lett. at Nuo. Cim. 40(1984)19).

Impossibility of Squeezed coherent states for a Para-bose oscillator

It has been shown that squeezed coherent states do not exist for the para-Bose oscillator.

(T.S.Santhanam and M.Venkata Satyanarayana, Phys. Rev. D to appear)

Special topics in the quantum theory of angular momentum

Two special topics in the quantum theory of angular momentum are discussed. They are:(i) the relationship between the coupling and recoupling coefficients(for two and three angular

moments, respectively) and sets of generalized hypergeometric functions of unit argument; and (ii) the 'non-trivial' or polynomial zeros of angular momentum coefficients and their classification.

(K.Srinivasa Rao, Pramana, 24(1985) 15).

On the polynomialzzeros of Clebsch-Gordan and Racah coefficients:

It has been shown that the symbolic binomial expansions for the Clebsch-Gordan and Racah coefficients are exact for n=1 (where n+1 indicates the number of terms in the series expansion). When exact, these binomial forms reveal polynomial zeros of degree, one which are trivial structure zeros, hitherto considered as 'non-trivial' zeros, along with polynomial zeros of degree ≥ 2.

(K.Srinivasa Rao and V.Rajeswari, J.Phys. A: Math. and Gen.17A(1984) L243)

An identity satisfied by the harmonic oscillator brackets

An identity satisfied by the harmonic oscillator (Talmi-Moshinsky) brackets has been derived from two equivalent methods for evaluating an integral often encountered in cluster model studies.

(K.Srinivasa Rao, Int. J. for Theor. Phys. 24(1985) No.1)

Realization of First Order Optical Systems using thin Lenses

A first order optical system has been investigated in full generality within the context of wave optics by reducing the problem to a study of the ray transfer matrices. The simplest such systems correspond to axially symmetric propagation.

Realization of such systems by centrally located lenses separated by finite distances has been studied. It has been shown that, contrary to the commonly held view, the set of first order systems that can be realized using axially symmetric thin lenses exhausts the entire SL(2,R) group; at most three lenses are needed to realize any element of this group. In particular, inverse of free propagation has been so realized. Among anisotropic systems it has again been shown that every element of the lens group Sp(4,R) can be realized using a finite number of thin lenses.
(E.C.G.Sudarshan, N.Mukunda* and R.Simon*, submitted to J.Optical Society).

Generalised Coherent states and generalised squeezed coherent states

Roy and Virendra Singh showed that the harmonic oscillator possesses an infinite string of exact shape-preserving coherent wave packet states $|n\alpha\rangle$ having classical motion. It has been shown that the states $|n\alpha\rangle$ could be obtained from the coherent state $|\alpha\rangle$ and it has also been shown how a coherent state $|\alpha\rangle$ could be expanded in the basis of $|n,\alpha\rangle$'s. Further the possibility of 'squeezing' the state $|n\rangle$ is investigated and the 'generalized squeezed coherent states' obtained. The squeezed coherentsstates for the displaced oscillator are defined. The physical meaning of squeezing is pointed out.
(M.Venkata Satyanarayana, Phys. Rev.D32(1985) 400).

Probability theory, stochastic processes and Applications: the stochastic non-linear equations and order of scattering

Non-linear stochastic equations, especially of the generalised Riccati type, arising in many situations in physics and engineering were solved using the tool of order of scattering technique. This is a great improvement over the earlier methods used by Adomian and others. The new method, at each stage of computation, sums up a set of an infinite class of diagrams not covered by the earlier methods.

(G.Adomian* and R.Vasudevan, J. of Math. and Phys. Sciences 18(1984) 139

A stochastic approach to inverse scattering in geophysical layers

A method has been proposed to analyse the stochastic profile of the geophysical layers (Gopillaud layers) from the response or sequenc of responses obtai ed by input im ulses, like seismic explosions. The reflected and transmitted amplitudes provide the data from which the inverse determination can be done using various techniques including potential determination methods from phase shifts. These ideas are adumbrated.

(G.Adomian* and R.Vasudevan, Math. Modelling an Int.J.5(1984) 339

Combinants, Bell polynomials and Applications

The concept of combinants introduced in the formulation of the generating function for probabilities is analysed, demonstrating the fact that they play the same role in computing cumulants as probabilities do in computing moments. The

mathematical framework of Bell polynomials is used to relate combinants and probabilities. The effective use of combinants in branching processes is brought out. Also the coupled differential equations governing the combinants yield direct coupled equations for cumulants. The concept of mixed combinants has been developed.

(R.Vasudevan, P.R.Vittal* and K.V.Parthasarathy*, J.Phys.A: Math. Gen. 17(1984) 989)

Storage problems in continuous time with random inputs and random outputs and deterministic release

The first passage problems lead to great insights regarding different threshold studies in storage, inventory, biological and environmental systems. A model of a dam with both random inputs and outputs along with deterministic exponential release has been treated for the first time using imbedding methods and inventing novel types of densities. Third order equations for the Laplace transform of the densities and closed form solutions have been obtained. Situations of overflow and emptiness are investigated and solutions, in terms of known functions, have been obtained.

(R.Vasudevan and P.R.Vittal*, J. of Applied Math. and Computation, 16(1984) 309)

Fluctuation-Dissipation Relations in the presence of multiplicative Noise

This work analyses the modifications warranted in the fluctuation-dissipation relations when a multiplicative noiseis present in the Langevin equation modelling the dynamics of

a system. Concepts relating to Stratonovic and Ito type stochastic integration methods have been employed in arrived at modifications of the first as well as the second fluctuation-dissipation theorems.

(R.Vasudevan and K.V.Parthasarathy*, submitted to the J. of Transport Theory and Statistical Physics)

PLASMA PHYSICS

Resistive instabilities in a plasma

Instabilities produced by finite-resistivity effects in a plasma are of great interest in connection with research in fusion devices, solar flares and geomagnetic substorms. The physical mechanism of this instability is elucidated and in particular, the tendencies in the system towards the instability and the tendencies opposing it, if any, are identified. As an illustration, the example of the so called gravitational interchange mode wherein a plasma with the statistically stable vertical density gradient is situated in a vertical gravitational field and a sheared horizontal magnetic field is considered. The physical picture developed is expected to be useful in sorting out phenomena that appear when more subtle properties of the resistive modes in a plasma are considered.

(B.K.Shivamoggi, submitted to European Journal of Physics)

Modulational instability of a finite-amplitude Alfven wave

A finite-amplitude plane-polarized Alfven wave is shown to undergo a modulational instability consequent to its trapping in density cavities which are created by the ponderomotive

force associated with the Alfven wave. The instability arises when the density cavity travels at subsonic speeds. (B.K.Shivamoggi, submitted for publication to Astrophysics and Space Science)

Parametric excitation of circularly polarized waves

Parametric excitation by a modulating magnetic field of circularly-polarized waves propagating along the magnetic field have been considered.

(B.K.Shivamoggi, submitted to Chechoslovak Journal of Physics)

Driven magnetic field reconnextion

The boundaries of a plasma in a magnetostatic equilibrium with a magnetic null surface inside the plasma are perturbed at a rate fast compared with even the hydromagnetic evolution rate. The ensuing adjustments in the plasma and the magnetic field threading through it are investigated.

(B.K.Shivamoggi, submitted for publication in Physica Scripta)

Tearing-mode instability in a compressible plasma

The tearing-mode instability of a sheet pinch in a compressible plasma has been investigated. The treatment is analytical. The compressibility effects, as a first approximation, are assumed to be small and are described as a correction to the standard FKR theory. The compressibility effects, when assumed small, are found to become important only in the thin resistive layer near the magnetic neutral surface. The results show that compressibility effects stabilize the tearing modes. This result may have some relevance to the observed stability of current sheets for prolonged times in the laboratory.

(B.K.Shivamoggi, submitted for publication in Physics of Fluids)

Evolution of current sheets near a hyperbolic magnetic neutral point: Effect of plasma density variation

A nearly exact solution of the magnetohydrodynamic equations for a time-dependent, two-dimensional flow of a compressible plasma of finite conductivity in a hyperbolic magnetic field has been obtained. This solution predicts that the current sheet at the neutral point evolves more rapidly when the plasma density builds up locally around the magnetic neutral point.

(B.K.Shivamoggi, submitted to the Physics of Fluids)

Relativistic non-linear plasma waves

An intense electromagnetic wave nonlinearly propagating in a plasma gets coupled to a Langmuir wave in the plasma in the relativistic case. A generalised perturbation theory is proposed for this system of coupled waves. This theory allows for both amplitude and phase modulations of the coupled waves and can therefore, successfully, deal with internal resonances if they arise in the system in question. This theory also recovers results of the known special cases in the appropriate limit, and provides insight into the nature of quasi-longitudinal waves in the relativistic case.

(B.K.Shivamoggi, submitted to the Journal of Plasma Physics)

Modulational stability of Ion acoustic waves

Karpman's mechanism is explored for the modulational instability of ion-acoustic waves on interaction with a slow plasma motion. The latter are found to be modulationally stable unlike the Langmuir waves.

(B.K.Shivamoggi, submitted for publication to the Canadian Journal of Physics)

Non-linear electrostatic Ion-cyclotron waves

The non-linear effects on electrostatic ion-cyclotronwwaves travelling perpendicular to the applied magnetic field in a cold-ion and hot-electron plasma are investigated. The method of strained parameters is used to develop a special solution which represents purely periodic waves with the non-linear effects showing up as an amplitude dependent frequency shift and multiperiodicity.

(B.K.Shivamoggi, submitted for publication in Fizika-Yugoslovia)

MOLECULAR SPECTROSCOPY

On the use of root location theorems for matrices in the problem of determination of molecular force constants

It has been shown that root location theorems for matrices can be effectively used in the problem of determination of molecular force constants. As an example a parametric method of evaluation of these constants has been developed for molecules, with Wilson's F and G matrices involving only one and two dimensional blocks, using isotopic frequency shifts or frequencies and coriolis coupling constants. Numerical examples have been provided and generalization to higher dimensional problems has been briefly discussed.

(N.Subramanian*, R.Srinivasamoorthy*, G.A.Savari Raj* and R.Jagannathan, Indian J. Phys. 58B(1984) 349)

MATHEMATICS

Prof.C.S.Seshadri hdeliveredd an extensive course of lectures (three per week) intended as an introduction to diverse

aspects c. 'Modern Geometry' Nov.1984 to May 1985.

Prof.K.R.Unni, delivered a course of lectures (three per week), on 'Analysis' from Dec.1984 to Jan.1985.

Line bundles on Schubert varieties

The normality of Schubert varieties in the generalized flag variety, associated to a semi-simple algebraic group, was proved.

(C.S.Seshadri, submitted to the proceedings of the TIFR Colloquium on Vector Bundles, 1984)

PARTICIPATION IN INTERNATIONAL CONFERENCES

Dr.Krishnaswami Alladi participated in the Conference on Analytic Number Theory and Diophantine problems, held at the Oklahoma State University, Still Water, from June 24 to July 3, 1984, with travel support given by the Department of Science and Technology, New Delhi, and gave a talk at a special session. He participated in a meeting of the American Mathematical Society, on ''Diophantine problems, Diophantine approximations and transcendency'', held at Bowdoin College, Brunswick, Maine, from July 15-21, 1984.

Dr.R.Sridhar participated as a delegate of the Institute, in the 17th International Conference on Low Temperature Physics (LT-17) held at the University of Karulsruhe, West Germany, from August 15 to 22, 1984. He participated in the International Workshop on condensed matter physics, at the International Centre for Theoretical Physics, Trieste, Italy, from August 29 to September 12, 1984.

Prof.T.S.Santhanam participated and gave an invited talk in the XIII International Conference on Differential Geometric Methods in Theoretical Physics, held at Shamen, Bulgaria from August 20-26, 1984.

Prof.G.Rajasekaran participated and gave an invited talk at the International Symposium on Theoretical Physics to celebrate the Diamond Jubilee of Bose Statistics, held at the Indian Institute of Science, Bangalore from November 19 - December 1, 1984.

Dr.B.K.Shivamoggi, as delegate of the Institute, participated in the International Conference on Plasma Physics held at Lousanne, Switzerland, from June 27 to July 3, 1984.

Dr.K.Srinivasa Rao participated and chaired a session at the 4th International Conference on Clustering Aspects of Nuclear Structure and Nuclear Reactions, held at Chester, from July 23-27, 1984, as an exchange scientist sponsored by the Indian National Science Academy and the Royal Soceity of London. As a delegate of the Institute, he participated in the International Conference on Nuclear Physics held at Bhabha Atomic Research Center, Bombay from December 27-31, 1984.

Prof.E.C.G.Sudarshan participated in the International Conference on 50 years of weak interactions, held at Racine, Wisconsin, from May 29 to July 8, 1984. His paper entitled, Origin of the Universal V-A Theory in collaboration with Prof.R.E.Marshak, - reviewing the circumstances under which the V-A theory of Weak Interactions due to Sudarshan and Marshak, was discovered and the crucial role it played in the development of the Electro-weak theory - was presented at this Conference by Prof.Marshak. He inaugurated and gave an invited talk at the International Symposium on Theoretical Physics to celebrate the Diamond Jubilee of Bose Statistics, held at the Indian Institute of Science, Bangalore, from November 19 - December 1, 1984. Mr.M.Venkata Satyanarayana also participated in this Symposium.

Mr.J.Srinivasan and Miss.V.Rajeswari, participated in the International Conference on Nuclear Physics held at Bhabha Atomic Research Centre, Bombay, from December 27-31, 1984.

PARTICIPATION IN NATIONAL CONFERENCES

Prof.E.C.G.Sudarshan inaugurated and delivered an invited talk at the Silver Jubilee Workshop on Recent Advances in Theoretical Physics, held at the Indian Institute of Technology, Kanpur from December 5-15, 1984. He gave an invited talk at the working conference on Social and Philosophical Implication of Artificial Intelligence held at New Delhi, from December 21-22, 1984.

Prof.G.Rajasekaran, participated and gave a lecture in the Workshop on 'Gauge theories, Gravitation and the Early Universe' held at the Physical Research Laboratory, Ahmedabad, in November 1984. He participated and gave a series of lectures in the workshop on 'Recent advances in theoretical physics', held at the Indian Institute of Technology, Kanpur, in December 1984. He gave an invited talk on 'Expectations from e^+e^- experiments at High Energies', at the Winter School on Experimental Methods in High Energy Physics, held at Mahabaleswar in January 1985. He participated and gave a series of lectures on 'Superstring Field Theory', in the Workshop on Superstrings at Indian Institute of Technology, Kanpur, in March 1985.

Dr.R.Parthasarathy chaired a session and gave a lecture in the Workshop on 'Recent advances in theoretical physics', held at the Indian Institute of Technology, Kanpur in December 1984.

Dr.R.Sridhar, was invited to deliver a talk on 'Single and two-phonon excitations in Superfluid Helium-4', in the National Semina on Phonon Physics of condensed Matter, held at the Bhopal University, from February 6-9, 1985.

Dr.K.H.Mariwalla, was invited to participate and deliver two lectures on 'Heisenberg-Weyl-Wi_ ıer Systems' a ı l another two lectures on 'Vector Field Actions on R^n and Symmetries of differential Systems', at the Bose Workshop on Operator Algebraic Models in Physical Theories, from March 11 to 23, 1985, under the joint auspices of Satyendranath Bose Institute of Physical Sciences, Calcutta University; The Asiatic Society, Calcutta; and the Calcutta Mathematical Society.

VISITING ASSIGNMENTS

Alladi Krishnaswami visited the University of Texas at Austin, from July 4-14, 1984. He is now a Visiting Associate Professor at the University of Hawaii, Honolulu, for 9 months from August 25, 1984. As a Visting Associate Professor at the University of Hawaii, in Honolulu, he conducted a Number Theory Seminar and lectured on the theory of Partitions, Sieve Methods and Probabilistic Number Theory. In November 1984, he addressed the Colloquium of the Mathematics Department of the University of Hawaii. In January 1985, he presented a paper, by invitation, at the Special Session on Number Theory, held at Anaheim, California. Following that meeting he gave colloquium talks at the University of Arizona in Tucson, the University of Colorado at Boulder and the University of Florida in Gainsville.

Shivamoggi, B.K., is at present a Visiting Associate Professor at the University of Central Florida, Orlando, for 9 months, from September 1, 1984.

Sridhar, R., Visiting Scientist, Institute of Physics, Bhubaneswar for one week in November 1984.

Srinivasa Rao, K., Visiting Scientist, Centre for Theoretical Studies, Indian Institute of Science, Bangalore, for one month (March-April 1984), Visiting Scientist, Institute of Physics, Bhubaneswar, for one week in July 1984. He visited U.K. for 3 weeks, from July 21-August 12, 1984, as an exchange scientist sponsored by the Indian National Science Academy and the Royal Society of London. During this period, he visited the University

of Manchester, Daresbury Laboratory and the Oxford University where he delivered lectures and had discussions Alexander von Humboldt Foundation Fellow at the Institute for Theoretical Nuclear Physics, University of Bonn, Bonn, for 2 months (August 13 - October 14, 1984).

Sudarshan, E.C.G., Professor of Physics, University of Texas, Austin, Texas, (March-July, 1984, September 18-October 9, 1984). During this period he was a Visiting Professor for one month at the Instituto di Fisica Teorica, Napoli, Italy (May-July 1984) and a Visiting Professor for one month at the Chalmers University of Technology, Gothernburg, Sweden (July 1984). He was at the University of Texas, Austin, Texas, again from January - April 1985. During this period he continued his teaching and research activity.

Jagannathan, R., Visiting Scientist, Centre for Theoretical Studies, Indian Institute of Science, Bangalore, for one month, January - February 1985.

Satyanarayana, M.V., was invited to participate in the Conference on Laser, Atomic and Molecular Physics, held at the International Centre for Theoretical Physics, Trieste, Italy, from January 26 to March 25, 1985. He gave an informal talk on his research work relating to coherent and squeezed coherent states, at this Conference.

PUBLICATIONS IN JOURNALS

Adomian, G.* and Vasudevan, R. 'The stochastic non-linear equations and order of scattering', J. of Math. and Phys. Sciences 18 (1984) 139.

Adomian, G.* and Vasudevan, R. 'A stochastic approach to inverse scattering in geophysical layers', Mathematical Modelling an Int. J., 5 (1984).339.

Alladi, Krishnaswami, 'Moments of additive functions and the sequence of shifted primes', J. London Math. Soc. (to appear).

Alladi, Krishnaswami, Erdos, P., and Vaaler, J., 'Multiplicative Functions and Small Divisors, Proc. of the Oklahoma Conf. on Number Theory (1984) Birkhauser.

Alladi, Krishnaswami, 'A study of the moments of additive functions using Laplace transforms and Sieve methods', Proc. of 4th Matscience Conf. on Number Theory, Springer-Lecture Notes 1122 (1985) 1.

Balasubramanian, R., Conrey, J.B.* and Heathborn, D.R.,* 'Asymptoti mean square of the product of the Riemann Zeta function and Dirichlet polynomial', J. fur die reine und Angewandte Math. 357 (1985) 161.

Balasubramanian, R. and Ramachandran, K.,* 'On the mean value conjecture of Titchmarsh's series V', Acta Arithmetica (to appear)

Bohr, H.* and Rajasekaran, G., 'Large-N gauge theory of loops and strings-I' Phys. Rev. (in Press).

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* external collaborator

Bohr, H.* and Rajasekaran, G. 'Large-N gauge theory of loops and strings-I' Phys. Rev. (in Press).

Ghassib, H.B.* and Sridhar, R. 'On the Fronlich decomposition and the condensate fraction in He-II', Phys. Lett. 100A (1984) 198.

Godbole, R.M.*, Jayaraman, T.*, Pati, J.C.*, Rajasekaran, G. and Rindani, S.D.* 'The recent single-tag two-photon experiments at PETRA and the issue of quark charges', Phys. Lett. 142B (1984) 91.

Gruber, B.*, Wilson Raj* and Santhanam, T.S. 'A unified approach to the representation theory of the graded algebra Gsl(2)', J. Math. Phys. 25 (1984) 1253.

Lakshmibai, V.* and Seshadri, C.S., 'Singular Locus of a Schubert Variety', Bull. of Am. Math. Soc. 11 (1984) 363.

Lakshmibai, V.* and Seshadri, C.S., 'Geometry of G/P-V' J. of Algebra (to appear).

Parthasarathy, R., Santhanam, T.S., and Mariwalla, K.H. 'On the classical solution of SO(3) Gauge Theory and 't Hooft-Polyakov monopole', Pramana 24 (1985) 457.

Rajasekaran, G., Jayaraman, T.* and Rindani, S.D., 'Direct photon production in e^+e^- collisions', Phys. Rev. (in Press).

Rajasekaran, G., 'What is the next step after electroweak unification?' in 'Recent Advances in Theoretical Physics', World Scientific Pub. Co., Singapore (to be published).

Ranganathan, N.R. and Vasudevan, R. 'Remarks on duality transformations in lattice spin systems', J. Phys.A: Math. Gen. 17 (1984) 1143.

Santhanam, T.S. and Satyanarayana, M.V., 'Squeezed coherent states of parabose oscillators', Phys. Rev. D30 (1984) 2251.

Santhanam, T.S., 'A unified description of the representations of the graded algebra Gsl(2)', J. Math. Phys. 25 (1984) 1253.

Satyanarayana, M.V., 'Generalised Coherent States and Generalized Squeezed Coherent States', Phys. Rev. D32 (1985) 400.

Shivamoggi, B.K., 'Magnetohydrodynamic properties near a X-type magnetic neutral line', J. Plasma Phys. (to appear).

Srinivasa Rao, K. and Rajeswari, V., 'Saalschutzians and Racah coefficients', Int. J. of Theor. Phys. (1985) (to appear).

Srinivasa Rao, K. and Rajeswari, V., 'On the polynomial zeros of 3-j and 6-j symbols', J. Phys.A: Math. and Gen. 17A (1984) 1243.

Srinivasa Rao, K. 'An identity satisfied by the harmonic oscillator brackets', Int. J. of Theor. Phys. 24 (1985) No.1.

Srinivasa Rao, K. 'Report on the Fourth International Conference on Clustering aspects of nuclear structure and nuclear reactions', Phys. News. 15 (1984) 122.

Srinivasa Rao, K., 'Special topics in the Wigner-Racah algebra in Quantum Theory', Pramana 24 (1985) 15.

Srinivasa Rao, K. and Rajeswari, V. 'Response', Am. Math. Soc. Notices 31 (1984) 165.

Srinivasa Rao, K., 'A Note on the classification of the zeros of Angular Momentum coefficients', J. Math. Phys. (1985)(to appear

Srinivasa Rao, K. and Rajeswari, V., 'Classification of the polynomial zeros of the 3-j and the 6-j coefficients', Revista Mexicana de Fisica 31 (1985) No.4.

Subramanian, N.*, Srinivasamoorthy, R.*, Savari Raj, G.A.* Jagannathan, ..., 'On the use of ...ot location th.orems for matrices in the problem of determination of molecular force constrants', Indian J. Phys. 58B (1984) 349.

Sudarshan, E.C.G., 'Quantum Measurement and Dynamical Maps', Contribution to honour Yu'val Ne'eman on his 60th Birthday (1984) - Festschrift.

Vasudevan, R. Vittal, P.R.* and Parthasarathy, K.V.* 'Combinants, Bell polynomials and applications', J. Phys.A: Gen. Math. 17 (1984) 989.

Vasudevan, R. and Vittal, P.R.* 'Storage problems in continuous time with random inputs and random outputs and deterministic release', J. of Applied Maths. and Computation 16 (1985) 309.

Vasudevan, R. and Srinivasan, S.K.*, 'Non-Markovian model of photon statistics in a cavity', Phys. Optica (1985) to appear.

Parthasarathy, R. and Premkumar Yesudian, C., 'Neutrino Neutral current Iso-scalar excitations in ^{12}C - Iso-spin mixing-II', Ann. Phys. (New York, to appear.

*External Collaborator

CONTRIBUTED PAPERS, INVITED TALKS IN CONFERENCE PROCEEDINGS

Alladi, Krishnaswami, 'The monotonicity principle for the sieve' Lecture Notes in Mathematics, Ed.K.Alladi, Lecture Notes in Maths. Springer-Verlag, 1122 (1985) 1.

Jagannathan, R. 'On projective representations of finite abelian groups', Ed.K.Alladi, Lecture Notes in Maths, Springer-Verlag, 1122 (1985) 130.

Rajasekaran, G. 'Grand Unified Theories', Proc. of the High Energy Phys. Symp. Mysore (1984) 1.

Rajasekaran, G. 'Magnetic monopoles', Proc. of the 30th Ann. Symp. of the Saha Institute of Nuclear Physics, Calcutta (1984).

Santhanam, T.S. 'Indecomposable representations of some Lie and graded Lie algebras' Lecture Notes in Phys. Springer-Verlag 201 (1984) 73.

Santhanam, T.S. and Madivanane, S. 'Indecomposable representations of the graded algebra Ospl(2,1)', Proc. of the Int. Cont. on Differential Geometric Methods in Theor. Phys. Bulgaria (1984) to appear.

Santhanam, T.S. 'Invariant wave equations and indecomposable representations', Proc. of the XIV Int. Con. on Gp. Theor. Methods in Physics, Seoul (1985) to appear.

Seshadri, C.S. 'Line Bundles on Schubert Varieties', submitted to the Proc. of the T.I.F.R. Colloquium on Vector Bundles (1984)

Sridhar, R. and Shanthi, A., Proc. of the 17th Int. Symp. on Low Temp. Phys.(L-17), Karlsruhe, Elsevier Science Pub.(1984)1203.

Sridhar, R., 'Single and two-phonon excitations in Superfluid He-4', Proc. of National Seminar on Phonon Phys. of Condensed Matter, Bhopal (1985) to appear.

Sridhar, R. and Shanthi, A., 'On the determination of two-roton parameters in liquid Helium-II' Nucl. Phys. and Solid State Phys. (India) 27C (1984) 147.

Srinivasa Rao, K., 'An identity for the harmonic oscillator brackets' Contributed papers, 4th Int. Conf. on clstering aspects of Nucl. Structure and Nucl. Reactions, Chester (1984) 123.

Srinivasa Rao, K. Sridhar, R. and Srinivasan, J. 'Charge from factor of ^{6}Li and ^{7}Li' contributed papers, 4th Int. Conf. on Clustering asp ects of Nucl. Structure and Nucl. Reactions, Chester (1984) 125.

Srinivasa Rao, K. and Srinivasan, J. 'Photodisintegration of ^{6}Li and ^{7}Li' contributed papers, 4th Int. Conf. on clustering aspects of Nucl. Structure and Nucl. Reactions, Chester (1984) 127.

Srinivasa Rao, K. and Bhasin, V.S.* 'Quasi-free cluster knock-out reactions from ^{6}Li', contributed papers, 4th Int. Conf. on clustering aspects of Nucl. Strucutre and Nucl. Reactions, Chester (1984) 247.

Srinivasa Rao, K. and Rajeswari, V. 'π^{-}/π^{+} ratio pion photo-production from nuclei' proc. of Int. Conf. on Nucl. Phys. Bombay (1984).

PREPRINTS

Joshipura, A.S. 'A Dirac Neutrin from Flavour Mixing'.

Joshipura, A.S. 'Fritzsch Type Quark Matrices and Dirac'Neutrino in SU(5).

Kuruvilla Eapen, 'A finite Temperature Field Theory of a Superconductor'.

Kuruvilla Eapen, 'Ferromagnetism in the s-d Hybridised Hubbard Model in the Roth Scheme'.

Parthasarathy, R., Rajasekaran, G. and Vasudevan, R. 'Quantum Interference Effects in a 5 Dimensional Kaluza-Klein Theory'.

Parthasarathy, R. and Srinivasan, V. 'Atiah-Patodi-Singer n-invariant and Massive Modes in a 5-Dimensiona Kaluza-Klein Theory'.

Parthasarathy, R. 'Fermions and Stability in Kaluza-Klein Theory'.

Radhakrishnan, V. 'Bifurcation of the Solutions of Onsager's nonlinear Integral Equation for Nematie Liquid Crystals'.

Rajasekaran, G. Jayaraman, T.* and Rindani, S.D. 'MOdification of the equivalent Photon Approximation for the Production of Massive spin-1 Particles'.

Sridhar, R. 'Temperature dependence of the Structure Factor of Liquid ^{4}He'.

Srinivasa Rao, K. and Srinivasan, J. 'Photodisintegration of ^{6}Li and ^{7}Li'.

Sudarshan, E.C.G. and Marshak, R.E. 'Origin of the Universal V-A Theory'.

Sudarshan, E.C.G. 'Mid-Century Advances in Particle Physics'.

Sudarshan, E.C.G. 'Uses of Quantum Mechanics'.

Sudarshan, E.C.G. and Urjit Yajnick* 'Charge conjugation, half-integral fermion numbers.

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*External Collaborator

SEMINARS AT THE INSTITUTE

Balram Rajpu - University of Tennessee at Knoxville
Spectral Representation of Semi-stable Processes (2.4.84)

Srinivasa Rao, K. - I.M.Sc.,
Course of lectures on Nuclear Theory (11.4.84)

Rajasekaran, G. - I.M.Sc.,
Magnetic Monopoles in Broken-Colour QCD (18.4.84)

Vasudevan, R. - I.M.Sc.,
Random Impulses and Hyperfine Interactions (18.4.84)

Jagannathan, R. - I.M.Sc.,
Finite Dimensional Quantum Mechanics - Gudder's Model (25.4.84)

Santhanam, T.S. - I.M.Sc.,
The Problem of Generations in Unified Gauge Theories (25.4.84)

Sridhar, R. - I.M.Sc.,
Spin-Polarized Hydrogen (25.4.84)

Balakrishnan, V. - I.I.T., Madras
Anamalour Diffusion in One Dimension (28.4.84)

Shivamoggi, B.K. - I.M.Sc.,
Integrability of Hamiltonian Systems (30.4.84)

Rajaraman, R. - Centre for Theoretical Studies, Bangalore
Fractional Charge in Field Theory and Polymer Physics (2.5.84)

Jagannathan, R. - I.M.Sc.,
On the Entropic Formulation of Uncertainty for Quantum Measurements (3.5.84)

Sridhar, R. - I.M.Sc.,
Spin Polarized Hydrogen (3.5.84)

Rajasekaran, G. - I.M.Sc.,
New unexpected phenomena in high energy experiments (10.5.84)

Parthasarathy, R. - I.M.Sc.,
Neutrino neutral-current excitation of $^{12}C^{*}(1^{+}; T=1; 15.1$ Mev) (10.5.84)

Pasupathy, J. - Centre for Theoretical Studies, Bangalore
Cosmological Consequences of identifying the (2.2) with Canonical Higgs Boson (11.5.84)

Mani, H.S. - I.I.T., Kanpur
Static Properties of Baryons in Skyrme Model (15.5.84)

Vasudevan, R. - I.M.Sc.,
One Dimensional Cometing Ising Model (17.5.84)

Raghunathan, K. - TIFR, Bombay
Parity Violation in C_s Atom (17.5.84)

Govindarajan, T.R. - Loyola College, Madras
Supersymmetric $SU(2)_L \times SU(2)_R \times U(1)_{B-L}$ Model (18.5.84)

Ramachandran, R. - I.I.T., Kanpur
Composite Model with Supersymmetry (21.5.84)

Waghmare, Y.R. - I.I.T., Kanpur
Nuclear Structure Studies Using Elementary Particles as Probe - three lectures (22.5.84 to 24.5.84)
Classical Semi-Classical Prescriptions to the Fusion of Heavy Ions - three lectures (28.5.84 to 30.5.84)

Athreya, K. - Iowa State University, USA
Discounted Branching Random Walks (1.6.84)

Srinivasa Rao, K. - I.M.Sc.,
Pion Double Charge Exchange Scattering (17.5.84)

Ranganathan, R. - Royal Military College Kingston, Canada
Atomic Dynamic of Dense Gases (4.6.84)

Bruch Rothschild - University of California at Los Angeles, USA
Recent Results and Problems in Ramsey Theory (4.6.84)
Triangulations of the Convex Hull of a Set of n-Points (5.6.84)

Parthasarathy, R. - I.M.Sc.,
Kaluza-Klein Theory in (4+n) Dimensions (8.6.84)

Vasudevan, R. - Defence Research Development Organisation, Bangalore
Scope of Applications of Computers in Defence (13.6.84)

Singh, L.P. - Utkal University, Bhubaneswar
Path Integral Formulation of The Theory of Loops and Strings (14.6.84)
Physical Aspects of Multi-Monopole Solutions (15.6.84)

Srinivasan, V. - Central University, Hyderabad
Supersymmetry Formulation of Stochastic Quantization (25.6.84)
Chiral Anamoly and Quantized Hall Effect (29.6.84)

Joshipura, A.S. - I.I.T., Kanpur
Supersymmetric Model Building (3.7.84)

Behera, S.N. - Institute of Physics, Bhubaneswar
Theory of Raman Scattering in layered-charge density wave (CDW) and Compounds (5.7.84)
Phonon Response of a System undergoing CDW and Superconducting transitions (9.7.84)
A Field theoretic model for first order structural phase transition (12.7.84)

Madivanane, S. - I.M.Sc.,
Realization of the Basic Representations of the Euclidean Lie Algebra - I - from a Physicist s point of vie (6.7.84)

Santhanam, T.S. - I.M.Sc.,
Superalgebra, Supertableau etc. (12.7.84 and 19.7.84)

Madivanane, S. - I.M.Sc.,
A New Formula for characters - I (20.7.84)

Shivamoggi, B.K. - I.M.Sc.,
Highlights of ICPP 1984 (23-7-84)
Highlights of ICPP 1984 - III (24-7-84)

Rajasekaran, G. - I.M.Sc.,
Fields with Manishing Colour Currents (26.7.84)

Raghunathan, M.S. - TIFR, Bombay
Groups Generated by Reflections - 2 lectures (24.7.84, 25.7.84)
Loop Groups and Affine Weyl Groups (26.7.84)

Bhama Srinivasan - University of Illinois at Chicago, USA
Representations of Finite Classical Groups (25.7.84)

Rhama Venkataraman
The Canonical Ensemble Redefinied with a Quadratic Term in the Hamiltonian (31.7.84)

Varadhan, S.R.S. - Courant Institute of Mathematical Sciences, NY
Function Space Integrals and applications - 2 lectures (1.8.84, 2.8.84)

Mariwalla, K.H. - I.M.Sc.,
Symmetries of Nth order ordinary differential Equations and applications (3.8.84)

Kulkarni, R.S. - Indiana University, USA
Topological aspects of Kleinian groups (7.8.84)
An analogue of the Riemann mapping theorem for Lorentz matrices (8.8.84)

Sinha, K.P. - Centre for Theoretical Studies, Bangalore
Jahn-Teller Polarons and Superconducting Properties of Some Systems (10.8.84)

John Thompson - Cambridge University, England
Finite Simple Groups (11.8.84 and 13.8.84)

Tata, K. - University of Texas at Austin, USA
Seeing Super Symmetry (14.8.84)

Murthy, M.K. - TIFR, Bombay
Local Solvability for Linear Partial Differential Operators (14.8.84)

Baskaran, G. - International Centre for Theoretical Physics, Trieste, Italy
Quantum Hall Effect in 2 Dimensions (14.8.84)

Kalpana Kallianpur-University of Texas at Austin, USA
Testing the Triple Gauge Couplings of the Weinberg-Salam Theory (16.8.84)

Xerxes Tata - University of Oregon, USA and CERN, Geneva
Hot Supersymmetry (16.8.84)

Pasupathy, J. - Centre for Theoretical Studies, Bangalore
(2.2) as the Higgs particle (28.8.84)

Balachandran, A.P. - Syracuse University, USA
Fractional Charges and Magnetic Monopoles (31.8.84)

Mukunda, N. - Centre for Theoretical Studies, Bangalore
Magnetic Monopoles (4.9.84)

Balasubramanian, R. - TIFR, Bombay
Recent Progress in Analytic Number Theory - Waring's Problem (5.9.84)
Class Number Problem (6.9.84)
Riemann Zeta Function (10.9.84)

Parthasarathy, R. - I.M.Sc.,
Kaluza-Klein Theory - An Elementary Introduction (15.9.84)

Sridhar, R. - I.M.Sc.,
A Bird's Eye View - LT17 (21.9.84)

Naik, P.C. - Institute of Physics, Bhubaneswar
Long-Range Interaction between Spins (26.9.84)
Anologue of Aharonov-Bohm Effect in Spin Gauge Theory (27.9.84)
Spontaneous Symmetry breaking in Large N theories (28.9.84)

Sreekantan, B.V. - TIFR, Bombay
High Energy Astronomies (28.9.84)

Santhanam, T.S. - I.M.Sc.,
A brief report on the International Conference on differential geometric methods in Theoretical Physics held in Shumen, Bulgaira from 20-26 Aug.84 (5.10.84)

Misra, S.P. - Institute of Physics, Bhubaneswar
Super Gravity - 3 lectures(15.10.84, 16.10.84, 18.10.84)

Gopal Prasad - TIFR, Bombay
Anistropic groups over local and global fields (19.10.84)
The Kneser-Tits problems (22.10.84)

Morandi,G. - Universita di Napoli, Italy
When do the equations ofmotion determine their Lagrangian descripti n uniquely? (Inver e prob1em) (7.12.84)

Morandi,G.- Universita di Napoli, Italy
Spontaneous Symmetry Breaking in Many Body Systems (7.12.84)

Radhakrishnan, V. - I.M.Sc.,
Super Conducting Devices (11.12.84)

Mariwalla, K.H. - I.M.Sc.,
Addled Ado on Action Ambiguities (12.12.84)

Rohit Parikh - City University of New York
Modal Logic (18.12.84)
Dynamic Logic (19.12.1984)
Logic of knowledge (20.12.84)

Vigier, Jean-Dierre-Inst. Henri Poincare, France
Wave Particle Duality and the Principle of complementarity (15.12.84)
Statistical interpretation of quantum mechanics (17.12.84)

Hari Dass, N.D. - Raman Res. Inst., Bangalore
Lattice Gauge Theories - 2 lectures (18.12.84, 19.12.84)

Mahajan, S.M. - Physical Research Lab., Ahmedabad
Introduction to Fusion (19.12.84)
Alfven waves in confined plasma (20.12.84)

Kapoor, A.K. - University of Hyderabad, Hyderabad
Hamiltonian Path Integrals (20.12.84)
Exact Path integration (21.12.84)

Viswanathan, K.S. - Simon Fraser Univ. Canada
Alternate Kaluza - Klein Theories of Gravity and Supergravity 2 lectures - (26.12.84, 27.12.84)

Sakita, B. - City College of the City Univ. of New York
Stochastic Quantization (27.12.84)
Large 'N' Baryons and strong coupling (29.12.84)

Rajasekaran, G. - I.M.Sc.
What is the next step after electroweak unification? A review of recent developments in High Energy Physics (5 lectures - 8.1.85)

Mumford, D. - Harvard Univ. USA
Algorithms in algebraic geometry (31.12.84)
Computer vision (2.1.85)
Survey of work on moduli problems (4.1.85)

Prasanna, A.R. - PRL, Ahmedabad
Gravitation as a Guage theory - I and II (2.1.85 and 3.1.85)

Girija, V. - Univ. of Pittsburgh, USA
Rapidity measurements in inclusive (P) peactions - interpretation using tra sport theory (4.1.85)

Balslev, E. - Univ. of Aarhus, Denmark
Resonances and resonance functions for Schrodinger operators (5.1.85)

Narasimham, T.N. - LRL, Berkeley, USA
Diffusion equation and path integral (5.1.85)

Pakvasa, S. - Univ. of Hawaii, USA
CP violation in the standard model-3 lectures (9.1.85,10.1.85, 11.1.85)

Nagarajan, M.A. - Daresbury Lab., UK
Quasi-elastic processes in nucleus - nucleus collisions (7.1.85)
Variational principle for many-body, many-channel scattering amplitudes sum rules and polarizabilities (9.1.85)

Ramanan, S. - TIFR, Bombay
Line bundles on G/B (8.1.85)

Nix, J.R. - Los Alamos Lab., New Mexico
Calculation of nuclear ground state masses and deformation(10.1.85)

Nandakumar, V.M. - Univ. of Cochin, Cochin
Coexistence of excitonic and superdonducting phases (11.1.85)

Enoch, J. - Univ. of California, Berkeley, USA
Retinal phtoreceptors and wave guides (18.1.85)

Immirzi, G. - Univ. of Naples, Italy
Calculating anomalies in gauge theories (25.1.85)

Lesanovzky, A. - Mathl, Inst. of the Czechoslovak
On optimal replacement policy (30.1.85)
A contractive property in finite state Markov chains (31.1.85)

Vasudevan, R. - I.M.Sc.,
Mathematical Physics (1.2.85)

Radhakrishnan, V. - I.M.Sc.
Condensed matter physics (4.2.85)

Anishetty, R. - ETH, Switzerland
Vacuum decay through bubbles (6.2.85)
Vacuum decay in gauge theories (8.2.85)

Sarma, K.V.L. - TIFR, Bombay
EMC effect (12.2.85)
Proton decay and nuclear effects (14.2.85)

Anishetty, R. - ETH, Switzerland
Vacuum decay in gauge theories (11.2.85)
Mass inequalities for composites (12.2.85)

Eapen, K. - I.M.Sc.
Finite temperature field theory of a superconductor (20.2.85)

Balasubramanian, R. - I.M.Sc.
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Sarma, K.V.L. - TIFR, Bombay
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Seshadri, C.S. - I.M.Sc.
Geometry (21.2.85)

Gustafson, R.A. - TIFR, Bombay
Some combinatorial identities, a conjecture of Dyson and the Weyl character formula (5.3.85)
Representation theory of U(n) and special function I and II (6.3.85, 7.3.85)

Rumely, R. - Macquarie Univ. Australia
Capacity theory of algebraic curves (27.2.85)

Vasudevan, R. - I,M.Sc.
Mathematical methods of physics (22.2.85)

Jagananthan, R. - I.M.Sc.
Mathematical methods of physics (22.2.85)

Mariwalla, K.H. - I.M.Sc.
Ambiquities in description via potential in classical and quantum physics (6.3.85)

Kannappan, S. - Knoxville, USA
Tamil word processing using computers with sound and printing capability (7.3.85)

Ram Murthy - Univ. of McGill, Canada
Counting finite groups (12.3.85)
The first case of Fermat's last theorem (13.3.85)
Primitive points on elliptic curves (14.3.85)

Sivaprasad, K. - Univ. of New Hampshire
An inversion scheme for computing the velocity profile from reflected data (28.3.85)

Pasupathy, J. - Indian Institute of Science, Bangalore
Properties of the proton in QCD (29.3.85)

Rajasekaran, G. - I.M.Sc.
Superstrings (30.3.85)

LIBRARY

During the year 1984-85 724 books and bound volumes of periodicals were added to the library.

Assistance was provided in obtaining books, journals and technical materials for the members of the faculty and students for their research work from the libraries of Indian Institute of Technology, University of Madras, Engineering College, A.C.College of Technology, Reactor Research Centre at Kalpakkam and the Tata Institute of Fundamental Research at Bombay, on an Inter-Library loan basis. Similar help was also rendered on a reciprocal basis to other Institutions, thereby strengthening the spirit of cooperation with them.

The library got as a gift, the back volumes (Vol.1 to 7) of the Fibonacci Quarterly, from Dr.H.V.Krishna, Professor of Mathematics, Manipal Institute of Technology, Manipal.

A kilburn 1600 MR plain paper copier was acquired for the Institute and is at present housed in the Library.

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*Temporary Staff

**On leave

$^{\rho}$ Casual employees

$^{\sigma}$ On Deputation from DAE, Bombay.