वार्षिक प्रतिवेदन

ANNUAL REPORT

1999 - 2000

सत्येन्द्र नाथ बसु राष्ट्रीय मौलिक विज्ञान केन्द्र

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

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SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

BLOCK JD, SECTOR III, SALT LAKE, CALCUTTA 700 098

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PART A

FOREWORD

The year (1 April 1999-31 March 2000) has seen many new developments. On the academic side, five new colleagues have joined the Faculty in different areas of Cosmology/Foundation Issues of Quantum Mechanics, Mesoscopic Phenomena, Complex Systems, Electronic Structure/Materials Physics and Nonlinear/Quantum Optics. The Satyendranath Bose Memorial Lecture was delivered by Prof. C.N.R. Rao on the topic of 'Charge Ordering in Rare Earth Manganates' on 23rd December 1999. The lecture was very well-attended.

A two-week long international workshop on Foundation of Quantum Mechanics, Quantum Optics, Mesoscopic Phenomena and Quantum Computing was successfully organized during 1-13 January 2000. A large number of speakers from India and abroad, and students participated in what turned out to be very actively attended discussion-sessions.The proceedings of this Workshop are scheduled to appear in a special volume of PRAMANA. On the inaugural day of the workshop i.e., 1st January 2000, which happens to be Prof. S. N. Bose's birthday, a bust of Bose was installed by Dr. S. Varadarajan.

There was also an SERC School on 'Electronic Structure and Physics of Materials' during 31st October–20th November, 1999 followed by a two-day conference on 'Physics of Materials' (22-23 November, 1999). About six speakers came from abroad and there were many others from India. The ensuing interactions led to possible research collaboration between the Stuttgart group and our own colleagues. I should also mention four other small but very interactive meetings on : (1) Biology-Inspired Physics; (2) Growth Models and (3) Interface of Field Theory and Condensed Matter Physics and (4) Nano Materials.

Our Pre-Ph.D. training programme, initiated in autumn of 1999, is also going on well. Last year, eight scholars endowed with JRF were enrolled, of whom two came from neighboring countries. These scholars have already begun to work on different research projects.

We celebrated the National Science Day on 28th February 2000 through several functions. The emphasis was on inspiring young students into Basic Sciences. The function was attended by about one hundred college students (mostly 3rd year B.Sc.) from neighbouring institutions e.g. Presidency, St. Xavier's, Vidyasagar, Ashutosh, Brabourne and Bethune Colleges; it was inaugurated by the Minister of Higher Education, West Bengal, Prof. Satyasadhan Chakraborty, who announced that a new technological university bill would soon be brought to the West Bengal Assembly and the university would be happy to affiliate the proposed integrated Ph.D. programme of the S.N. Bose National Centre, for the purpose of awarding degrees; two lectures were delivered, one by Prof. Amal Kr. Roychoudhury, FNA on 'Popular Science – A Word of Caution' and another by Prof. Binayak Dutta Roy on 'Bose Condensation'; a science quiz contest was organized by Prof. Partha Ghose; various innovative physics experiments were demonstrated by the Indian Association for Physics

Teachers (IAPT); a Braille Transcription System with possibility of simultaneous transcription into several Indian languages, was exhibited; a science exhibition on the works of eight famous Indian scientists was held, with the help of BITM and an archive in the memory of Prof. Satyendra Nath Bose was initiated, with Prof. Bose's personal effects and letters on display.

On Administration, I am happy to report that our library has been considerably expanded with the appointment of a new Librarian. The library is expected to be soon air-conditioned and networked with other libraries in the vicinity. With joining of the new Finance Officer, the administration has been strengthened. Also, our guesthouse and adjoining cafeteria as well as the transport system are functioning satisfactorily. A major campus-development project has been undertaken under which three new gardens have already come up. The Computer Centre has now been centralized and a networking system is in its advanced state of preparation.

Overall, I am pleased with our efforts, which can be judged by various research collaborations between our own colleagues and visitors, our Faculty getting invited to lecture in national and international meetings, as well as our Ph. D. students obtaining good post-doctoral positions in international institutions. We can, of course, do much better and therefore, I hope that the next year's Annual Report will be a testimony to further progress.

It is a pleasure to thank Ms. Shohini Majumder for undertaking the arduous task of preparing the Annual Report.

S. DATTAGUPTA
Director

[**Added Note** : as we were going to Press we learnt of the sad and untimely demise of our Founder Director, Professor Chanchal Kumar Majumdar, on 20th June, 2000. I thank CURRENT SCIENCE for giving permission to reproduce here the obituary I wrote in the 10 July issue. We have also included under the List of Publications of Faculty, two of Professor Majumdar's papers which carried the address of the S. N. Bose National Centre.]

S.N. Bose National Centre for Basic Sciences

Prof. C.N.R. Rao, FRS delivering the 10th S.N. Bose Memorial Lecture on 'Charge Ordering in Rare Earth Manganates' on 23rd December 1999.

Dr. S. Varadarajan, FNA inaugurating the bust of Prof. Satyendra Nath Bose on the occasion of his birthday on 1st January 2000.

Chanchal Kumar Majumdar (1938-2000) – An Obituary

Chanchal Kumar Majumdar, an exceptionally gifted Condensed Matter Physicist, passed away in Calcutta on 20th June 2000. His death was so unexpected that it came as a rude shock to the scientific community.

Majumdar had a brilliant academic record in Krishnanagar and Calcutta. Subsequently he obtained his doctoral degree in Physics from University of California, La Jolla in 1965 under the supervision of Walter Kohn who went on to win the Nobel prize in Chemistry in the nineties. With Kohn he proved a theorem (the Kohn-Majumdar theorem) on the continuity of the bound and unbound states of the Fermi gas. From 1965 to 1966, Majumdar held a post doctoral position in Carnegie Institute of Technology (now called Carnegie-Mellon University), Pittsburgh before joining the Tata Institute of Fundamental Research (TIFR) in Mumbai. From TIFR, he had another post doctoral stint in the University of Manchester. In Pittsburgh and Manchester, Majumdar came in contact with stalwarts like James S. Langer and Sam F. Edwards, though he chose to work independently on the analytic properties of the Onsager solution of the Ising model and non-exponential stress relaxation in glasses.

TIFR days were the most productive for Majumdar. He had a group of several bright students and with them, he tackled a variety of problems with deep mathematical insight. They include the three-magnon bound state equation, Heisenberg antiferromagnetic chain with known ground state, the critical isotherm of the Ising model and of the Lennard-Jones gas, the band structure of cerium, spin waves in finite magnetic chains, etc. It is interesting to note that during those days in India,what we now know as condensed matter physics was dominated by lattice dynamics. Majumdar was a rare exception amongst his peers. He was well-versed in then-current subjects of statistical mechanics and critical point phenomena, and their applications to electron states and magnetic properties of solids.

Perhaps the most important contribution of C. K. Majumdar for which he is internationally known is the work (with Dipan Ghosh in 1969) on the exact enumeration of the ground state of an anti-ferromagnetic chain, with specially ascribed values for nearest neighbour and next nearest neighbour interactions. This work on what is now part of the folklore as the Majumdar-Ghosh Hamiltonian is a wonderful illustration, as it were, of how open-ended basic research can be. Almost two decades later the model led to a prototype 'resonating valence bond' state, in the context of high temperature superconductivity. One other point is noteworthy

here. The years 1965 to 1975 had not yet seen the growth of computational physics as is extant in India today; Majumdar indeed was a pioneer computational physicist of our country. In 1976, he was awarded the Shanti Swarup Bhatnagar prize in Physical Sciences, and in the same year, he was elected Fellow of the Indian Academy of Sciences.

The decade from 1976 to 1986 marked a new phase in Majumdar's life. As Palit Professor of Physics in Science College of Calcutta University and Head of Magnetism /Solid State Physics Department of the Indian Association for the Cultivation of Science (IACS), he devoted himself to education, teaching and curriculum development.In addition, he switched interest to down-to-earth experimental studies, applying his early work (1965-70) in the theory of positron annihilation spectroscopy to radiation damage, and also involving Mössbauer spectroscopy of corrosion and inhibition of iron ores in eastern India. His other experimental contribution included the enhancement of the critical temperature of a high temperature superconductor due to alpha bombardment. Much of these experiments were carried out by Majumdar's collaborators and students at the Palit Laboratory, IACS and the Variable Energy Cyclotron Centre. He was elected to the Fellowship of the Indian National Science Academy (INSA) in 1982.

The final phase (1987-99) of Majumdar's professional life began when he was appointed the Founder Director of the newly established Satyendranath Bose National Centre for Basic Sciences. This period saw him in the role of an institution-builder. He devoted himself tirelessly to the development of infrastructure facilities of the new centre. He also lent active support to various workshops, seminars and conferences organized in the centre by different national bodies as well as teachers' training programmes.

Chanchal Kumar Majumdar was a versatile individual. An evidence of his enigmatic dexterity is the project he undertook in 1992 on the simulation of fluid flow on the Hoogly Estuary by parallel programming. The word 'Chanchal' in Bengali means restless. He no doubt had a restless mind. After retiring as Director of the Bose Centre in February 1999, he took up the position of an INSA Senior Scientist at the Indian Statistical Institute from March 1999 and started working on "History of Science". Majumdar's sudden death has snatched away at an early age a truly extraordinary personality.

REPORT FROM THE DEAN (ACADEMIC PROGRAMMES)

The Centre went ahead with augmenting its faculty strength in its perceived thrust areas, as reported in our 1999-2000 report. Five new faculty members joined the Centre during the year:

- Dr. M. Sanjay Kumar, working in the area of Quantum Optics;
- Dr. Archan Majumdar, working in the area of Foundations of Quantum Mechanics and Quantum Optics;
- Dr. Prasenjit Singha Deo, working in the area of Mesoscopic Systems;
- Dr. Jaydeb Chakrabarti, working in the area of complex fluids and colloidal materials;
- Dr. Tanusri Saha-Dasgupta, working in the area of Physics of Materials.

Dr. Avijit Mukherji resigned his position at the Centre.

We had two senior scientists associated with the Centre during this time, advising us on various aspects of research and teaching – Prof. Binayak Datta Roy and Prof. Partha Ghose.

Collaborative research among the faculty and with individuals and groups in other research centers was strengthened. The two projects in the area of Astrophysics, one funded by ISRO and the other by the DST continued during the year. The Network project, nodally set up in the University of Dhaka, Bangladesh and funded by the Abdus Salam International Centre for Theoretical Physics, Trieste was renewed again for this year. This particular project was held up as one of the successful regional networks by Prof. G. Denardo, the retiring Chairman of ICTP's Overseas Activities Programme. Again the group working on the Physics of Materials at the Centre played a pivotal role in this Project. The Collaborative Project with the Centre for Catalysis and Materials Study, University of Warwick continued for another year.

Eleven research scholars have been carrying out research for their Ph.D. degrees under the guidance of the Centre's faculty. This year the Centre began a formal Post. M.Sc. teaching programme. All new entrants to research guided by the Centre's faculty now had to go through this programme successfully in order to continue research at this Centre. Of the eighty odd applicants, six were chosen through a written and oral examination held jointly with the Saha Institute of Nuclear Physics, Calcutta. In addition, two foreign students, one from Nepal and another from Bangladesh, were admitted on the recommendation of their respective Ministries and Vice-Chancellors.

Our research scholars gave several lectures/seminars and presented poster on their work, both in India and abroad :

1. Subhradip Ghosh on "Magnetic properties of random CoCu alloys", a talk presented in the 'Condensed Matter Days-99', August 1999,Jadavpur University.
2. Subhradip Ghosh on "Electronic structure and magnetic properties of binary alloys", a seminar presented in the SERC school,November 99,SNBNCBS.
3. Subhradip Ghosh on "Electronic structure and magnetic properties of random binary alloys a first principles study", a colloquium presented at the Materials Science Division, Bhabha Atomic Research Centre, Bombay, February 2000.
4. Tapas Kumar Das on "Accretion Powered Extra-galactic Jets", a colloquium presented at Indian Institute of Astrophysics, March 2000.
5. Tapas Kumar Das on "Modelling the Origin of Astrophysical Outflows from Galactic and Extra-Galactic Sources Powered by Compact Objects", a seminar presented at Tata Institute of Fundamental Research, September 1999.
6. Tapas Kumar Das on "The Formation of Extra-Galactic Cosmic Jets", a talk presented at Young Physicists' Colloquia, Saha Institute of Nuclear Physics, August 1999.
7. Indranil Chattopadhyay on "Role of Radiative Momentum Deposition in Acceleration of Winds and Outflows around Compact Objects", a talk presented at the *Young Astronomers Meet,* Uttar Pradesh State Observatory, Nainital, 1-3 June, 1999.
8. S. G. Manickam on "Correlation among QPO frequencies and quiescentstate duration", a poster presented at the National Space Science Symposium, Toshali Sands, Puri, March 1-4, 2000.

Single author papers were published by our research scholars :

1. T.K. Das, 1999, "Modelling the Origin of Astrophysical Jets from Galactic and Extra-Galactic Sources", *Ind. Jour. Phys. 73(B)* (6,899).
2. T.K. Das, 1999, "Computation of Mass Outflow Rate from Relativistic Quasi-Spherical Accretion onto Black Holes", *Monthly Notices of the Royal Astronomical Society* (308,201).
3. Indranil Chattopadhyay, 1999, 'Theoretical Investigation and Numerical Simulation of Radiative Outflows Around Compact Objects', *Indian Journal of Physics,* 73B(6) 881.

As in previous years, the Centre's faculty taught M.Sc. courses in the University of Calcutta and the Presidency College. They included Prof. Binayak Datta-Roy, Prof. A. Mookerjee and

Dr. Amitabha Lahiri. Several faculty members were involved in the Jagadish Bose National Talent Search examination.

The Centre hosted an SERC School on "Electronic Structure of Solids" during November, 1999 followed by a Conference on "The Physics of Materials". Young research scholars from India, Bangladesh and Nepal, were coached by senior experts from India, Germany and the US. The latter was scheduled to take place in Bhubaneswar. However the venue was shifted to Calcutta because of the devastating cyclonic storm that hit the Orissa coast. A Winter School on the "Foundations of Quantum Mechanics and Quantum Optics" was hosted by the Centre during January 2000 with large participation from India and abroad. Mini-conferences were held during the year. These included those on "Nano-Materials", "Quantum Field Theory and its applications to Condensed Matter Physics", "Growth Models" and "Biology and Physics".

Abhijit Mookerjee
Dean, Academic Programme

THE STAFF DURING 1999-2000

The Faculty

Name	Designation	Ph. D. from	Year	Area of Research
Sushanta Dattagupta	Professor & Director	Brookhaven Nat. Lib.	1973	Structure and Dynamics of Condensed Matter
Abhijit Mookerjee	Professor & Dean	University of Cambridge	1973	Physics of Materials
Sandip K. Chakrabarti	Associate Professor	University of Chicago	1985	Astrophysics
Subodh Kumar Sharma	Associate Professor	S.I.N.P. *(Universiy of Calcutta)*	1977	Light Scattering
Nilakantha Nayak	Associate Professor	I.I.T. Kharagpur	1978	Quantum Optics and Laser Physics
Rabin Banerjee	Associate Professor	S.I.N.P. *(University of Calcutta)*	1988	Quantum Field Theory
Anita Mehta	Associate Professor	University of Oxford	1986	Soft Condensed Matter and Complex Systems
Subhrangshu Sekhar Manna	Associate Professor	S.I.N.P. *(University of Calcutta)*	1987	Statistical Mechanics
Debashis Gangopadhyay	Reader	S.I.N.P. *(University of Jadavpur)*	1988	Quantum Field Theory
Srilekha Banerjee	Reader	University of Calcutta	1982	Soft Condensed Matter
Samir Kumar Pal	Reader	I.O.P.B. *(Utkal University)*	1989	Mathematical Physics
P. Singha Deo	Reader *(joined December 1999)*	I.O.P.B. *(Utkal University)*	1996	Mesoscopic Systems
M. Sanjay Kumar	Reader *(joined December 1999)*	University of Hyderabad	1989	Quantum Optics

Name	Designation	Ph. D. from	Year	Area of Research
Rina Das	Scientific Officer 'D'		–	–
Manu Mathur	Fellow	I.M.Sc. *(University of Madras)*	1993	Quantum Field Theory & QCD
Ranjan Chaudhury	Fellow	T.I.F.R. *(University of Mumbai)*	1988	Condensed Matter Theory
Pratip K. Mukhopadhyay	Fellow	I.I.Sc., Bangalore	1989	Experimental Condensed Matter
Partha Guha	Fellow	University of Oxford	1996	Mathematics
Anilesh Mohari	Fellow	I.S.I., Delhi	1992	Mathematics
Sugata Mukherjee	Fellow	Freie Universitat, Berlin	1986	Physics of Materials
Amitabha Lahiri	Fellow	Syracuse University	1991	Quantum Field Theory
Avijit Mukherji	Fellow *(resigned January 2000)*	University of Cambridge	1996	Mathematical Physics
Gautam Gangopadhyay	Fellow	I.A.C.S. *(Jadavpur University)*	1993	Chemical Physics
Biswajit Chakraborty	Fellow	I.M.Sc *(University of Madras)*	1993	Quantum Field Theory
Kalyan Mandal	Fellow	I.I.T., Kharagpur	1994	Experimental Condensed Matter
Archan S. Majumdar	Fellow *(joined September 1999)*	University of Delhi	1994	Foundations of Quantum Theory and Cosmology
Jaydeb Chakrabarti	Fellow *(joined November 1999)*	I.I.Sc., Bangalore	1995	Soft Condensed Matter and Complex Systems
Tanusri Saha Dasgupta	Lecturer *(joined December 1999)*	University of Calcutta	1995	Physics of Materials

Senior Scientists, Visiting Scientists and Research Associates

Haridas Banerjee	INSA Senior Scientist
Rudra Prasad Malik	Visiting Reader
Sarmistha Ghosal	Visiting Scientist *(completed November 1999)*
Prabhat Kumar Thakur	Visiting Scientist *(completed January 2000)*
Jayashree Saha	Research Associate *(on leave)*
Devashis Banerjee	Research Associate *(completed April 2000)*
Sonali Chakrabarti	Research Associate *(completed November 2000)*
Manoj K. Samal	Research Associate *(joined December 1999)*

Research Scholars

Parthapratim Biswas	Condensed Matter Theory and Statistical Physics *(completed Ph.D. in December 1999)*
Biplab Sanyal	Condensed Matter Theory and Statistical Physics *(Ph.D. to be completed in July 2000)*
Chhanda Basu Chaudhuri	Condensed Matter Theory *(till January 2000)*
Subhradip Ghosh	Condensed Matter Theory
Tapas Kumar Das	Astrophysics
Sarmistha Kumar	High Energy Physics
Indranil Chattopadhyay	Astrophysics
Banibrata Mukhopadhyay	Astrophysics
Tomy Scaria	Mathematical Physics
Sivakumar G. Manickam	Astrophysics
Atishdipankar Chakrabarti	Statistical Physics
Anuj Nandi	Astrophysics

Post M.Sc. Students

Santabrata Das	Samir Mandal	Dipankar Rana
Rumani Karmakar	Sumana Banerjee	Swarnali Bandopadhyay
Sudip Roy	Durga Paudyal	Kamal Krishna Saha

Librarian

Indrani Bhattacharyya *(joined November 2000)*

Administrative, Technical and Auxiliary Staff

Anima Dattaswami	Finance Officer/Acting Administrative Officer *(joined October 1999)*
Apurba Kanti Sarkar	Accounts Officer
Sunish Kumar Deb	PA to Dean
Dipti Prakash Banerjee	Office Superintendent
Sukanta Mukherjee	Assistant (General)
Sirsendu Ghosh	Senior Stenographer
Tapan Kumar Sen	Assistant
Anjan Bhattacharya	Upper Division Clerk
Jaydeep Kar	Upper Division Clerk
Prasenjit Talukdar	Upper Division Clerk
Santosh Kumar Singh	Upper Division Clerk
Sanad Kumar Shukla	Upper Division Clerk
Gopal Chandra Ghosh	Supervisor of General Amenities
Shiba Prasad Nayak	Pump Operator
Bijoy Kumar Pramanik	Guest House Attendant
Arun Kumar Bhattacharya	Library Stack Attendant
Bhupati Naskar	Library Stack Attendant
Pradip Kumar Bose	Attendant
Partha Chakraborty	Attendant

Personnel on Campus Construction

Aditya Pal Choudhury	Project Assistant

Consultants

Partha Ghosh	Consultant (Academics)
Binayak Dutta Roy	Consultant (Training Programme)
D.N. Bhattacharya	Consultant (Administration)
C. Halder	Consultant (Engineering)

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CONSTITUENTS OF THE COMMITTEES

Governing Body

The composition of the Governing Body of the Centre during the year 1999-2000 was as follows :

1.	Professor V. S. Ramamurthy Secretary Department of Science & Technology Government of India, New Delhi	Chairman
2.	Professor G. S. Agarwal Director Physical Research Laboratory Ahmedabad	Member
3.	Professor S. N. Behera Director Institute of Physics, Bhubaneswar	Member
4.	Professor Probir Roy Senior Professor Tata Institute of Fundamental Research Mumbai	Member
5.	Shri Rahul Sarin Joint Secretary and Financial Adviser Department of Science & Technology Government of India, New Delhi	Member
6.	Shri Manish Gupta Chief Secretary Government of West Bengal, Calcutta	Member
7.	Professor S. Dattagupta Director S. N. Bose National Centre for Basic Sciences Calcutta	Member

The Administrative Officer, SNBNCBS is a Non-Member Secretary of the Governing Body.

Professor G. S. Agarwal, Professor S. N. Behera and Professor Probir Roy will be serving

on as members for a period of 5 years [Clause 21, Rules, MOA] from 19th July 1996. Others are ex-officio members.

Finance Committee

The following members constituted the Finance Committee during the year :

1.	Professor S. Dattagupta Director, SNBNCBS	Chairman
2.	Professor M. Chowdhury IACS, Calcutta	Member
3.	Professor V. Krishnan IISc., Bangalore	Member
4.	JS & FA or his Nominee, DST, New Delhi	Member
5.	Administrative Officer SNBNCBS, Calcutta	Member-Secretary

Professor V. Krishnan and Professor Mihir Chowdhury are nominated by GB as Members of Finance Committee for a period of 5 years from 1995 to 2000.

Building Committee

The members of the Committee are :

1.	Professor S. Dattagupta Director, SNBNCBS, Calcutta	Chairman
2.	Professor C. Vaswani Ex-Chief Engineer, CPWD(ER)	Member
3.	Shri C. Haldar Ex-Additional Chief Engineer, DAE	Member
4.	Shri R. De SO(G), VECC	Member
5.	Administrative Officer SNBNCBS, Calcutta	Member-Secretary

Academic Programme Advisory Committee

During the year 1999-2000, the Academic Programme Advisory Committee of the Centre consisted of the following members:

1.	Professor N. Mukunda IISc., Bangalore	Chairman
2.	Professor S. Ananthakrishnan NCRA, Pune	Member
3.	Professor R. Balasubramanian IMSc., Chennai	Member
4.	Professor B. M. Deb Punjab University, Chandigarh	Member
5.	Professor N. Kumar RRI, Bangalore	Member
6.	Professor S. Dattagupta SNBNCBS, Calcutta	Member
7.	Professor A. Mukherjee SNBNCBS, Calcutta	Member
8.	Dr. R. Banerjee SNBNCBS, Calcutta	Member
9.	Dr. S. S. Manna SNBNCBS, Calcutta	Member
10.	Dr. N. Nayak SNBNCBS, Calcutta	Member

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SEMINARS AND TPSC ACTIVITIES

List of seminars at the Centre in 1999-2000

- **MAHAPATRA, Susanta,** University of Heidelberg, Heidelberg, *Quantum Dynamics of Vibronically Coupled Systems,* April 7, 1999;
- **FRANZ, Silvio,** Abdus Salam ICTP, Trieste, *Constrained Boltzmann distributions, effective potentials and the glass transition,* April 12, 1999;
- **KAR, Kamales,** SINP, Calcutta, *Supernova Explosions and Related Physics,* April 21, 1999 (Colloquium);
- **BANERJEE, Rabin,** SNBNCBS, *Some Aspects of Soldering and Duality in Quantum Mechanics,* April 28, 1999 (Colloquium);
- **MALIK, Rudra Prasad,** SNBNCBS, *Topological Aspects in Gauge Theories,* May 5, 1999;
- **DEV, B N,** IOP, Bhubaneswar, *Spontaneous Nanostructural Island Formation of Ge layers on Si Surfaces,* May 12, 1999;
- **SENGUPTA, Sujan,** Vanderbilt University, Nashville, USA, *Evolution of Crystal Magnetic Field in Neutron Stars Under Strong Gravitational Field,* May 17, 1999;
- **SANYAL, Biplab,** SNBNCBS, *Study of Surfaces from Growth Models to First Principles Electronic Structure Calculations,* May 25, 1999;
- **CHAKRABARTI, J,** Materials Science Division, IGCAR, Kalpakkam, *Long-range Attraction between Charged Metal Balls spread on a Dielectric Surface,* June 9, 1999;
- **MAHARANA, J,** IOP, Bhubaneswar, *Recent Developments in String Theory,* June 18, 1999 (Colloquium);
- **DE, Asit K,** SINP, Calcutta, *Gauge Fixing and Chiral Gauge theories on Lattice,* June 23, 1999 (Colloquium);
- **GHOSE, Partha,** SNBNCBS, *Why Bohmian Mechanics?,* June 30, 1999(Colloquium);
- **MAJUMDAR, Archan S,** SNBNCBS, *Wave Function Collapse — Is there Any Empirical Evidence?,* July 21, 1999, 11 a.m.;
- **SEN, Parangama,** Surendra Nath College, Calcutta, *Two New Aspects of Critical Phenomena,* July 21, 1999, 2 p.m.;

- **THAKUR, Prabhat K,** SNBNCBS, *Multifractal Scaling Results for Electronic States in Generalized Harper Model, Random-Dimer Potential, Fibonacci Quasi-Periodic Systems and electrified random chains,* July 22, 1999, 11 a.m.;
- **SAHA-DASGUPTA,** Tanusri, IISc., Bangalore, *Roughening and Wetting of Antiphase Boundaries in Alloys : A Monte Carlo Study,* July 22, 1999, 2 p.m.;
- **ANANTHAKRISHNAN, S,** NCRA, Pune, *GMRT – India's Telescope for Radio Astronomy,* July 28, 1999(Colloquium);
- **DATTA, Bhaskar,** IIA, Bangalore, *Nuclear Partition Functions,* August 4, 1999 (Colloquium);
- **BHATTACHARYYA, Aninda J,** SNBNCBS, *Study of Ion Conducting Polymers through Experiment and Computer Simulation,* August 11, 1999;
- **KHARE, A,** IOP, Bhubaneswar, *Exact Solution of an N-body Problem in One Dimension,* September 6, 1999;
- **SEN, S,** Trinity College, Dublin, *Applications of the Schwarz resolvent method,* September 7, 1999 (Colloquium);
- **DATTAGUPTA, Sushanta,** SNBNCBS, *Quantum Phase Transitions,* September 14, 1999 (Colloquium);
- **RAY, Dhiranjan,** Jadavpur University, Calcutta, *Convergent Accelerating Transforms: its Application to Physical Problems,* September 17, 1999;
- **GANGOPADHYAY, Debashis,** SNBNCBS, *Homogeneity and Isotropy of Spacetime in thePresence of Torsion,* September 21, 1999 (Colloquium);
- **DASGUPTA, Ananda,** SINP, Calcutta, *Lie Algebraic Applications in Quantum Optics,* October 5, 1999;
- **PANCHAPAKESAN, N,** Delhi University, *Gravitational Lensing by Galaxies and Cosmology,* October 12, 1999 (Colloquium);
- **ADHIKARI, Satrajit,** H.B.Oersted Institute, Copenhagen, *Geometric Phase Effect in Chemical Reactions,* November 30, 1999;
- **PICK, R M,** Universite Pierre et Marie Curie, Paris, *Liquid-Glass Phase Transition and the Mode Coupling Approach,* December 6, 1999;
- **MANDAL, Bhabani P,** SINP, Calcutta, *Generalizations of BRST Transformations,* December 7, 1999;

- **MARINO, E C,** UFRJ, Rio de Janeiro, *Field Theory & Condensed Matter Physics : A Meeting Ground,* December 16, 1999 (Colloquium);
- **MARINO, E C,** UFRJ, Rio de Janeiro, *A Field Theory of Spin-Glass Systems,* December 17, 1999;
- **RAY, Alak K,** TIFR, Mumbai, *Neutrinos from Supernovae,* December 21, 1999 (Colloquium);
- **DEY, Rukmini,** University of Texas, Austin, *A Dimensional Reduction of the Seiberg-Witten Equations and its Geometric Quantization,* December 23, 1999;
- **DAS, Mukunda,** Australian National University, Canberra, *Noise in the Realm of Physical Sciences,* December 28, 1999;
- **GOPAKUMAR, Rajesh,** Harvard University, USA, *Large N Gauge Theory and String Theory,* January 12, 2000;
- **MAJUMDAR, Pinaki,** Mehta Research Institute, Allahabad, *Hall Effect in the Ferromagnetic manganites,* January 24, 2000;
- **DAS SARMA, Sankar,** University of Maryland, USA, *Physics in the Next Century and in the New Millenium,* January 25, 2000 (Colloquium);
- **BISWAS, Parbati,** University of Freiburg, Germany, *Extension of Dendrimers in External Fields : Rouse and Zimm dynamics,* February 1, 2000;
- **RAMA KANT,** University of Freiburg, Germany, *Extension of Star Polymers in External Fields,* February 8, 2000;
- **GHOSH, H,** University of Arizona, USA, *Pairing Symmetry in Cuprates,* February 14,2000;
- **MEHTA, Anita,** SNBNCBS, *Coupled Dynamics in sand: Compaction, Avalanches and Surface Roughening,* February 15, 2000. (Colloquium);
- **SINHA, Sitanbhra,** IISc., Bangalore, *Noise-free Stochastic Resonance in Simple Chaotic Systems,* March 21, 2000;
- **BANERJEE, Haridas,** SNBNCBS, *Chiral Anomalies in Field Theories,* March 28, 2000 (Colloquium).

Amitabha Lahiri
Seminar Secretary

Winter Institute on 'Foundations on Quantum Theory and Quantum Optics' (1-13 January 2000) held at the S.N. Bose National Centre.

Participants at the Winter Institute on 'Foundations of Quantum Theory and Quantum Optics.'

Prof. N. Mukunda, FNA, Chairman, Academic Programme Advisory Committee, giving the Opening Address at the 'Winter Institute on Foundations of Quantum Theory and Quantum Optics'.

Session on 'Quantum Computing' at the 'Winter Institute of Quantum Theory and Quantum Optics'.

THE THEORETICAL PHYSICS SEMINAR CIRCUIT (TPSC), 1999-2000

The TPSC has nine main centres and ten associate centers under various main centers. Calcutta is one of the main centers with Shantiniketan and North East consortium (operating from IIT-Guwahati) as its two associate centers. The Calcutta centre operates from the SNBNCBS and it also coordinates the entire TPSC activities of the Circuit. Prof. S. Dattagupta is the Chairman of the National Committee of the TPSC. Dr. N. Nayak and Dr. M. Mathur are the Conveners of the Calcutta Centre. The following TPSC visitors delivered talks at the SNBNCBS between April 1999 and March 2000 :

1. Dr. M. Sanjay Kumar, RRI, Bangalore (now at SNBNCBS): Decoherence at zero temperature (April 13, 1999).
2. Dr. A. Venugopalan, PRL, Ahmedabad: Superrevivals in the quantum dynamics of a particle confined in a finite square well potential (April 20,1999).
3. Dr. S. N. Majumdar, TIFR, Mumbai: Persistence in non-equilibrium systems (October 26, 1999).
4. Dr. V. V. Sreedhar, Dublin Institute of Advanced Studies, Ireland: Spin and Statistics (November 15, 1999).
5. Dr. S. Arun Kumar, IMSc., Chennai : Stroboscopic theory of atomic statistics in micromaser (December 22, 1999).
6. Dr. Amit Ghosal, TIFR, Mumbai: Disorder driven superconductor-insulator transition (January 28, 2000).
7. Dr. Abhishek Dhar, IISc., Bangalore: Phase transition in frustrated systems (February 2, 2000).
8. Prof. V. Balakrishnan,IIT-Chennai : Mean recurrence for deterministic and stochastic dynamics-continuous time limit (February 17,2000) and Statistics of recurrence in dynamical systems (February 18, 2000).
9. Dr. V. S. Ashoka, TIFR, Mumbai: Electromagnetically induced transparency with Zeeman coherence (February 23, 2000).
10. Dr. G. Manoj, IMSc., Chennai: Spatial correlations in persistence (March 1, 2000).
11. Dr. K. Maharana, Utkal University, Bhubaneswar : Nonlinear Dirac and diffusion equations in 1+1 dimensions from stochastic considerations (March 29, 2000).

Nilakanta Nayak & Manu Mathur
Conveners, TPSC

CONFERENCES, WORKSHOPS AND SYMPOSIA AT THE CENTRE

APRIL1999 – MARCH 2000

WORKSHOP ON NON-LINEAR ANALYSIS AND ITS APPLICATION

JUNE 10-15, 1999, SNBNCBS & CU

The S. N. Bose Centre and the Department of Pure Mathematics, Calcutta University jointly sponsored the programme organized by the proposed Indian Society of Nonlinear Analysts. The first two days (June 10-11) of the workshop were held at the S. N. Bose Centre and the remaining two days (June 14-15) at the Department of Mathematics, Calcutta University, Ballygunge Campus. The speakers included A. B. Roy (JU), A. Sengupta (IITK), M. C. Chaki (Retd., CU), D. K. Ganguly (CU), E. Tarafdar (University of Queensland, Australia), A. Mookerjee (SNBNCBS) and Anita Mehta (SNBNCBS). The topics of discussion were: Bifurcation and Chaos, Ill Posed Problems, Chaotic Dynamical Systems, Differential Geometry and Differential Equations, Hausdorff Measures and Dimension, Fixed Point Theorems and applications, Control Theory and so on.

SERC SCHOOL 1999 ON ELECTRONIC STRUCTURE AND PHYSICS OF MATERIALS

OCTOBER 31-NOVEMBER 20, 1999, SNBNCBS

With complete support from the Department of Science & Technology, Government of India, the School drew enthusiastic response from the participants who were selected from universities and institutions all over India. About 24 of them attended the three-week School. There were also 26 local participants of whom 13 were from the Centre. Among the 23 lecturers, five were from abroad : O. K. Andersen and O. Gunnarsson, MPI, Stuttgart; Bulbul Chakrabarti, Brandeis University, USA; S. D. Mahanti, Michigan State University, USA and S. Satpathy,University of Missouri, USA. The speakers at the national level included – G. P. Das, S. K. Ghosh, S. Banerjee (BARC, Mumbai); M. Randeria, N. Trivedi, E.V. Sampathkumaran (TIFR, Mumbai); I. Dasgupta (IIT, Mumbai); H. R. Krishnamurthy, D. Das Sarma, T. Saha-Dasgupta (IISc., Bangalore); D. G. Kanhere (Pune University); S. Auluck (Roorkee University); S. Narasimhan (JNCASR, Bangalore); B. N. Dev (IOP, Bhubaneswar); M. K. Harbola (CAT, Indore); M. K. Sanyal (SINP); S. Mukherjee and A. Mookerjee (SNBNCBS). The enthusiastic reactions from the participants reflected their great interest in the topics covered. These were: Density Functional Theory, Electronic Structure and Total Energy Methods, Beyond the Density Functional Theory, Materials, Properties and Phenomena, Phase Stability, Optical Properties, Transport Properties, X-Ray and Neutron Scattering and Strongly Correlated Systems.

CONFERENCE ON "PHYSICS OF MATERIALS"

NOVEMBER 22-23, 1999, PURI shifted to SNBNCBS

The conference was aimed to be the satellite meeting to the SERC School on Electronic Structure and Physics of Materials (October 31-November 20, 1999) and was scheduled to be held at the Toshali Sands, Puri. The pathetic aftermath of the super cyclone in Orissa resulted in a shift of the venue to S. N. Bose Centre. However, the two-day conference passed off well. The scientists from abroad - 0. K. Andersen, 0. Gunnarsson, S. D. Mahanti and S. Satpathy continued their stay and delivered lectures. There were three speakers from the Centre: S. Dattagupta, A. Mookerjee and Sugata Mukherjee. The participants in the SERC School whose presentations were considered to be the best were invited to register in this satellite meeting.

WINTER INSTITUTE ON "FOUNDATIONS OF QUANTUM THEORY AND QUANTUM OPTICS"

JANUARY 1-13, 2000, SNBNCBS

The Winter Institute was quite a big event that drew attention of many researchers working in the fields of Quantum Optics (Theory and Experiment), Quantum Measurement Theories, Quantum Computation, Experimental Tests of Foundations of Quantum Theory, Mesoscopic Physics and Quantum Chaos. There were 95 registered participants, of whom 20 were from abroad. However, the audience included a large number of local participants who did not register, but attended lectures of specific interest. Some of the eminent speakers were: G. S. Agarwal (PRL, Ahmedabad), D. Atkinson (University of Groningen, Netherlands), S. Das Sarma (University of Maryland, USA), L. K. Grover (Bell Labs., USA), P. Mello (University of Mexico, Mexico), N. Mukunda (IISc., Bangalore) and E. C. G. Sudarshan (University of Texas, USA). The speakers from the Centre were S. Dattagupta, Partha Ghose, Archan S. Majumdar and Prasenjit Singha Deo. Four members of the faculty were among the registered participants. A lump sum of the fund came from the S. N. Bose Centre. Other important sponsors were the Department of Science & Technology, Government of India, BRNS and Abdus Salam International Centre for Theoretical Physics, Trieste. The NOC included Professor S. M. Roy (TIFR) and Professor S. Dattagupta (SNBNCBS). The LOC members were Professor Partha Ghose (Convener), Professor A. Mookerjee, Dr. N. Nayak, Dr. A. S Majumdar and Dr. M. K. Samal.

MINI-WORKSHOP ON "GROWTH MODELS"

FEBRUARY 2-3, 2000, SNBNCBS

The two-day mini workshop provided an effective forum for interactions within a small group of specialized researchers working on various growth models. Of the 26 participants, 13 were from the Centre. Professor S. Das Sarma (University of Maryland), Dr. Sangam Banerjee (SINP), Dr. Krishna Kumar and Dr. Abhishek Dhar (TIFR) were among the speakers. The speakers from the Centre were: Anita Mehta, S. S. Manna, Jaydev Chakrabarti and Tanusri Saha-Dasgupta.

PHYSICS AT THE NANO-SCALE

MARCH 7-9, 2000, SNBNCBS

The workshop had extensive discussions on different perspectives of Nano Scale Physics. The specific topics were growth and characterization, clusters, surfaces and interfaces, electronic structure and transport. The programme was held at the Centre and the Convener was Professor Dipankar Chakraborty. Professor Abhijit Mookerjee, SNBNCBS was the co-convener. About 25 scientists, of which 11 were from SNBNCBS attended the meeting. The speakers included Professors S. N. Behera, IOP, Bhubaneswar; P.Pramanik, IIT-KH; A. K. Pal, IACS; Dipankar Chakraborty, IACS; Abhijit Mookerjee, SNBNCBS and Dr. Sugata Mukherjee, SNBNCBS. Professor K. L. Chopra, IIT-KH and Professor Ajay Gupta, IUC (DAEF), Indore were among the speakers but could not attend.

MINI-WORKSHOP ON QUANTUM FIELD THEORY : Application to Condensed Matter Physics

MARCH 13-14, 2000

The two-day workshop dwelt mainly on the following areas: Luttinger liquids, lattice Bosons, invariant coherent states for composite Bosons and quantum Hall skyrmions, antiferromagnets, Landau-Lifshitz model of ferromagnetism, topological excitations in quantum spin models, Fermi liquid breakdown in two-dimensions and so on. There were 33 participants, of which 2 were from outside Calcutta. There were twelve talks in all including four by SNBNCBS members (B. Chakraborty, R. Chaudhury, D. Gangopadhyay and Samir K. Paul). Among other speakers were : R. Shankar, IMSc., Chennai; Sumathi Rao, MRI, Allahabad; and Indrani Bose, Bose Institute, Calcutta. The workshop was jointly convened by M. Mathur and B. Chakraborty.

Participants at the 'SERC School on Electronic Structure' (31st October – 20th November 1999) organised by the Centre.

Conference on 'Materials Physics' (22nd - 23rd November, 1999).

ONE DAY MEETING ON BIOLOGICAL SCIENCES

MARCH 16, 2000, SNBNCBS

The meeting, held at the S. N. Bose Centre, aimed at exploring new avenues in the field of Biological Sciences and Biology-inspired Physics. Researchers of eminence were invited to deliver talks. The idea was to stimulate attention of physicists and mathematical model builders, who mostly comprised the audience, towards certain aspects of biological sciences. The speakers included Siddhartha Roy, Bablu Bhattacharya and Gautam Basu of Bose Institute, Shyamal Ray and Pratap K. Das of Indian Institute of Chemical Biology. The meeting was quite lively and participants, 45 in total, took part in interactions. As a follow-up, new collaborative efforts have started. The programme was jointly convened by Jaydeb Chakrabarti and Gautam Gangopadhyay (Faculty,SNBNCBS),Kamalesh Bhowmick (SINP) and Indrani Bose (Bose Institute), under the chairmanship of S. Dattagupta, Director.

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SEMINARS OF GENERAL INTEREST

In addition to technical scientific seminars and colloquia held regularly at the Centre, a new series of talks on topics of more general interest began from June 1999. The following seminars were held at the Centre :

CHAUDHURI, Sukanta, Professor of English, Jadavpur University, *The influence of scientific principles on renaissance art and culture in Europe,* June 18, 1999.

GHOSE, Partha, SNBNCBS, *Science and Rabindranath,* November 18, 1999.

LAL, Ananda, Reader in English, Jadavpur University, *Cross-currents in contemporary Indian theatre,* December 2, 1999.

RAY, Rajat, Professor of History, Presidency College, *The civil society and its limits : the Indian experience,* January 20, 2000.

ROY, Subroto, Professor, Vinod Gupta School of Management, IIT, Kharagpur, *On freedom and the scientific point of view,* February 17, 2000.

BASU, Srabashi, Indian Statistical Institute, Calcutta, *Projection of HIV : a study of Calcutta,* March 2, 2000.

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Prof. Satyasadhan Chakraborty, Hon'ble Minister for Higher Education, Government of West Bengal, garlanding the bust of Prof. S.N. Bose on National Science Day, 28th February, 2000.

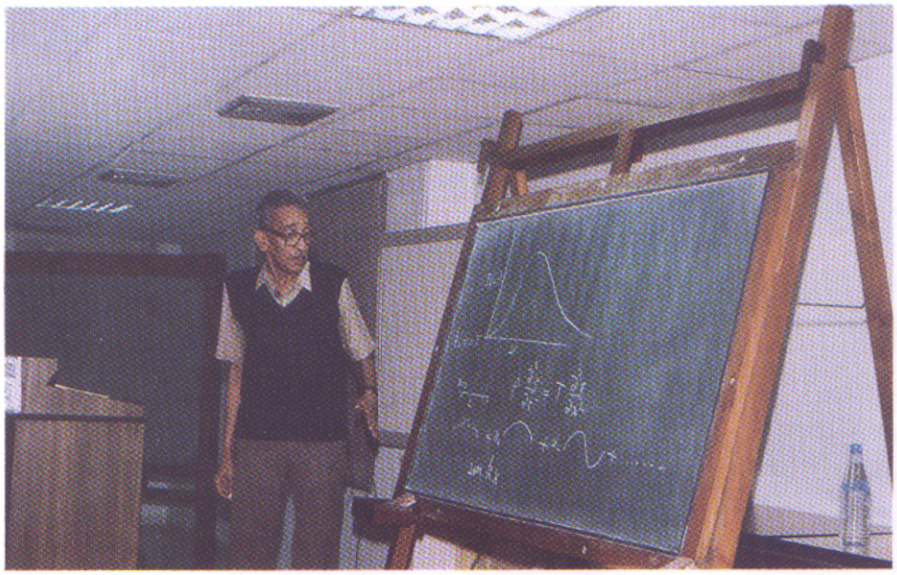
Science Day celebrated at the Centre on 28th February 2000.

Prof. Satyasadhan Chakraborty, Minister for Higher Education, Government of West Bengal, speaking to visually challenged Pupils using the Braille transcription system developed by the Centre.

Shri Pankaj Das, Principal, Louis Braille Memorial School addressing the National Science Day Celebrations at the Centre.

B.Sc. Students going through the Science Exhibition on National Science Day.

'Science Quiz' organised by the Centre on National Science Day on 28th February 2000.



Prof. Binayak Dutta Roy lecturing on 'Bose Condensation' on National Science Day.

National Science Day, 28.2.2000: Prof. Amal Kumar Ray Chaudhuri, FNA lecturing on 'Popular Science : A Word of Caution'.

FACILITIES

Computer Centre

The computer centre of S. N. Bose National Centre extends state-of-the-art facilities to its users round the clock. The facilities include DEC-Alpha, SGI-Indigo-2 and HP-9000 715 workstations, all connected through local area network. Moreover, there are several PCs, ascii-terminal and a X-terminal in the network. All machines are connected to the Internet through a Cisco router and 64 kbps links to VSNL. Power is supplied through a 15 KVA UPS. Postscript laser printers and a colour scanner are also available. The Centre provides e-mail, text-editing and web-browsing facilities to all members and visitors.

The recently procured 30 Compaq machines are distributed in Terminal room, Faculty floor and Library. These machines are also networked. Most of the office staff were given training in the use of various computer packages and have been using computers for day-to-day office work.

Rina Das, *Computer-in-Charge, Engg.*
S. S. Manna, *Computer-in-Charge, Academics*

Library

The Center's library has undergone major changes this year.

- Stock and Services: The library has a specialized collection of books and journals on basic sciences. At present the library has about two thousand five hundred books and forty four professional journals in its collection. A newspaper section and a recreational journal section have been introduced last year.
- The library has joined a consortium for Mathscinet (online version) initiated by Indian Statistical Institute, Calcutta.
- Introduction of open-access system, a provisional card catalogue, in-house photocopying service and other facilities are now available to library users.
- A concept plan for library design and refurbishment has been drawn up to provide proper functioning environment to staff and users. This includes plans to computerize library services at the earliest.

- Archive: On 1st January 2000 a bust of Prof. Satyendranath Bose was unveiled by Dr. S. Varadarajan in the library annexe room which has been earmarked for the setting up of an archive in the memory of Prof. S. N. Bose.
- The librarian attended the annual SIS convention at INSA, New Delhi from 24th to 29th January 2000.
- A trainee librarian has joined on a temporary basis from January 2000.

Indrani Bhattacharyya
Librarian

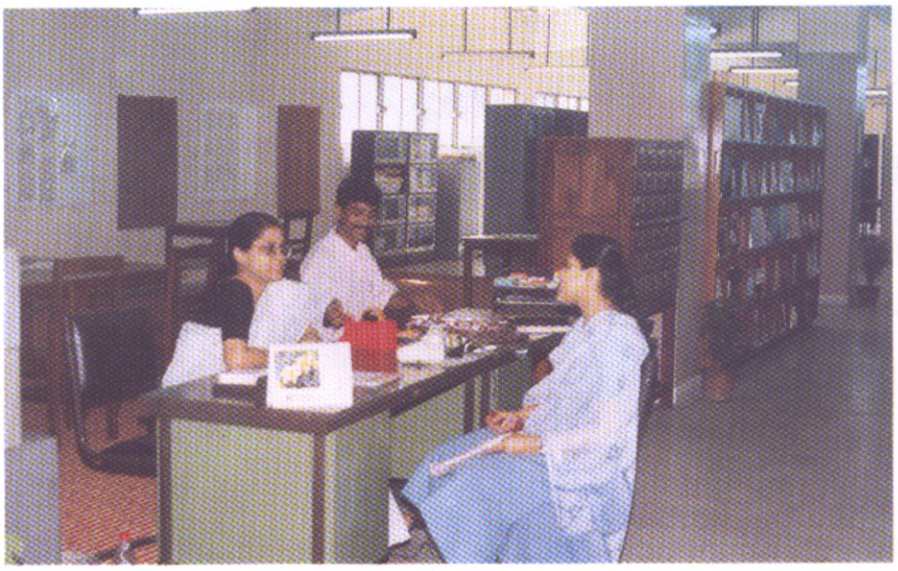
Laboratory

- New facility in the laboratory: Vibrating reed sound velocity and internal friction measurement apparatus has been installed in the lab towards the end of March 2000. It was partially funded from an overseas project grant and a spares grant from ICTP, Trieste, Italy. This is the first such facility in eastern India and the third in India. It can operate down to ~90K at present and is estimated to reach ~1ppm in δV and <1% in Q^{-1}.

  Being such a powerful technique, it has attracted attention from institutions in India and abroad. Samples have come from places like IACS, Calcutta, SINP, Calcutta and El-mania University, Egypt. The technique can be used for different aspects of measurements, involving glass transition, structural relaxations etc. and is in addition to my present interest in magnetic relaxations.
- Upgradation of existing facility: The a.c. susceptibility apparatus has been suitably modified to measure the harmonics (second, third etc.) besides the routinely measured quantities.
- Summer Project student: Mr. Pankaj Pal, from Jadavpur University, worked as a summer project student from April to June 1999.

Pratip Kr. Mukhopadhyay,
Laboratory of Condensed Matter Physics

Computer Centre at S.N. Bose National Centre



The newly developed library of the Centre

Guest Room at the Guest House of the Centre

Cafetaria, S.N. Bose National Centre

Infrastructure

- A modern sound system has been set up in the lecture hall. A wooden platform and a lectern for speaker have been built in the lecture hall.
- The Centre has purchased an overhead projector with a laser pointer.
- Landscaping and agri-horticulture work has been started in a phased manner, and the Horticulture Society of India has been appointed as Consultant of the Centre. To start with, a plan for development of three gardens in the premises of the Centre has been undertaken.
- The Centre has purchased a new Ambassador Staff car. An eight seater Maruti Van has been hired to provide transport facility to visitors and to facilitate day to day out door work of the office.
- A bus has been hired for staff members who come far off south in addition to an existing hired bus for north bound staff members.

Anima Duttaswami,
Acting Administrative Officer

Guest House

The Centre has its own modern Guest House and fully air-conditioned Cafeteria located within the premises. Apart from serving regular meal to the staff members of the Centre as well as visitors, the cafeteria also serves as a venue for hosting lunches and high teas on special occasions, seminars, conferences etc. of the Centre. In the Guest House, there are 6 fully furnished air-conditioned suites with attached baths and kitchenettes, 2 single air conditioned furnished rooms and 40 fully furnished non-airconditioned rooms with attached baths.

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FACULTY PERSONAL PROFILES FOR 1999-2000

Rabin Banerjee

Current research interests and ongoing collaborations

Together with H.J. Rothe and K.D. Rothe we have studied the construction of generators of local gauge symmetries of a lagrangian. Based on the priciple of commutativity of a general variation with the time differentiation operation, a master equation was derived. This equation determined the constraints among the parameters entering in the definition of the gauge generators.

The above method was further advanced by me to show the complete equivalence between the lagrangian and hamiltonian approaches to determining the gauge generators. Also, an unified approach of studying both global and local symmetries was presented. Indeed the master equation referred earlier was seen to be the analogue of the Noether theorem; namely, the time conservation of the generator of gauge transformations.

Together with S.Ghosh we have shown that the soldering technique developed by me (in collaboration with C.Wotzasek) for combining two distinct lagrangians displaying opposite aspects of some symmetry, into a single effective lagrangian, is the analogue of canonical transformations in the hamiltonain framework.

Contrary to usual claims, it has been possible to construct duality symmetric lagrangians in odd dimensions. This was explicitly done for the three dimensional case in collaboration with C.Wotzasek. We have also provided bosonised expressions for chiral Schwinger models in four dimensions. The phenomenon of mass generation in the two dimensional Schwinger model was also manifest in the four dimensional model. In both these dimensions it was shown that the Schwinger model is the result of an interference between two chiral Schwinger models having opposite chiralities.

List of Publications for 1999-2000

Refereed publications in journals/books

1. R.Banerjee and P.Mukherjee, (1999), Some comments on the spin of Chern Simons vortices, *Prog. Theor. Phys.* 101, 1189.
2. R.Banerjee and E.C.Marino, (1999), A new approach for bosonisation of massive Thirring model in three dimensions, *Mod. Phys. Lett. A* 14, 593.
3. R.Banerjee and B.Chakraborty, (1999), A new type of duality symmetry in the theory of N-form abelian fields, *J.Phys. A: Math. Gen.* 32, 4441.

4. R.Banerjee and Sarmistha Kumar, (1999), Self duality and soldering in odd dimensions, *Phys. Rev. D* 60, 085005.

5. R.Banerjee, H.J. Rothe and K.D.Rothe, (1999), Hamiltonian approach to Lagrangian gauge symmetries, *Phys. Lett. B* 463, 248.

6. R.Banerjee, H.J. Rothe and K.D.Rothe, (2000), Recursive construction of generator for Lagrangian gauge symmetries, *J.Phys.A:Math. Gen* 33, 2059.

7. R.Banerjee, H.J.Rothe and K.D.Rothe, (2000), Master equation for Lagrangian gauge symmetries, *Phys. Lett. B* 479, 429.

8. R.Banerjee and S.Ghosh, (2000), Canonical transformations and soldering, *Phys. Lett. B,* B 482, 302.

Invited seminars given at

1. 'Master equation for Lagrangian gauge symmetries', Erwin Schrodinger Institute, Vienna, Austria, June 1999.

2. 'Covariant and consistent anomalies in arbitrary dimensional chiral gauge theories', Physics and Maths Deptt., King Charles University, Prague, Czeck Republic, September 1999.

3. 'The principle of commutativity and lagrangian gauge symmetries', CTS, IISc. Bangalore, November 1999.

4. 'Lagrangian and hamiltonian approaches to gauge symmetries', SINP,February 2000.

5. 'Soldering in quantum mechanics', Physics Department, B.H.U., Varanasi, March 2000.

6. 'Gauge symmetries in quantum mechanics', Physics Department, B.H.U. Varanasi,March 2000.

Invited talks at conferences

The talk cited in number 4 above was given at the QFT workshop at SINP.

Invitations (accepted) to conferences

QFT workshop at SINP, February 2000.

Awards and organisational achievements

Organised two days (13, 14 March 2000) Workshop on 'Applications of Quantum Field Theory to Condensed Matter Systems', at SNBNCBS.

Fellowships, associateships and visiting professorships awarded

Awarded a Visiting Associateship (June 1999) at the Erwin Schrodinger Institute, Vienna, Austria.

Thesis supervised

Mr. Pradip Mukherjee submitted his thesis at Jadavpur University during 1999.

Membership of organising committees of conferences

Convener at the QFT workshop held at SINP, February 2000.

Joint projects held with other centres

Theoretical work between myself and my colleagues at Rio and Heidelberg.

Other scientific/educational projects

Gave a colloquium at SNBNCBS (April 1999) on 'Duality and Soldering Formalism in Quantum Mechanics'.

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Srilekha Banerjee

Current research interests and ongoing collaborations

Simulation studies on biomembranes : The Fluid Mosaic Model of a semipermeable plasma membrane, as proposed by Singer and Nicholson in 1972, is being studied using Monte Carlo simulation technique. The interacting membranes in aqueous environment may be conceived as a lamellar stack of lipid bilayers separated by average water spacings. The periodically stacked bilayers show characteristics of liquid crystalline smectic phase. Both Intra-membrane and Inter-membrane interactions are to be taken into account for constructing

the Hamiltonian of the system. The behaviour of the fluctuating membranes under various conditions, as well as the structural phase transitions or Polymorphism in individual membranes are being studied.

The simulation results are in par with the outcomes of experiments performed on Liposomes in Jadavpur University. The effect of Cholesterol and various drugs is also being studied.

Ongoing collaboration with Prof. Papiya Nandy, Physics Deptartment, Jadavpur University.

List of Publications for 1999-2000

K. Mogensen, E. Stenby, S. Banerjee and V. A. Barker, 1999, 'Comparison of Iterative Methods for Computing the Pressure Field in a Dynamic Network Model', *Transport in Porous Medi*a, 37, Issue 3, 277-301.

Invitations (accepted) to conferences

Invited to present a paper in 'The IMACS International Conference on Scientific Computing and Mathematical Modeling', to be held from May 25-27, 2000 at the University of Wisconsin, Milwaukee, USA.

Conferences attended

1. *Workshop on Growth Models,* SNBNCBS, March 2-4, 2000.
2. *One day meeting on Biological Sciences,* SNBNCBS, April 16, 2000.

Other scientific/educational projects

A CD-based Data Bank for storing astrophysical data, comprising of satellite observations on Black Holes and Neutron stars, has been partially compiled by me at the Centre. The system was made quite user-friendly in the sense that the data-bank could be accessed via internet from any part of the world

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Jaydeb Chakrabarti

Current research interests and ongoing collaborations

I joined this Centre in November 1999. My research interest is primarily in soft condensed

matter physics, namely, application of statistical mechanics to classical systems, including both statics and dynamics. Biological systems are one such field where I am actively working on.

Pattern Formation in a chemical system where the reagents have structural correlations (manuscript under preparation) : We investigate pattern formation in a reaction-diffusion system where the chemically active substances have short-range structural correlation as in liquid. We incorporate the correlation effects by generalizing Fick's law of diffusion. We apply our model in the linear regime for conventional 'activator-inhibitor' system, relevant to biological morphogenesis, in the steady situations. The bulk steady state shows a critical system parameter for pattern formation. In slit-like geometry, the steady state pattern develops after a critical slit separation, but may eventually terminate depending on the system parameters.

Invited talks at conferences

- Talk on "Freezing of colloidal suspensions in an external potential" in "Slow Dynamics and Freezing in Condensed Matter Systems" held in School of Physical Sciences, JNU, New Delhi during 9-10th March, 2000.
- Lectures on "Advanced simulation techniques" in "SERC School on Statistical Mechanics and Simulatiomi Techniques" held in Chemistry Department, IIT Kanpur during February 6-26, 2000.
- Talk on "Effect of spatial correlations on Pattern Formation", miniworkshop held in SNBNCBS on 'Nonequilibrium Stat Mech and Growth Model', 2-3 February 2000.

Awards and organisational achievements

Organised one-day meeting on Biological Sciences along with Dr. G. Gangopadhyay on 16th March, 2000.

Other scientific/educational projects

Currently one student (Swarnali Bandopadhyay) is working with me for her Post M.Sc. project. This project aims at the calculation of pair interaction between charged colloids in the presence of neutralizing background. We would like to investigate the role of the electrical property of the colloidal balls, having mesoscopic length scale, in the effective interaction, especially if this can lead to controversial attraction between like-charged colloids in the presence of neutralising background.

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S.K. Chakrabarti

Current research interests and ongoing collaborations

Work is carried out on various aspects of black hole accretion and outflows, by using theoretical and numerical techniques and using results of observations by various spacecrafts. Dirac equation in curved spacetime is solved, with special reference to Schwarzschild and Kerr black holes.Studies are made of the quasi-periodic oscillations (QPOs) of X-rays from accretion disks around black hole candidates and new correlations have been found between the duration and frequency of QPOs. In order to understand environs of galactic and extra-galactic black holes, nucleosynthesis in advective matter around black holes is being studied as functions of various accretion parameters. The stability of the disk is also studied in presence of exo-thermic and endo-thermic reactions. Acceleration of outflows are studied in presence of radiative processes on the disk. Dynamics of matter inside planetary rings is examined close to resonance (due to the presence of moons around the planet) sites and results are compared with Voyager data. Molecular cloud evolution and possibility of the formation of complex organic and inorganic molecules are also examined.

List of Publications for 1999-2000

Refereed publications in journals/books

1. S.K.Chakrabarti, Estimation and Effects of the mass outflow from shock compressed flow around compact objects,1999, *Astronomy and Astrophysics,* 351, 185.
2. B. Mukhopadhyay & S.K. Chakrabarti, 1999, Semi-analytical Solution of Dirac Equation in Schwarzschild Geometry, *Classical and Quantum Gravity,* 16, 3165.
3. T. Das & S.K. Chakrabarti, 1999, 'Computation of the Mass Outflow Rate from Neutron Star and Black Hole accretion disks', *Classical and Quantum Gravity,* 16(19), 3879.
4. S.K. Chakrabarti, 1999, "Latest trends in the study of accretion and outflows around compact objects", a Review Article in the Proceedings of 'Young Astrophysicists of Today's India', *Indian Journal of Physics*, 73B(6), 931.
5. S. G. Manickam & S.K. Chakrabarti, 1999, "On the nature of quasi-periodic oscillations in the black hole candidate GRS 1915+105", in Proceedings of 'Young Astrophysicists of Today's India', *Indian Journal of Physics*, 73B(6), 967.
6. S.K. Chakrabarti & S.G. Manickam, 2000, 'Discovery of a Correlation among QPO frequencies and Quiescence-state Duration in Black Hole Candidate GRS 1915+105', *Astrophysical Journal Letters,* 531, L41.

7. B. Mukhopadhyay & S.K. Chakrabarti, 2000, 'Nucleosynthesis in Accretion Flows Around Black Holes', *Astronomy & Astrophysics,* 353, 1029.
8. I.Chattopadhyay & S.K. Chakrabarti, 2000, 'Effects of Radiative Acceleration on Topologies of Outflows', 2000, *Int. J. Mod. Phys D,* 9(1), 57.
9. S.Chakrabarti & S.K. Chakrabarti, 2000, 'Can DNA bases be produced during molecular cloud collapse?' *Astronomy & Astrophysics Letters,* 354, L6—L8.

Edited proceedings

S.K. Chakrabarti (Guest-editor) Proceedings of the 'Young Scientists of Today's India', Indian Journal of Physics, 73B(6), 1999.

Papers published in proceedings

1. S.K. Chakrabarti, 1999, 'Latest trends in the study of accretion and outflows around compact objects', a Review Article in the Proceedings of 'Young Astrophysicists of Today's India', Indian Journal of Physics, 73B(6), 931.
2. S.G. Manickam & S.K. Chakrabarti, 1999, 'On the nature of quasi-periodic oscillations in the black hole candidate GRS 1915+105, in Proceedings of 'Young Astrophysicists of Today's India', Indian Journal of Physics, 73B(6), 967.

Scientific publications in newspapers/journals

'Berate Cholun Mahakashe',an invited article from 'The Anandabazar Patrika' (1.1.2000).

Invited seminars given at

- 'Identification of Astrophysical Black Holes' at Space Research Institute, Moscow (July 1999).
- 'Latest Trend in Black Hole Astrophysics', a Colloquium at the Indian Institute of Astrophysics, Bangalore (October 1999).
- 'Do Astrophysical black holes exist?', a Colloquium at the Saha Institute of Nuclear Physics, Calcutta (November 1999).
- 'Search for Astrophysical Black Holes', Physics Dept. Seminar at Delhi University (February 2000).
- 'Modern Developments in the Theory of Accretion Disks and Jets around Black Holes',TPSC Seminar at Tata Institute of Fundamental Research, Mumbai (February 2000).

Invited talks at conferences

1. 'Formation of Outflows from Accretion disks around Compact objects', a series of two lectures at the 3rd workshop of the International Centre for Relativistic Astrophysics, Pescara (July 1999).
2. 'Solution of Dirac Equation in Kerr Geometry' at 3rd workshop of the International Centre for Relativistic Astrophysics, Pescara (July 1999).
3. 'Gravitational Experiments Near a Black Hole' at the 'Gravitation Frontiers', a Symposium on 'Experimental Gravitation' held at Samarkhand State University, Uzbekistan (August 1999).
4. 'Advances in Radio Astronomy' at the Symposium on Millimeter and Microwave Technology, Institute of Radio Physics and Electronics (December 1999).
5. 'Our Universe' at the Space Science Symposium at RKMR College (March 2000).

Conferences attended

- '3rd workshop of the International Centre for Relativistic Astrophysics', Pescara (July 12th-21st, 1999).
- 'Gravitation Frontiers' at Samarkhand State University (August 16th-21st, 1999).
- Symposium on Millimeter and Microwave Technology, Institute of Radio Physics and Electronics (December 1999).
- 'National Space Science Symposium' at Toshali Sands, Puri (March 1st-4th, 2000).
- 'Space Science Symposium' at RKMR College (March 29th, 2000).

Membership of editorial boards of journals

Sub-Editor of Astrophysics Section of Indian Journal of Physics (continued since 1999).

Other scientific/educational projects

1. Half an hour interview of Prof. M. K. Dasgupta by S. K. Chakrabarti, AIR (April 1999).
2. 'A night too soon', a ten minutes interview broadcast in Doordarshan (August 1999).
3. Discussed my work in special section entitled 'Faces of Bengal' by Anandabazar Patrika (April 2000), in 'Career Guide' by Sananda magazine (June 2000), in

'Knowhow' by Telegraph newspaper, in 'Science Reporter' (March 2000), in 'Editorial' and 'In the News' by New Scientist (21.1.2000), cover story of Anandamela (February 2000) etc.

4. Supervising Mr. Tapas Kr. Das (SRF), Mr. Banibrata Mukhopadhyay (SRF), Mr. Indranil Chattopadhyay (SRF), Mr. Sivakumar Manickam (JRF, ISRO Project), Mr. Santabrata Das (JRF, DST Project), Mr. Anuj Nandi (JRF, DST Project) and Mr. Abhijit Bhattacharya (JRF, Jadavpur University; Co-supervisor : Dr. A. M. Basu).

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Biswajit Chakraborty

Current research interests and ongoing collaborations

Landau - Lifshitz model of ferromagnetism can be equivalently described by nonrelativistic CP^1 model. We consider the model obtained by gauging the global SU(2) group and adding a corresponding Chern-Simons term. We show that the model admits solitonic configurations, described by self dual equations, provided a suitably chosen triplet of background scalar fields is introduced. Unlike the ungauged CP^1 model, these solitons cannot be characterized by the second homotopy group any more(in collaboration with A.S.Majumdar).

Dirac quantization of CP^1 model coupled to the Hopf term using Batalin - Tyutin formalism, where the second class constraints are elevated to first class, is being carried out and possibility of any fractional spin at the quantum level is being investigated (with R.P.Malik and Subir Ghosh (ISI,Calcutta).

List of Publications for 1999-2000

1. Effects of gauging on symplectic structure, the Hopf term coupled to CP^1 model and fractional spin, B. Chakraborty and A. S. Majumdar, *Int. J. Mod. Phys.* A14 (1999) 1561.
2. A new type of duality symmetry in the theory of N-form Abelian fields, R. Banerjee and B. Chakraborty, *J.Phys. A: Math.Gen.* 32 (1999) 4441.
3. Solitons in a gauged Landau – Lifshitz model, B. Chakraborty and A.S. Majumdar, *Phys. Rev.* D61 (2000) 027702.

Organisational achievements

1. Was a member of the Local Organising Committee of the "Winter Institute on Foundations of Quantum Theory and Quantum Optics" held at SNBNCBS during 1-13 January 2000.
2. Was one of the conveners of the "Mini Workshop on Quantum Field Theory: Applications to Condensed Matter Physics" held at SNBNCBS during 13-14 March 2000.

Talks given at conferences

1. Gave a talk on "Solitonic configurations and fractional spin in variants of nonlinear sigma model" in the "Workshop on Current topics in Quantum Field Theory" held at Saha Institute of Nuclear Physics during 18th-22nd January 2000, as a part of its Golden Jubilee celebration.
2. Gave a talk on "Some studies involving Landau-Lifshitz model of Ferromagnetism" in the "Mini Workshop in Quantum Field Theory : Applications to Condensed Matter Physics", 14th March 2000 held at SNBNCBS.

Courses offered in the Centre : Gave one semester course on "Classical Mechanics and Field Theory" for Post M.Sc. students of the Centre.

Visit to other Institutes/Universities : Visited Physics Department, Assam University, Silchar for one month from 27th March 2000 onwards to offer a course on Radiation Theory for their M.Sc. students(4^{th} Semester).

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Ranjan Chaudhury

Current research interests and ongoing collaborations

My current research interests have been in the areas of superconductivity, magnetism, many-body Physics and statistical mechanics. Very recently my research interest has also grown in the field of biology interfaced with statistical mechanics.

I have constructed an effective field theory for anisotropic quantum Heisenberg model in the medium and short wave-length regime in collaboration with S. K. Paul (SNBNCBS). This is an extension of our previous work done in the long wave-length regime. This latest work was motivated by the apparent contradiction between the theoretical and experimental results for

2D Heisenberg antiferromagnet for S=1/2. Our present calculational results are in conformity with neutron scattering results for $La_2C_uO_{4,}$ showing the presence of topological excitations for ansiotropic Quantum Heisenberg antiferromagnet, even in 2D, in the short-wave-length regime. In collaboration with D. Gangopadhyay (SNBNCBS), S. K. Paul (SNBNCBS) and M. Mathur (SNBNCBS), I have been studying frustrated Heisenberg antiferromagnets using 'coherent state formalism'.

In collaboration with D. Gangopadhyay (SNBNCBS), I have been working on realization of Vander Warden's colouring theorem for real binary and ternary alloys with numerical inputs for various material parameters.

As a further extension of my collaborative work with B. K. Chakraverty (LEPES, CNRS, GRENOBLE, FRANCE), I have been looking at the problem of fermionic bound state formation in a pauli-blocked fermi sea in 2D in detail.

In collaboration with J. Chakrabarti (IACS), I have initiated an analysis of correlations within a DNA molecule.

Publications for the year 1999-2000

R. Chaudhury and S. K. Paul, (1999), "Possible Existence of Topological Excitations in Quantum Spin Models in Low Dimensions", Phys. Rev. B60, 6234.

Invited seminars

"Overview and some recent developments in High temperature Superconductivity", 22nd November, 1999, ISI.

Invited talks at conferences

"Interacting Fermions in Two Dimensions: Possible Instabilities", in the Miniworkshop on 'Quantum Field Theory : Application to Condensed Matter Physics' held at SNBNCBS during March 13-14, 2000.

Membership of organising committees of conferences

Member of Organising Committee for CMDAYS '99.

Other scientific/educational projects

1. Taught two courses in 2 terms for Post M.Sc. Students (1st Batch of Post M.Sc. Students) viz.:

   (a) "Path Integral Technique and applications to Quantum Mechanics and Quantum Statistical Mechanics" (jointly with S. K. Paul) in 1st term during August 1999-December 1999.

   (b) "An introduction to superconductivity and magnetism" in 2nd term during January–March 2000.

2. Supervising a post M. Sc. Student (Ms. Sumana Banerjee) for the project entitled "A Study of the possible role of Charge Transfer Processes in copper-oxide superconductors and other Transition Metal Oxides "during the 2nd and 3rd terms.

3. Supervised a summer student (Mr. Ashish Kundu from BHU) for six weeks (May-June, 2000).

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Rina Das

Under a project BRAILESCRIPT funded by Department of Electronics, a Braille Transcription System was developed by me and Professor P. K. Das and Professor A. Choudhuri of Computer Science & Engg. Department of Jadavpur University. This system automates the Braille translation by eliminating the need to have specialised knowledge of Braille transcription on the part of the operator. With this prototype, brought here from Jadavpur University we have started to produce some books in Braille for higher secondary students. The regional Braille Press at Narendrapur Ramkrishna Mission produces the books for West Bengal Secondary Education Board only. One social worker helped us selecting the books for class XI and B.A. Part I. One trained operator and two blind proof readers helped us in doing this. During these four months we have produced two books for Class XI and notes for B.A.(English) of Calcutta University and B.A.(Bengali) of Jadavpur University. This system was demonstrated before twenty blind students from various schools and colleges on Science Day, 28th February 2000. It was highly acclaimed by various TV channels and some newspapers.

The Minister-in-Charge of Higher Education, Government of West Bengal praised this effort and expressed his unequivocal support for setting up a Resource Centre in this Institute. He appreciated the need for setting up such a centre which would go a long way in alleviating the hardship the blind students pursuing higher education have to face because of severe shortage of Braille books and handouts.

The Department of Scientific and Industrial Research under Department of Science & Technology, Government of India has given a project to the Centre for producing the prototype at WEBEL Mediatronics Ltd. The Mass Education Department of West Bengal has been convinced to sanction funds to blind schools for purchasing this system. WEBEL Mediatronics wants us to certify the quality of these printers.

We have started imparting training to the resource teachers that opted for schools for integrated education and also to the special schools.We got financial sanction from Department of Science & Technology, Government of West Bengal. The Mass Education Department is also collaborating in this training programme.

We want to build this network of computers in a client/server environment with indigenous software packages and various peripherals and accessories. The basic objective of the project is to create the following facilities at the Resource Centre and the Nodal centers : preparations of test books, text papers, newspapers, journals, magazines etc. in Braille form at the Resource Centre for near-instantaneous dissemination of information. The information could be downloaded from the Resource Centre and printed locally at the Nodal Centre in Braille and converted into audio output thereby reducing the time of dissemination from the currently prevailing years and months to days and hours.

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S. Dattagupta

Current research interests and ongoing collaborations

- Magneto-Optic Piston Effect (MOPE) and Optical Hall Effect (OHE) [in collaboration with Prof. Rupamanjari Ghosh of JNU];
- Activated Escape Over Oscillating Barriers and Dynamical Symmetry Breaking [in collaboration with Prof. Subir Sarkar of JNU];
- Quantum Zeno Mechanism of C-Axis Transport in Oxide Superconductors [in collaboration with Dr. M. Sanjay Kumar of SNBNCBS and Prof. Narendra Kumar of RRI];
- Decoherence Effects in a Quantum Kubo Oscillator [work done with Dr. Gautam Gangopadhyay and Dr. M. Sanjay Kumar of SNBNCBS]; and
- Optical and Acoustic Phonon Frequencies and Damping in Manganites [work done with Prof. Ajay K. Sood and his group at I.I.Sc.].

- Also, writing a book (along with Prof. Sanjay Puri of JNU) on 'Dissipative Phenomena in Condensed Matter', contracted with Springer-Verlag, Heidelberg.

Talks given in 1999–2000

1. Inaugural talk at a Workshop of Jagadish Bose National Science Talent Search (JBNSTS) for North-East School children, *8th May 1999.*
2. Talk at Kumaun University, Garhwal on "A Model Quantum Magnet" during the mid-year meeting of the Indian National Science Academy, *14th May 1999.*
3. Inaugural talk at Indian Association of Physics Teachers (IAPT) at Presidency College, Calcutta, during the opening of a two-week long workshop on "Innovative Physics Experiments", for the final year B. Sc. Students, *1st June, 1999.*
4. Talk on "Magnetic Glass" at IUC-DAEF, Salt Lake, Calcutta, *1st July, 1999.*
5. Colloquium on "Magneto-Optic Piston Effect", at Institute of Physics, Bhubaneswar, *12th July 1999.*
6. Special Lecture on "Magneto-Optic Piston Effect" at the Mid-year meeting of the Indian Academy of Sciences, IISc., Bangalore, *17th July 1999.*
7. Talk on "Magneto-Optic Piston Effect" at Benaras Hindu University, Benaras as a visitor under the Theoretical Physics Seminar Circuit (TPSC) Programme, *24th July 1999.*
8. Special Lecture on "Quantum Phase Transition" at Institute of Physics, Bhubaneswar, during their Foundation Ceremony, *3rd September 2000.*
9. SNBC Colloquium on "QPT (Quantum Phase Transition)", *14th September 1999.*
10. Talk on "Magneto-Optic Piston Effect" at IIT-Kharagpur, *6th October 1999.*
11. Talk on "Quantum Phase Transition" at IIT-Kharagpur, *7th October 1999.*
12. Valedictory Lecture at Indian Science News Association held at the SINP(old) building, *18th November 1999.*
13. Talk on "Stern-Gerlach-Study of Magnetic Clusters" at the Conference on 'Electronic Structure and Materials Physics' at SNBNCBS, *21st November 1999.*
14. Talk on "Activated Rate Processes in a Strongly Modulated Potential" at a discussion meeting on Nonequilibrium Statistical Physics, at IISc., Bangalore, *25th November 1999.*

15. Lecture on "Neutron Scattering Study of Tunneling Centres", at a workshop on Scattering Methods in Condensed Matter, Orange County, Coorg, *1st December 1999.*

16. Talk on "Magneto–Optic Piston Effect" at IACS during the special symposium in honour of Prof. K. S. Krishnan, *5th December 1999.*

17. Inaugural lecture on "Activated Rate Processes", in an international conference on "Math-Modelling" at IIT Kharagpur, *9th December 1999.*

18. "Langevin Equation" at St. Xavier's College, for B.Sc. Honours Physics students, *11th December 1999.*

19. "Quantum Zeno Effect in C-axis Transport in Oxide Superconductors" at the Winter School on Foundations of Quantum Mechanics, Quantum Optics and Mesoscopic Phenomena, *10th January 2000.*

20. "Stochastic Processes in NMR : I & Stochastic Processes in NMR : II" at a Workshop in J. C. Bose Institute, *22nd & 25th February 2000.*

21. "Brownian Motion" at Academic Staff College, Calcutta University, *22nd March 2000.*

22. "How Science is organized in India" at Academic Staff College, Calcutta University, *23rd March 2000.*

List of Publications for 1999-2000

- Magneto-optic piston effect(with R. Ghosh and J. Singh),Physical Review Letters, 83, 710-713, 1999.
- A model magnetic glass, Indian Journal of Physics, 73(s), No. 1, 141-150, 1999.
- Optical Hall Effect (with J. Singh and R. Ghosh), Phys. Rev. A, 61, No. 2, 025402-025404, 2000.

Conferences attended

1. Foundation Day meeting at IOP, Bhubaneswar on "Current Trends in Physics", 1-4 September 1999;
2. The 26th General Assembly of the International Council of Scientific Unions (ICSU), Cairo, 25-30 September 1999;
3. Discussion meeting on "Recent Trends in Non-Equilibrium Statistical Physics", IISc., Bangalore, 15-25 November 1999;

4. Workshop on "Scattering Methods in Condensed Matter", at the Orange County, Coorg, 28th November – 3rd December, 1999;
5. K. S. Krishnan Symposium at IACS, 5–7 December 1999;
6. International conference on 'Mathematical Modelling', IIT–Kharagpur, 9–11 December, 1999.

Academic honours

1. Elected Fellow of the Third World Academy of Sciences (TWAS).
2. Elected Vice-President (1999-2000), International Affairs, Indian National Science Academy (INSA).

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Binayak Dutta Roy

Current research interests and ongoing collaborations

Towards a molecular level model of microscopic bubbles : Bubbles of nano-dimensions are conventionally invoked to describe the observed characteristics of position annihilation in liquids. An approach towards a molecular level description of this phenomenological concept has been developed to some extent by the Calcutta Pasitronium Group (comprising of Bichitra Ganguly, Debarshi Gangopadhyay, Tapas Mukherjee and B. Dutta Roy) in collaboration with Vsevelod Byakov and S. V. Stepanov of the Institute of Theoretical and Experimental Physics at Moscow.

A model for the temperature, pressure and solvent dependence of positronium acceptor reactions : Positronium reaction rates with weak acceptors leading to the formation of complexes are known to exhibit several intriguing features: non-monotonic temperature dependence, large variability with respect to different solvents, and anomalies in the response to external pressure at ambient temperature (large changes in some media and hardly any in others). The Calcutta Positronium Group have developed a semi-quantitative model to explain all these phenomena through the introduction of a novel concept of critical surface tension which unifies observations in diverse non-polar solvents at different temperatures and pressures.

Positronium nitrobenzene reactions in benzene as a solvent : The Calcutta Positronium Group together with R. L. Bhattacharya's group in Calcutta University have made an experimental and phenomenological study of this reaction which clarifies many of the contentious issues raised in the past.

1/N expansion for scattering **:** We have initiated a study to develop a new approximation scheme for non-relativistic potential scattering by effecting an expansion in powers of 1/N where N is the dimension of the space (Collaborator: Mahendra Sinha-Roy of Presidency College).

Model independent bounds on pion form factors in matter **:** Dispersion relations shall be used to obtain model independent bounds on pion form factors in matter. (Collaborators : Kumar S. Gupta, Saha Institute of Nuclear Physics and Abhee Dutt Majumder, Mc Gill University).

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Debashis Gangopadhyay

Current research interests and ongoing collaborations

Quantum Field Theory **:** I am investigating the lagrangian formulation of duality with my student Rajsekhar Bhattacharyya, CSIR-UGC-SRF, Jadavpur University. We have shown that, t Hooft's holographic principle has an analogue in length scales much larger than those of quantum gravity. This also leads to new classical solutions of Yang-Mills Theory. Applications of our method to other quantum field theories are presently being studied and new insights and results have already been obtained.

Statistical Mechanics/Condensed Matter and Field Theory **:** I am studying applications of the spin coherent state formalism to various spin models with Ranjan Chaudhury, Manu Mathur and S.K.Paul. Stereographic projections on to the z-plane have yielded interesting results. With Ranjan Chaudhury, I am also continuing the study of Van der Waerden's Colouring Theorem as regards its physical applications.

Gravitation/String Cosmology **:** I am investigating certain aspects of gravity from the perspective of spin networks and triangulation of random surfaces. I am investigating certain observational aspects of string cosmology in presence of space time torsion.

List of Publications for 1999-2000

D. Gangopadhyay and S.Sengupta (1999): "Duality Invariance of Cosmological Solutions with Torsion", *Int. Jour. Mod. Phys.* A14, 4953-4966.

Conferences attended

1. Participated in "International Conference on Gravitation and Cosmology (ICGC 2000)", IIT–Kharagpur, 4-7 January, 2000.
2. Participated in "Workshop on Current Topics in Quantum Field Theory", SINP Calcutta, 18-22 January, 2000.

Invited to seminars

1. "Homogeneity and Isotropy of Spacetime in Presence of Torsion", SINP, Calcutta, India, 1st September, 1999.

Other scientific/educational projects

Active participation in the JBNSTS programme.

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Gautam Gangopadhyay

Current research interests and ongoing collaborations

One of my main interests is in the theoretical studies of linear and nonlinear quantum optical systems. These studies consist of coherent and incoherent interaction between radiation and matter. In these cases spontaneous dissipation of energy and dephasing are an integral part of the problem.

I have a general interest in Chemical Physics. I have some working knowledge in reaction rate theory, Dynamical problems in molecular systems. Recently I am interested in spectroscopic aspects of molecular assemblies, namely, dendrimer super molecules and also on the cyclic reaction kinetics.

Effect of long-time correlated noise in spectroscopy : Based on system-bath models we have constructed the modified Bloch equation for colored bath. For colored bath a temperature dependent splitting on the spectral profile is obtained. This is exemplified through the transient linear absorption and in resonance fluorescence and weak field absorption of the driven system.

Molecular Processes : I have studied electronic and vibrational motion of a model molecular system. These studies will help to understand the dynamical aspects of driven, dissipative molecular systems and to study various transport phenomena of intra- and inter-molecular systems.

Absorption bandshape function of a model molecular system: We have given a generalization of the Glauber identity of displacement operators of harmonic oscillator to a similar identity of nonunitary generalized displacement operators, which is useful for dissipative quantum systems. A class of generating functions of Laguerre polynomials is derived. These generating functions are used to study molecular processes. We have studied the absorption bandshape function of a displaced oscillator model of a molecular system.

List of Publications for 1999-2000

1. G. Gangopadhyay, S. Ghoshal and Y. Tanimura (1999), "A thermal bath induced new resonances in linear and nonlinear spectra of a two-level system" *Chem. Phys.*, 242, 367.
2. G. Gangopadhyay, (1999), "An operator approach to the construction of generating function for the product of Laguerre polynomials: A thermal average band-shape function of a molecule", *J. Phys. A, Math. and Gen.*, 32, L441.

Lectures delivered

1. "Probing the dynamics of a molecular system through ultra fast spectroscopy" in the conference of "Recent Trends in Theoretical Chemistry" at the Chemistry Department, Jadavpur University, Calcutta, 24th March, 2000.
2. Delivered two courses at the Post-MSc. level on
   (a) Reaction Rate Theory (16 lectures); and
   (b) Theory of ultra fast molecular spectroscopy (32 lectures).

Conference attended

Attended the Winter School, SNBNCBS, January 2000.

Other scientific/educational projects

Member of the Local Organizing Committee of the one-day meeting on Biological Sciences, 16th March, 2000 at SNBNCBS.

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Partha Ghose

Research activities

My work on the possibility of distinguishing between standard quantum theory and de Broglie-Bohm theory continued. I have been able to establish a definite incompatibility between the two theories for a two-particle bosonic system going through a double-slit.This incompatibility appears only in time-ensembles but not in Gibbs ensembles. A realistic experiment using photon pairs generated by parametric down-conversion is under preparation. This work is being done in collaboration with Archan Majumdar of SNBNCBS, G. Introzzi of the Instito Nazionale di Fisica Nucleare, Pavia and M. Genovese of the Instituto Elettrotecnico Nazionale Galileo Ferraris, Torino, Italy. The experiment is likely to be done in Torino in autumn, 2000.

I have also partially completed my work on the possibility of quantum mechanics as a limiting case of classical mechanics in which decoherence plays a major role. Further work on the details of the mechanism of interaction with the environment in simple cases is in progress in collaboration with Manoj Samal of SNBNCBS.

List of Publications for 1999-2000

Books

1. *"Testing Quantum Mechanics on New Ground* ", published by Cambridge University Press, Cambridge, UK, April 1999.
2. *"Cosmic Quest",* published by Thema, January 2000.

Conferences attended

1. International Symposium "*The One and the Many*" organized by the Centre for Philosophy and Foundations of Science, India International Centre, New Delhi, 28-30 December 1999 (chaired one session).
2. International "*Winter Institute on Foundations of Quantum Theory and Quantum Optics",* SNBNCBS, January 2000 (acted as Chairman of the Local Organising Committee and chaired one session).

Invited talks

- *"On the history of Bose Statistics*" at the International Symposium "*The One and the Many*", New Delhi, December 29, 1999.

- "*An experiment to distinguishing between Broglie-Bohm and standard quantum mechanics*" at the "Winter Institute on Foundations of Quantum Theory and Quantum Optics", SNBNCBS, January 2000.

Awards and Honours

1. Elected Fellow (1999), National Academy of Sciences, India.
2. Awarded 'Indira Gandhi Prize for Popularization of Science (2000)' jointly with Prof. Yash Pal by INSA.

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Partha Guha

Current research interests and ongoing collaborations

It is known that the periodic Korteweg - de Vries (KdV) equations can be interpreted as the geodesic flow of the right invariant metric on the Bott-Virasoro group, which at the identity is given by the L^2-inner product. I extended this result to various extensions of the Bott-Virasoro group. In a series of papers I studied how different integrable systems can be interpreted as geodesics flows on these extensions.

If u_is are periodic function on the line, the operator $d^n/dx^n+u_{n-1}d^{n-1}/dx^{n-1}+ \ldots +u_0$, acting on periodic functions, is called a Adler-Gelfand-Dikii (or AGD) operator. I derived the KdV equation as an evolution equation of the AGD operator under the action of *Vect(S^1)*. The solutions of the AGD operator defines an immersion in homogeneous coordinates. I derived the Schwarzian KdV equation as an evolution equation of the solution curve. We also established a connection between the projective vector field, a vector field leaves fixed a given extended projective connection, and the C. Neumann system. I showed that certain quadratic function of a projective field satisfies the C. Neumann system.

I am exploring the amazing interconnections between classical invariant theory and transvectants, modular forms and Rankin-Cohen brackets and Hirota bilinear operators. The Hirota derivative has a natural interpretation as a partial intertwining operator in the representation theory of $sl(2,\mathbf{C})$ which allows its use in the generation of algebraic invariants.

With Dieter Mayer I am studying the multiple zeta function as applied to dynamical systems. This would lead to a natural generalization of dynamical zeta function.

List of Publications for 1999-2000

Refereed publications in journals books :

1. Tile t-functions of AKS hierarchy and twistor correspondences, Reviews in Mathematical Physics 11, 981-1000, 1999.
2. Quest for Universal Integrable Model (with Mikhail Olshanetsky), Journal of Nonlinear Mathematical Physics 6, no.3, 273-293, 1999.
3. Diffeomorphism, Periodic KdV and C. Neumann System, Differential Geometry and its Applications 12, 1-8, 2000.

Invited seminars given at

Oberseminar Differential geometrie: Fakultat fur Mathematik, Bielefeld. (2.2.2000); Diffeomorphisms of S^1, projective structure and integrable systems.

Informal seminar on Construction of Higher Categories via Ashtekar formalism (4.2.2000).

Awards and organisational achievements

(i) S. Chandrasekhar Memorial ICSC-World Laboratory award, 1998-2000.

(ii) Member of the International Association for Mathematical Physics.

(iii) Member of the Nonlinear Network (Australia).

Fellowships, associateships and visiting professorships awarded

1. Wissenschaftlicher Assistant of Professor Dieter Mayer, Mathematische Physik, Technische Universitat Clausthal. (1.4.99 – 31.5.99, resigned after that).
2. Guest Fellow, Institut des Hautes Etudes Scientifiques, 8.2.00 – 31.3.00.
3. Visiting Fellow, Fakultat fur Mathematik, Universitat Bielefeld, 24.1.00 – 7.2.00.

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M. Sanjay Kumar

Current research interests and ongoing collaborations

My general interest in the last few years has been in the areas of Quantum Optics and Non-equilibrium Statistical Mechanics. Since joining the Centre (in December 1999), I have been involved in the following problems :

Zeno Blocking of Interplanar Tunneling by Intraplane Inelastic Scattering in Oxide Superconductors - a Generalized Spin-Boson Analysis : It was proposed earlier that the observed temperature dependence of the c-axis resistivity of oxide superconductors can be understood as arising from the inhibition of electron transport along the c-axis due to in-plane incoherent inelastic scatterings suffered by the tagged electron [Kumar and Jayannavar, Phys. Rev. B45, 5001 (1992)]. In the above mentioned work it was assumed that each in-plane inelastic scattering event is like a measurement of which plane the electron is in, and this as in Quantum Zeno effect, leads to the suppression of interplane tunnelling; however the interaction Hamiltonian responsible for in-plane scattering was left unspecified. In the present work we have considered a specific form for the interaction Hamiltonian - the tagged electron is coupled to harmonic oscillator baths at adjacent planes (the baths at any two planes being uncorrelated) and is coupled also to the intraplane momentum-flip degree of freedom via the bath degrees of freedom. Thus it is the baths which are bringing about a coupling between the intraplane and interplane degrees of freedom. For simplicity we confine ourselves to dynamics in two adjacent planes and allow for the possibility of intraplane scattering leading to flipping between two momentum states only. In the case when the intraplane dynamics is absent, our model reduces effectively to the usual spin-boson model. We solve for the reduced tunnelling dynamics of the electron using a non-Markovian master equation approach. Our numerical results on the survival probability of the electron in the initial plane show that the intraplane momentum flips lead to further inhibition of the interplane tunneling over and above the inhibition effected by pure spin-boson dynamics. *(In collaboration with Prof. N. Kumar (RRI) and Prof. S. Dattagupta).*

Environment-induced Dissipationless Decoherence and Phase Diffusion : We have considered a model of environment-induced dissipationless decoherence where a quantum system is coupled to the bath via the system Hamiltonian itself. We have obtained an exact solution for the reduced density operator of the system for an arbitrary spectral density of the thermal bath and also written down an exact master equation in the Lindblad form. We compared and contrasted the above results with those obtained by considering the system frequencies to be randomly modulated. We observe that a coupling to the bath as above necessarily induces a Kerr-like coherent contribution to the reduced dynamics of the system. We have shown that this Kerr-like term gives rise to oscillations in the system observables that are a signature of the quantum nature of the bath and these cannot arise solely from randomly modulated system frequencies. We specialized our general results to the case of a harmonic oscillator, and motivated the analogy between dissipationless decoherence and phase diffusion.*(In collaboration with Dr. Gautam Gangopadhyay and Prof. S. Dattagupta).*

Conferences attended

Winter Institute on Foundations of Quantum Theory and Quantum Optics, SNBNCBS,1-13 January, 2000.

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Amitabha Lahiri

Current research interests and ongoing collaborations

An abelian gauge field coupled to an abelian two-form $B_{\mu\nu}$ through a $B \wedge F$ term acquires a mass, but there is no residual Higgs particle. If the Higgs boson (or anything similar) is never found in the real world, non-abelian extensions of such a theory can be considered as possible alternatives.

However, a non-abelian two-form does not have the same symmetries as its abelian cousin, and that makes construction of a theory notoriously difficult. Some time ago, I constructed an extension of the model which gives masses to non-abelian vector bosons. The inclusion of a non-dynamical auxiliary field restores the vector gauge symmetry which is present in the abelian model but absent in the naive non-abelian model. And there is no residual degree of freedom which looks like a Higgs boson.

I have constructed an algebraic proof of renormalizability of this model. Starting from a BRST construction, the most general quantum effective action obeying the corresponding quantum symmetries (not the same as the classical symmetries) as well as the known linear global symmetries can be found. It turns out to be the same as the tree-level gauge fixed action of the theory up to arbitrary numerical coefficients, leading to a rigorous proof of perturbative renormalizability. In particular, it follows that contrary to accepted wisdom, it is possible to construct a renormalizable, unitary theory of massive vector bosons in four dimensions without a residual Higgs boson. A similar statement was known in lower dimensions, but this is the first time a proof has been given in four dimensions.

Currently I am looking at the questions of asymptotic freedom and confinement, and of topological charges and non-perturbative states in this theory. I am also looking at the subtleties of applying the BFT method of converting second-class constraints into first-class ones in this theory. This last work is being done in collaboration with M. Sivakumar of Hyderabad Central University.

I have also finished writing an elementary textbook on Quantum Field Theory in collaboration with P. B. Pal of the Saha Institute of Nuclear Physics. This book is meant as a textbook for M.Sc. students. It will be published in the academic year 2000-01.

Invited talks to conferences

Invitations (accepted) to conferences

(i) *International Conference on Gravitation and Cosmology ICGC-2000*, 4-7 January 2000, Indian Institute of Technology, Kharagpur.

(ii) *Workshop on Current Topics in Quantum Field Theory*, 18-22 January 2000, Saha Institute of Nuclear Physics, Calcutta.

Membership of organising committees of conferences

- Member, Local Organizing Committee, ICGC-2000, 4-7 January 2000.
- Member, Local Organizing Committee, Workshop on Current Topics in Quantum Field Theory.
- Member, Local Organizing Committee, 15th SERC Main School on Theoretical High-Energy Physics, 14 February-4 March 2000, Saha Institute of Nuclear Physics, Calcutta.

Other scientific/educational projects

Taught a course on Quantum Field Theory (M.Sc. Part II, Optional Paper I) at the University of Calcutta.

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Archan S. Majumdar

Current research interests and ongoing collaborations

My research activity during this year has been focussed on the following topics which have been classified area-wise below :

Fundamental aspects of quantum theory and quantum optics: With P. Ghose of S. N. Bose National Centre I have started a joint theoretical-experimental project with G. Introzzi of Instituto Nazionale di Fisica Nucleare, Pavia, Italy, and M. Genovese of Instituto Electrotecnico Nazionale Galileo Ferraris, Torino, Italy. Ghose has demonstrated an incompatibility between the standard quantum theory and the de Broglie –Bohm model. We propose to test this incompatibility for photon trajectories based on a theoretical structure using the Kemmer-Duffin- Harishchandra formalism of electrodynamics. This formalism was

earlier used by Ghose and Home to develop a quantum theory for relativistic bosons. The experiment involves generation of entangled light beams by the process of parametric downconversion. Fourth order interference of two single photons is exhibited by the profile of their joint detection probability and this is to be measured by two separate and movable high efficiency photodetectors.

D. Home of Bose Institute and I are investigating the emergence of classicality in mesoscopic systems and bio-systems such as enzymes and collections of DNA molecules. Our preliminary results indicate that well-known extensions of quantum mechanics such as the environment induced decoherence scheme and also the dynamical collapse models fail to quantitatively explain certain aspects of the quantum to classical transition for such systems.

N. Nayak of S. N. Bose National Centre and I have been looking into the effects of Dicke cooperativity on three level systems such as the two-photon and two-atom micromasers. A key result is the enhancement of nonlinearities in these systems. We have also proposed an experimental test of Bell's inequalities using the single atom micromaser. This scheme obviates several difficulties of such tests using either photons or subatomic particles. Work is in progress on investigating the role of dissipation on entangled cavity-atom states and its effect on Bell's inequalities in a micromaser.

Gauge field theories in 2+1 dimensions : With B. Chakraborty of S. N. Bose National Centre I have continued our study of the symplectic structure of some variants of the *0*(3) nonlinear sigma model coupled to the Hopf and Chern-Simons terms in 2 + 1 dimensions. We have considered the gauged Landau-Lifshitz model with the CS term. We have found that this model admits self-dual topological solitons provided a suitably chosen triplet of background scalar fields is added.

Physics of the early universe : Further to my earlier work on implementing viable scenarios of extended inflation using Kaluza-Klein models, I have been pursuing the problem of generation of a time-dependent cosmological term, or "quintessence", in these models. Such a phenomenon is favored by current astrophysical observations. Calculations in the context of higher dimensional models seem to provide a justification for emergence of such a cosmological term, and will be reported in due course.

List of Publications for 1999-2000

Refereed publications in journals

(i) B. Chakraborty and A. S. Majumdar, (1999), "Effects of gauging on symplectic structure, the Hopf term coupled to the *CP*" model, and fractional spin', *Int. J. Mod. Phys.* A14, 1561.

(ii) D. Home and A. S. Majumdar, (1999), "On importance of the Bohmian approach for interpreting CP-violation experiments", *Foundations of Phys.* 30, 247.

(iii) B. Chakraborty and A. S. Majumdar, (2000), "Solitonic configurations and fractional spin in the gauged Landau-Lifshitz model", *Phys. Rev.* D61, 027702.

Conference proceedings

A.S. Majumdar, (1999), "Inflationary universe in Kaluza-Klein theories", *Ind. J. Phys.*73 B, 843.

Invited talks at conferences

(i) "Probing dynamical models of wave function collapse in the cosmological scenario", *8th U.K. Conference on Foundations of Physics,* Blackett Laboratory, Imperial College, London, 13-18 September, 1999.
Title of the talk: "Multiple Stationary States in a Sandpile Model".

(ii) "Micromaser dynamics: testing Bell's inequalities", Winter Institute on Foundations of Quantum Theory and Quantum Optics, SNBNCBS, Calcutta, 1-13 January, 2000.

Other conferences attended

(i) *EPS-11, Trends in Physics,* London, 6-10 September, 1999; presented a paper entitled "Inflation in higher dimensional gravity models".

(ii) *International Conference on Gravitation and Cosmology,* IIT-Kharagpur, 4-7 January, 2000.

(iii) *Workshop on Quantum Field Theory,* Saha Institute of Nuclear Physics, Calcutta, 18-22 January, 2000.

Organisational achievements

As member of local organising committee, I played an active role in planning and functioning of the "Winter Institute on Foundations of Quantum Theory and Quantum Optics" held at SNBNCBS, Calcutta from 1-13 January, 2000, with about a hundred participants including forty invited speakers and twenty foreign participants.

Joint projects held with other centers : Prof. Partha Ghose and I have started a collaborative project with Dr. G. Introzzi of Instituto Nazionale di Fisica Nucleare, Pavia, Italy, and Dr. M. Genovese of Instituto Elettrotecnico Nazionale Galileo Ferraris, Torino, Italy on a proposed experimental test of the de Broglie - Bohm quantum theory. The theoretical formulation and simulation is in progress, and actual experimental runs are to begin in a few months.

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Rudra Prakash Malik

Current research interests and ongoing collaborations

BRST cohomology and Hodge decomposition theorem have been discussed for the two (1+1) dimensional free Abelian as well as non-Abelian (having no interaction with matter fields) gauge theories in the language of symmetry properties of the Lagrangian density. Exploiting these ideas, the topological nature of these theories has been established. These new topological field theories capture some of the key features of the Witten as well as Schwarz type of topological field theories. Two sets of topological invariants have been obtained which are related to each other by a duality transformation. Further work in this direction is in progress.

Exploiting the improved Batalin-Fradkin-Tyutin (BFT) method, we are carrying out the quantization of a three (2 + 1) dimensional CP^{N-1} model coupled to the Hopf term and looking into the possibility of existence of any fractional spin (with B. Chakraborty, SNBNCBS, Calcutta and S. Ghosh, ISI, Calcutta). This model is a nontrivial example of a physical system where BFT method can be applied.

Hodge decomposition theorem for the Abelian 2-form gauge theory in four (3+1) dimensions has been found out in collaboration with E. Harikumar and M. Sivakumar of University of Hyderabad. More work is in progress for the non-Abelian 2-form gauge theory. These are the field theoretical models for the Hodge theory.

Application of quantum groups to physical systems and the derivation of the relevant q-deformed calculi are the topics of collaboration with G. Rajasekaran and A. K. Mishra of IMSc., Chennai. In our formulation of the q-deformed dynamics, Lorentz as well as quantum group invariances are maintained together.

List of Publications for 1999-2000

Refereed journals

- Topological features in non-Abelian gauge theory, R. P. Malik, *Mod. Phys. Lett.* A 14 (1999), 1937-1949.
- Cohomological aspects of Abelian gauge theory, R. P. Malik, *J. Phys. A: Math Gen* 33 (2000), 2437- 2446.
- BRST cohomology and Hodge decomposition theorem, R.P. Malik, *Int. J. Mod. Phys.* A 15 (2000), 1685-1705.

Talks given at conferences

1. Gave an invited talk at Institute of Physics, Bhubaneswar on the occasion of it's Silver Jubilee Celebrations on 4th September 1999.
2. Gave an invited talk at University of Hyderabad in a workshop on "Dynamical systems: Modern developments" on 4th November 1999.

Visits to other institutes/universities

Gave TPSC talks at BHU Varanasi, IIT-Kanpur and Delhi University.

Seminars in Calcutta

Gave seminars at SNBNCBS (5th May 1999) and SINP (10th May 1999).

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Kalyan Mandal

Current research interests and on going collaborations

The study of magnetic properties of amorphous magnetic materials : Very recently large change in magnetoimpedance, called giant magnetoimpedance(GMI), has been discovered in different kinds of amorphous magnetic materials. I have started working on GMI of amorphous wires and microwires in collaboration with the researchers of Instituto de Magnetismo Aplicado, Madrid, Spain. With the help of the same research group, I have developed stress induced anisotropy in amorphous magnetic thin films prepared by radio-frequency magnetron sputtering unit.

Investigation of magnetic Barkhausen noise (MBN) and magnetic flux leakage (MFL) signals from ferromagnetic steel : I have been studying MBN and MFL signals from single and dual easy axis ferromagnetic steel. My collaborators for this work are Professor D. L. Atherton of Queen's University, Canada and Dr. T. W. Krause of AECL, Canada. We have developed a theoretical model for MBN. We have also used MBN to detect stress concentration around different shaped defects.

The study of ferrite nanoparticles : I have prepared (Mn-Zn) – ferrite nanoparticles in a silicon matrix by sol-gel method. The sample has been characterized by X-ray diffraction and transmission electron microscope. The magnetic properties studied by a vibrating sample magnetometer and Mössbaver spectroscopy indicate the superparamagnetic behaviour when the particle size is around 10nm.

List of Publications for 1999-2000

In journals

- K. Mandal, D. Dufour, D. L. Atherton, 1999, "Use of magnetic Barkhausen noise and magnetic flux leakage signals for analysis of defects in pipeline steels", IEEE Transaction on Magnetics, *35, 2007-2017.*
- T. W. Krause, K. Mandal, D. L. Atherton, 1999, "Modeling of magnetic Barkhausen noise in single and dual easy axis system in steel", Journal of Magnetism and Magnetic Materials, *195, 193-205.*
- K. Mandal, Th. Cramer and D. L. Atherton, 2000, "The study of a racetrack-shaped defect in ferro magnetic steel by magnetic Barkhausen noise and flux leakage measurements", Journal of Magnetism and Magnetic Materials, *212, 231-239.*

In conference proceedings

1. K. Mandal, M. Tena, F. J. Castano, D. Gracia, M. Vazquez, A. Hernando, 2000, "The stress induced anisotropy in amorphous magnetic thin films", in Proceedings of "INTERMAG-2000" held at Toronto, Canada, paper no.-AR02.
2. K. Mandal, S.Puerta, M. Vazquez, A. Hernando, 2000, "The frequency and stress dependence of giant magneto impedance in amorphous microwires", in Proceedings of "INTERMAG-2000" held in Toranto, Canada, paper no.-HD 05.

Invited seminars given

1. "The effect of stress and annealing on the magnetic properties of amorphous magnetic materials" at Instituto de Magnetismo Aplicado, Madrid, Spain, May 20, 1999.
2. "The giant magneto impedance effect in amorphous magnetic materials", at Instituto de Magnetismo Aplicado, Madrid, Spain, November 16, 1999.

Visits to academic institutions

I visited Instituto de Magnetismo Aplicado, Madrid, Spain as a visiting scientist for one year, from April 1999 to March 2000.

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Subhrangshu Sekhar Manna

Current research interests and ongoing collaborations

- It has been observed that a directed critical slope sandpile model has more than one stationary state, depending on the initial profile to start with, when grains are dropped into the system only at the top.
- An MD code is being written to study the micro size liquid drops. We aim to modify this code to study a bubble within a liquid as a bubble model of positronium. Collaborators: B. Dutta Roy, B. Ganguly, D. Gangopadhyay.
- Lateral motion of strings in a dense environment is being studied to model diffusion of polymers in melts. This model is giving interesting results for growth of vicinal surfaces. Collaborator: D.Dhar.
- Fractal and conductivity properties of a rock model by a mixture of random disposition and ballistic deposition processes are being studed. Collaborators : S.Tarafdar and T. Dutta.

List of Publications for 1999-2000

Refereed publications in journals/books

1. *Critical States in a Dissipative Sandpile Model,* S.S. Manna, A.D. Chakrabarti and R. Cafiero, Phys.Rev. E., 60, R5005(1999).
2. *Sandpile Models of Self-Organized Criticality,* S.S. Manna, Current Science, 77, 388(1999).
3. *Externally Driven Granular Systems,* S.S. Manna, Physica A, 270, 105 (1999).
4. *Self-structuring of Granular Media under Internal Avalanching,* S. Krishnmamurthy, V. Loreto, H.J. Herrmann, S.S. Manna and S. Roux, Phys. Rev. Lett. 83, 304 (1999).
5. *Intermittent Granular Flow and Clogging with Internal Avalanches,* S.S. Manna and H. J. Herrmann, Euro. Jour. Phys., E, 1, 341-344 (2000).
6. *Irreversible Random Walks and Percolation Perimeters*, S.S. Manna in *Percolation Theory and Particle Systems* ed. Rahul Roy, Universities Press (India) Ltd., Indian Academy of Sciences (2000).

Invited talks at conferences

- Discussion Meeting on "Recent Trends in Non equilibrium Statistical Physics", Indian Institute of Science, Bangalore, 15-25 November, 1999.Title of the talk: "Multiple Stationary States in a Sandpile Model".
- International Conference on "Self-Organized Criticality and Phase Transitions in Driven Systems", International Centre for Theoretical Physics, Trieste, Italy, 1-4 March, 2000. Title of the Talk : "Multiple Stationery State in a Sandpile Model."
- National Workshop on "Slow Dynamics and Freezing in Condensed Matter", School of Physical Sciences, Jawaharlal Nehru University, New Delhi, 9-10 March, 2000. Title of the talk: "Exploring Self-Organized Criticality in a Granular Medium".

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Manu Mathur

Current research interests and ongoing collaborations

I am studying the SU(N) confinement problem by gauge invariant abelian projection. The consequences of SU(N) Dirac quantisation condition on confinement and the connection between SU(N) gauge theories with $U(1)^{N-1}$ abelian lattice gauge theory coupled to electric charges are being studied in detail.

I am studying the path integral approach to the partition function of the SU(3) Heisenberg spin chain by using the SU(3) coherent states. This problem has been studied only for the completely symmetric representations of SU(3). This coherent state method is being generalised to include arbitrary representations of SU(3).

List of Publications for 1999-2000

Refereed publications in journals/books

Manu Mathur, Rajiv V. Gavai "Z2 Monopoles, Vortices and the Universality of the SU(2) Deconfinement Transition" Phys. Lett. B 458 (1999) 331.

Invited seminars given at

Department of Physics, University of Pisa on "Abelianisation of SU(N) Gauge Theories with Gauge Invariant Dynamical Variables and magnetic Monopoles" (July 1999) and at Dublin Institute of Advanced Studies, Ireland (July 1999).

Visited Dublin Institute of Advanced Studies, Ireland (5-12 July, 1999).

Visited Department of Physics, University of Pisa, Italy (13-24 July, 1999).

Invited talks at conferences

Gauge Invariant Abelian Projection and Magnetic Monopoles in SU(N) Gauge Theories,at XVII International Symposium on Lattice Field Theory (Lattice 99) held at Pisa, Italy.

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Anita Mehta

Current research interests and ongoing collaborations

The focus of my research interests is that of complex systems : my current search in this context concerns traffic flow, models of societal learning, and importantly, the physics of granular materials on which I have specialized over the last decade. Most recently I have applied myself to the study of generalized surfaces and interfaces, with particular reference to epitaxial growth.

The physics of granular media : Following the formulation and analysis of coupled nonlinear stochastic equations via a two-species model (of intercluster and intracluster granular relaxation) to describe the dynamical evolution of sandpile surfaces, I am examining (in collaboration with **Gary Barker at the Institute of Food Research, Norwich, England)** the smoothing of sandpile surfaces induced by avalanches, using a disordered cellular automaton approach that we pioneered some years ago. Ongoing work on granular media includes collaborations on compaction (where Gary Barker and I were the first to predict the so-called 'reversible branch' of compaction in shaken powders, which was subsequently seen in experiments at the University of Chicago) where we are studying the irreversible-reversible transition; additionally we are formulating a new approach to inhomogeneous consolidation via density waves. I am also collaborating with Gary Barker and **Edmund Nowak, of the University of Delaware, USA on** time-series analysis of density fluctuations in tapped granular media. I am involved in a collaboration with **Mariano Lopez de Haro of the Centro de Investigacion en Energia, Cuarnavaca, Mexico** to look at fundamental aspects of Edwards' compactivity parameter. I was commissioned by **Cambridge University Press** to write a monograph on the subject of granular media, following the recommendations of several major scientists in the field.

Other collaborations

Models of societal learning and coarsening phenomena : I have formulated models of societal learning based on game-theoretic concepts, in an ongoing collaboration with Jean Marc Luck of the Service de Physique Theorique, Saclay, France. Our analysis of the resultant phase diagram has important implications for slow dynamics in coarsening.

Traffic flow : This project, being done in collaboration with Antonio del Rio of the Centro de Investigacion en Energia, Cuarnavaca, Mexico involves the investigation of traffic flow in open systems; we are looking at the nature of the 'jamming' transition in these systems, as well as investigating useful analogies with my earlier work on granular flow.

List of Publications for 1999-2000

Refereed publications in journals/books

(i) "Smoothing of sandpiles after avalanche propagation", Anita Mehta, in *Structure and Dynamics of Materials in the Mesosco pie Domain,* eds. M. Lal, R.A. Mashelkar, B.D. Kulkarni and V.M. Naik (Imperial College Press and the Royal Society, London, 1999), pp 340-352.

(ii) "Models of competitive learning: complex dynamics, intermittent conversions and oscillatory coarsening", Anita Mehta and Jean-Marc Luck, *Physical Review E 60,* 5218-5230 (1999).

(iii) 'A two-species model for aeolian sand ripples', Rebecca Hoyle and Anita Mehta, *Physical Review Letters,* 83, 5170 (1999).

Scientific publications in newspapers/journals

(i) "Maths, the universe and fried-egg theory", Anita Mehta, *The Times Higher Educational Supplement,* p 23, (London, 30 July 1999) (book review).

(ii) Book review commissioned by *The Times Higher Educational Supplement* (London, 2000)

Invited seminars given at

(i) Ecole Normale Superieure, Paris (26 September 1999).

(ii) University of Vienna, Vienna (5 October 1999).

(iii) International Centre of Theoretical Physics, Trieste (7 October 1999).

(iv) Raman Research Institute, Bangalore (18 November 1999).

(v) Centre for Mathematical Modelling and Computer Simulations, Bangalore (19 November 1999).

(vi) Indian Institute of Management, Calcutta, (17 January 2000).

(vii) S. N. Bose National Centre, Calcutta (15 February 2000).

Invited talks at conferences

Invitations (accepted) to conferences

(i) "Miniworkshop on Nonlinearity" organized by the Department of Mathematics, Calcutta University (1999).

(ii) Workshop on "Nonequilibrium systems at International Centre of Theoretical Physics", Trieste (26 August 1999).

(iii) International Conference on "Recent Directions in Nonequilibrium Physics" at Indian Institute of Science, Bangalore (November 1999).

(iv) Mini-workshop on "Growth Models" at S. N. Bose National Centre, Calcutta (2-3 February 2000).

(v) Workshop on "Slow Dynamics and Freezing in Condensed Matter Systems" at Jawaharlal Nehru University, New Delhi (9-10 March 2000).

(vi) Short course on 'History, Science and Society in the Indian Context', The Asiatic Society, Calcutta (6-23 March 2000).

Awards and organizational achievements

Fellowships, associateships and visiting professorships awarded

(i) Speaker for the Theoretical Physics Seminar Circuit, India (2000-2002).

(ii) Senior Associate of the Centre for Mathematical Modelling and Computer Simulations, Bangalore (1997-2000).

(iii) Awarded Associateship of the International Centre of Theoretical Physics, Trieste, Italy (1998-2004).

Membership of editorial boards of journals

Member of Board of Editors for Granular Matter, Springer-Verlag, Heidelberg (1997-2000).

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Anilesh Mohari

Current research interests and ongoing collaborations

My interest has been on non-commutative probability theory, in particular investigation on information gain by a quantum measurement, which need not be von-Neumann's simple measurement. We introduce a Shannon type of information associated with a general class of quantum measurement. Along with other properties, the information is sub-additive in case of repeated measurements. This concept is very closely related with dynamical entropy of an automorphism and allowed us to develop a non-commutative Kolmogorov-Sinai theory from Araki's relative entropy. Further investigation in this direction is going on to compute dynamical entropy for a Hamiltonian dynamics.

List of Publications for 1999-2000

L. Accardi and A. Mohari, Time reflected Markov processes, Infinite dimensional Analysis and QP, vol. 2, no-3, pp 397-426, September 1999,World Scientific.

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Abhijit Mookerjee

Current research interests and ongoing collaborations

Magnetic Alloys : Our Physics of Materials group had been using the TB-LMTO-ASR developed by us to study the magnetic properties of various magnetic/non-magnetic alloys. This work was being carried out with Subhradip Ghosh and Chhanda Basu Choudhury, SRFs of the Centre. Some of the theoretical work has been done parallel to experiments being carried out by P. K. Mukhopadhyay of our Centre.

Transition Metal Clusters : The joint project with the University of Warwick, England studied the dynamics of the absorption of O and –OH in transition metal clusters using parametrized and first-principles LMTO molecular dynamics. This was done in collaboration with Anindajiban Bhattacharyya, Research Fellow at the Centre, Sugata Mukherjee and A. K. Bhattacharyya of the University of Warwick.

The First Principles Hubbard Model : In collaboration with Tanusri Saha-Dasgupta I have been developing a dynamical coherent potential approximation to study the Hubbard model. The aim is to put this technique with the first principles LDA+U technique developed in the group of Prof. O.K. Anderson, MPI, Stuttgart. The aim is to apply this to study the optical properties of strongly correlated Vanadates. Prof. D.D. Sarma and his group at IISc. Bangalore, are carrying out the parallel experiments.

List of Publications for 1999-2000

1. "Growth and Electronic Structure of rough overlayers", A. Mookerjee, B. Sanyal and A. Mehta, *Physica* A 270, 143 (1999).
2. "TBLMTO-recursion: a tractable representation", S. Ghosh, N. Das and A. Mookerjee, *Int. J. Mod.* Phys., B 13, 723 (1999).
3. "Observation of large change of 7Be decay rate in Au and Al_20_3 and its implications", A. Ray, P. Das, S. K. Saha, B. Sethi, A. Mookerjee, C. Basu Chaudhury and G. Pari, *Phys. Lett.* B 455, 69 (1999).
4. "Structural and Optical Properties of SiTiO_3", S. Saha, T. P. Sinha and A.Mookerjee, *J. Phys. Cond. Matter* 12, 3325 (2000).
5. "High Pressure Studies of MgTe using first principles electronic structure calculations", C.Basu Chaudhury, G. Pari and A. Mookerjee, *Phys. Rev.* B 60, 11846 (1999).
6. "Magnetic properties of disordered CoCu alloys: a theoretical study ", S. Ghosh and A. Mookerjee, *J. Mag. Materials* 214, 291 (2000).

Conferences and seminars attended

1. 1st Regional Conference on "Magnetic and Super conducting Materials" held in Sharif University, Tehran, Iran between 27-30 September 1999.
   a. Invited talk on "Electronic and Magnetic Structure of Random Magnetic Alloys".
   b. Contributed paper on "Growth mechanism and magnetism in Rough Surfaces" with A.Mehta and B. Sanyal.
2. Conference on "Condensed Matter Physics (SCMP '99)" held in IACS, Calcutta between 4-6 December, 1999. Invited talk on "First Principles study of Alloys and their Phase Stabilities".
3. Seminar on "Frontier Research in Materials" given in the Physics Department, University of Pune, Pune, September 1999.
4. SERC School on "Electronic Structure of Metals and Alloys" held in the S. N. Bose National Centre during November 1-15, 1999. Three lectures on "Configuration averaging and the Augmented Space Method".
5. Conference on "Physics of Materials" held in S. N. Bose National Centre during November 18-19, 1999. Talk on "Recursion Method and Response Functions".
6. Mini Conference on "Nano Materials" held in S. N. Bose National Centre during January 2000. Talk on "Transition Metal Clusters".

Thesis examined

Thesis examiner of Rajendra Zope (Ph. D. student of Prof. P. V. Panat) of the University of Pune (September 1999).

Membership of editorial board of journals

1. Editor of the International Journal of Modern Physics B and Modern Physics Letters B, World Scientific, Singapore.
2. Editor of the Indian Journal of Physics, Calcutta.

Membership of organization committees of conferences

1. Member of the International Advisory Committee of the "1st Regional Conference on Magnetism and Superconductivity" held in Tehran, Iran.
2. School Director of the SERC School on "Electronic Structure of Metal and Alloys" held in the S. N. Bose National Centre.
3. Convener of the Conference on "Physics of Materials" held in the S. N. Bose National Centre.
4. Co-Convener of the Mini-Conference on "Nano Materials" held in the S. N. Bose National Centre.

Joint projects with other centres

1. Project of "Electronic Structure of transition metal clusters" with Prof. A. K. Bhattacharyya, Center for Catalysis and Materials Research, University of Warwick, England, funded by the University of Warwick, England.
2. Network project on "Electronic Structure of Metals and Alloys" with Professor Mesbahuddin Ahmed, University of Dhaka, funded by ICTP, Trieste, Italy.

Academic administration

Dean, Academic Programme of the S. N. Bose National Centre for Basic Sciences.

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S. Mukherjee

Current research interests and ongoing collaborations

My current research interests lie in the area of first-principles total-energy and electronic structure calculations, based on local density—functional theory and non local pseudopotentials and also using semi-empirical linear-combination-of-atomic-orbital (LCAO) methods and their application in atomic clusters, molecules and in extended non—periodic systems, like fullerenes. I am also interested in surface physics and in surface and bulk electronic properties of metal alloys.

Orthogonal tight-binding molecular dynamics simulation of silicon clusters have been carried out in collaboration with B.K. Panda and S.N. Behera of IOP, Bhubaneswar. Using this method groundstate properties of Si_n(n = 2-10) were obtained. The calculated cohesive energy, structure, polarizability etc. were found in agreement with ab-initio results. Currently this method is being used to calculate electronic properties of larger clusters.

In another collaboration with A. Mookerjee and A. Bhattacharya, a model for calculating chemisorption of oxygen atoms with transition-metal clusters has been proposed. Calculations suggest that oxygen atoms prefer to chemisorb onto the high coordination sites of the cluster surface. With increasing oxygen coverage the oxygen atoms penetrate the surface and the oxidation of the cluster surface starts.

List of Publications for 1999-2000

"Structure and Properties of Atomic Clusters", by S. Mukherjee, in *Trends in Atomic and Molecular Physics,* Ed. K.K. Sud and S.N. Upadhyay (Kluwer Academic/Plenum Publisher, New York, 2000), pp 35-57.

Invited talks at conferences

(i) Structural information of Clusters from Reactivity studies, presented at *Physics of Materials*, SNBNCBS, November 1999.

(ii) Electronic properties of semiconductor microclusters, presented at *Workshop on Physics at the Nanoscale,* SNBNCBS, March 2000.

Talks given elsewhere

(i) Structure and properties of atomic clusters, given at Institute of Physics, Bhubaneswar, May 1999.

(ii) Electronic structure of atomic clusters, given at Banaras Hindu University, January 2000.

Courses given

(i) Molecular Dynamics methods in Electronic structure calculations, course given at SERC School on Electronic Structure and Physics of Materials, SNBNCBS, November 1999.

(ii) Molecular Dynamics simulation methods in Condensed matter, a course given to the Post-M.Sc. students during January-March 2000.

Summer-students project

Miss Indrani Banerjee (M.Sc. student from Pune University) did a project entitled "Examination of Icosahedral and Cubooctahedral structures as models of atomic clusters" under my guidance during June-July 1999.

Membership of organizing committees/conferences

Member (co-opted) of executive committee of Indian Society of Atomic and Molecular Physics.

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P. K. Mukhopadhyay

Current research interests and ongoing collaborations

- With a group at Osmania University, and in collaboration with IUC-DAEF, Calcutta Centre, a joint work on oxide CMR materials has been initiated and is going on. Under this program, a student from the Osmania University visited the Calcutta centres for measurements.
- Since the vibrating reed apparatus was installed, various institutes got interested in it. A group at IACS and another at SINP had already sent their samples/substrates. A group at the Department of Physics in the El-Mania University, Egypt also sent some samples for measurements.

Conferences attended

1. Condensed Matter Days, Jadavpur University, Calcutta, 26-28 August, 1999.

2. Birth centenary celebration of Prof K.S. Krishnan Symposium on Condensed Matter Physics (SCMS-'99), I.A.C.S, Calcutta, December 4-6,1999.
3. Discussion meeting on Materials Research using Accelerator Facilities, Saha Institute of Nuclear Physics, Calcutta, December 7-9, 1999.
4. DAE Solid State Physics Symposium, Kalpakkam, December 20-24, 1999.

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Nilakantha Nayak

Current research interests and ongoing collaborations

My research interests concern Quantum Optics and Laser Physics. For the last few years, I have been emphasizing on cavity quantum electrodynamics in my investigations. There have been growing interest in the cavity QED due to possibilities of verification of its results in the micromaser and microlaser. Primarily, the device consists of a single-mode superconducting microwave cavity cooled down to sub-Kelvin temperatures into which atoms are pumped at such a rate that at most one atom is present there at anytime. The important factors in such arrangements are to have uniform atom-field coupling strength and its duration of interaction. Such setups, now in operation at the Max-Planck Institute, Munich and in MIT, are closely related to my approach in the investigation of the system. My work on micromaser reproduced the experimental results to a very good accuracy. It further pointed out the difficulties in generating number (Fock) states of the cavity field, known as trapped states in the literature, in the existing setup. Earlier investigations by other research groups predicted the existence of these trapped states. However, our analysis suggested changes in the ongoing experimental setup in order to observe these trapped states. We have also investigated the optical counterpart of the micromaser, the microlaser. At optical frequencies, the spontaneous decay of the lasing levels is important. We have included the reservoir induced interactions in our study and have derived an expression for the photon statistics of the cavity radiation field. We have studied the threshold characteristics of laser action and have shown that the field can be nonclassical in nature away from laser thresholds.

One important outcome of our study on micromaser is that there is close link between laser and micromaser theories. In fact, they can be put in a single framework and the relative strengths of the cavity field and atomic decays and atom-field coupling decide the laser, micromaser and microlaser actions.

In collaboration with V. Bartzis (Greece) and A. S. Majumdar (SNBNCBS), we have completed the investigation involving a micromaser model in which atoms are pumped in pairs. In other words, each time a pair of atoms enter the cavity and exit from there to-gether. The Dicke cooperative nature in the interaction of a collection of atoms with the radiation field plays an important role in the micromaser action. The Dicke superradiance makes the threshold requirements less compared to the conventional micromaser. The model is also capable of describing a two-photon micromaser (atom emitting two photons while jumping from upper to lower level via an intermediate level) which has been demonstrated at the Ecole Politechnique, Paris.

Recently, the availability of laser-cooled atoms has opened interesting and challenging problems in cavity-QED using cold atoms. An important factor in these studies is the quantum nature of the kinetic energy of the moving atoms. I have started studying cavity-QED and micromaser action using cold atoms.

The micromaser, described above, can be used to study the foundations of quantum mechanics. In collaboration with A. S. Majumdar (SNBNCBS), we are now investigating the violations of Bell's inequality in the micromaser as well as the microlaser. We find that dissipative effects accompanying the micromaser as well as the microlaser dynamics decide the possibilities of observing this violation. This work is in the final stage of investigation.

In addition, we have initiated the study of laser action in a novel system, the so-called photonic band gap materials, an optical analog of semiconductors. Because of its band structures in the allowed modes of frequencies of optical radiation, the emission probabilities of atoms change drastically. We have incorporated these aspects in our analysis and we are now studying conditions for thresholdless lasing to occur.

Conferences attended

1. Conference on "Physics of Materials" at the SNBNCBS (November 23-24,1999).
2. Winter Institute on "Foundations of Quantum Theory and Quantum Optics" at the SNBNCBS (January 1-13, 2000).
3. National Seminar on "Physics with Cold Atoms" at the Indian Association for the Cultivation of Science, Calcutta (February 25-26, 2000).

Invited lectures given

1. "Lasers micromasers and microlasers" at the Department of Physics, IIT, Kanpur (March 2000).

2. "Simulation of micromaser dynamics" at the Department of Physics, IIT, Kanpur (March 2000).
3. " Lasers, Micromasers and Microlasers" at the Department of Physics, BHU, Varanasi (March 2000).

Invited lectures at conferences

"Probing the foundations of quantum theory with micromaser: micromaser dynamics" at the Winter Institute on Foundations of Quantum Theory and Quantum Optics at the SNBNCBS (January 2000).

Membership of editorial boards of journals

Associate Editor (Honorary) of the Indian Journal of Physics for two years,1999 and 2000.

Organizational achievements

1. Convener of the national committee of the Theoretical Physics Seminar Circuit (TPSC), India since 1995.
2. Acting Administrative Officer of the SNBNCBS for six months starting May 1999.

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Samir K. Paul

Current research interests and ongoing collaborations

Ising model (in presence of magnetic field) on open Fibonacci chain is studied. Trace mapping on closed Fibonacci chain is shown to exist whereas for open chain the mapping ceases to exist. For zero magnetic field, however, trace mapping exists on the open chain. Existence of a special point on each open Fibonacci chain is shown analytically. Since the topology around this point remains unaltered we can perform block-spin transformations through a special series of transformations. Though there is no critical point in this case the transformations can be carried out analytically. This preserves nearest neighbour interactions (topology preserving transformation). Special case is the open Ising model on a uniform chain. This work is being done in collaboration with Susanta Bhattacharya (RS College, Howrah).

Possibility of the topological excitations in anisotropic quantum Heisenberg model in one and two dimensions is studied taking into account lowest order correction to long wave length limit. This analysis is implied in the medium 'q' regime. The most interesting feature is the existence of Wess-Zumino like term as a topological term in the two dimensional antiferromagnets. We make a possible comparison of our results with avilable neutron scattering experimental data. The work is being done in collaboration with Ranjan Chaudhury (SNBNCBS).

List of Publications for 1999-2000

Possible existence of topological excitations in quantum spin models in low dimensions", Ranjan Chaudhury and Samir K. Paul, PRB 60 (1999) 6234.

Invited talks at conferences

1. Talk given on the "Algebraic formulation of two dimensional turbulence", in Current Trends in Physics at Institute of Physics, Bhubaneswar during September 1-3,1999.
2. Talk given on "Path integral approach to the existence of topological excitations in quantum spin models in low dimensions" in the Mini-workshop on "Quantum Field Theory: Applications to Condensed Matter Physics" at SNBNCBS during March 13-14, 2000.

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Tanusri Saha-Dasgupta

Current research interests and ongoing collaborations

My current research interest is focused on the electronic structure calculation of strongly correlated materials using mean-field methods like Hartree-Fock method, methods based on recursion in augmented space, modeling of such materials using first-principles electronic structure techniques.

Very often, it is useful to describe systems of complexities with some models e.g. Hubbard model, well-known in the correlated electronic structure community. It is quite important to have reasonable estimate of the parameters of such models that describes the material of interest. Along with 0. K. Andersen (Max-Planck Institute FKF, Stuttgart, Germany) I am involved in the improved formulation of the LMTO method which enables to extract the tight-

binding parameters of complicated multi-atom systems like high Tc compounds, ladder compounds, perovskites etc. in a first-principles way. These tight-binding Hamiltonians are found to describe the low-energy physics very accurately. While the tight-binding formulation of the LMTO theory has been exploited to have the estimates of the tight-binding one-electron part, the estimate of the effect of correlation beyond the LDA that is present in the system was shown to be obtained from the LMTO based constraint density functional calculation. However the existing scheme of constraint density functional calculation based on the atomistic description of the participating orbital, works satisfactorily for systems with very large correlation, but breaks down for materials having moderate correlation. The improved formulation of LMTO method is ideally suited for carrying out the constraint density functional calculation without resorting to atomistic descriptions. Presently we are involved in further development of the improved LMTO formulation that will make such calculation feasible.

Along with D. D. Sarma (IISc., Bangalore, India) I have been involved in the mean-field electronic structure calculation of sulphides like $BaNiS_2$ and $BaCoS_2$. While $BaNiS_2$ is a paramagnetic metal, $BaCoS_2$ is an anti-ferromagnetic insulator. From our mean-field calculation we have shown that the metal—insulator transition in the doped $BaNi_xCo_{1-x}S2$ system is driven primarily by the covalency effect. Calculations on the double perovskite CMR material Sr_2FeMoO_6 have been carried to explain the high magnetic transition temperature driven by the unusual aspects of the electronic structure of this newly discovered compound.

I am also involved in developing a scheme to solve the Hubbard model using the Dynamical formulation of the Augmented Space Recursion introduced by A. Mookerjee (SNBNCBS), a method akin to Dynamical mean field method (DMFT), but goes beyond DMFT in the sense that it includes spatial in addition to time fluctuation. Work is on progress for this.

Besides, I am working on phase stability of alloys, employing Monte Carlo technique coupled with electronic structure method providing the ab-initio estimate of the parameters of the defining Ising model. Work has been done in collaboration with A. Arya, G. P. Das and S. Banerjee (BARC, Mumbai, India) on NiMo alloy system with many competing phases where the entropy calculation has been done in a mean-field way.

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M. K. Samal

Current research interests and ongoing collaborations

Quantum Entanglement, first noted by Einstein-Podolsky-Rosen (EPR) and Schrödinger, is the non-classical feature essentially caused by the superposition principle combined with the Hilbert space structure for composite systems. Bell has shown that it leads to a stronger correlation between parts of a composite quantum system than that allowed by *local realistic theories.* The local realistic theories are based on *Local Realism* which constitutes the conceptual basis for all classical field theories like Special theory of Relativity and General theory of Relativity.

Contradiction between local realistic theories and quantum theory occurs either for statistical predictions invoking Bell's inequalities for the EPR singlets or for the non-statistical ones about the Greenberger-Horne-Zelinger (GHZ) states. The experiment by Aspect et. al. (1984) and the subsequent ones (Zelinger et. al., 1998) have confirmed the predictions of quantum theory regarding the violation of Bell's inequality (and thus excluding the possibility of *local* hidden variable versions of Quantum Theory) although it should be noted that an experiment that has no loopholes *(these are insufficiencies in the experiment that allow for the simple construction of a local hidden variable theory)* has not been yet performed.These aspects of quantum theory have often been referred to *quantum nonlocality.*

The challenge of quantum nonlocality is two fold: to devise experiments free of presently existing loopholes and to explore theoretically various implications of quantum nonlocality. One major step in the direction of the former is to study EPR paradox in the decay of $J^{PC}= 1^-$ vector meson into a pair of neutral bosons. The copious production of ϕ meson decays into two neutral kaons in a ϕ factory accelerator as well as the B factory accelerators are very realistic possibilities. An experiment of this type is characterized by (i) almost perfect angular correlation between the two kaons, (ii) nearly 100% efficient high-energy particle detectors, and (iii) absence of noise. In collaboration with *Dipankar Home* of Bose Institute we study the violation of Bell's inequality in entangled neutral Kaons system. We are also exploring the implications of quantum nonlocality in bipartite entangled systems involving non-orthogonal states.

The *quantum-classical transition* has been a topic of active study in recent times. A novel approach in this direction is the possibility of quantum mechanics as a limiting case of classical mechanics in which decoherence plays a major role. This was recently *(quantph/ 0001025)* put forward by *Partha Ghose* of SNBNCBS. In a collaboration with him, further investigation is in progress on the details of the mechanism of interaction with the environment in various simple situations.

Conferences attended

1. International *"Winter Institute on Foundations of Quantum Theory and Quantum Optics"*, SNBNCBS, 1-13 January, 2000 (worked towards various local organisational activities).
2. Indian Council of Philosophical Research (ICPR) sponsored national seminar : *"Dimensions of Mind"* held at Rajasthan University, Jaipur during 28th February – 1st March, 2000.

Invited talks at conferences

"Quantum of Consciousness and Consciousness of Quantum" at the ICPR sponsored national seminar *"Dimensions of Mind"* held at Rajasthan University, Jaipur on 29th February 2000.

Work visits

Visited the Non-linear Dynamics and Chaos Group at PRL, Ahmedabad during 2-9 March and 29 March - 13 April, 2000 to explore the possibility of studying classical to quantum transition in chaotic systems using the equation given by Partha Ghose recently *[quantph/0001025].*

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Subodh Kumar Sharma

Current research interests and ongoing collaborations

Currently our main research interest relate to the way in which coal-water slurry drops and/ or emulsified fuel drops burn, and the use of light scattering as a diagnostic tool in this context. Emulsification (oil in water or water in oil) is known to improve combustion characteristics. Efficiency is increased due to the process of 'micro-explosion' in which the internal build up of vapour ruptures the drop resulting in smaller drops and a better dispersion. It is also found that the emission of particulates is reduced.

The thinking behind burning coal as coal-water and coal oil mixtures is that the use of oil could be reduced or even dispensed with. Slurries could be atomized in the same way as oil, producing water drops or oil drops in which coal particles are randomly dispersed. If the nature of the combustion is to be understood it is essential to monitor changes in the internal structure of the drop. We are interested in determining what aspects of light scattering are unique functions of internal structure.

In general a slurry drop may be modeled as a host water/oil sphere in which the coal particles are randomly dispersed. Exact solutions are not always available for such a problem. We have, broadly speaking, achieved two objectives: (i) We have developed an approximation method which can reasonably accurately predict the scattering quantities for such particles. (ii) We have been able to relate some of the scattering quantities to the concentration of coal inclusions in water. This work is in collaboration with Professor A. R. Jones of Imperial College.

List of Publications for 1999-2000

Refereed publications in journals/books

1. S. K. Sharma, H. S. Shah and D. J. Somerford, 1999 "A new method to calculate Legendre coefficients for use in multiple scattering problems", Journal of Optics (India), 28, 123- 131.
2. S. K. Sharma and A. K. Roy, 2000 "New approximate phase functions: test for nonpherical particles, J. Quant. Spectrosc. Radiative Transf., 64, 327-337.
3. S. K. Sharma and A. R. Jones, 2000 "On the validity of an approximate formula for absorption and scattering of light by a large sphere with highly absorbing spherical Inclusions ", J. Phys.(GB) D: Appl. Phys., 33, 584-588.

Invited review articles

- S. K. Sharma and D. J. Somerford, 1999 "Scattering of light in the eikonal approximation ", in Progress in Optics (ed. E Wolf) vol 39, 213-290.

Contributed papers at conferences

- S. K. Sharma, a new approximate phase function: test for non-spherical particles, at 4th conference on electromagnetic and light scattering by non-spherical particles at Vigo (Spain) September 20-21, 1999.

Conferences attended

Half-day meeting on "Light propagation through scattering media" at The Institute of Physics, London on 2.6.1999.

Seminars given

"Scattering and absorption of light by a large sphere with absorbing random inclusions", Combustion group seminar on 25.11.1999 at Imperial College, London.

Fellowships

Visiting Fellow at Imperial College, London from January 1,1999 to December 31, 1999.

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P. Singha Deo

Current research interests and ongoing collaborations

I am now working on transport and persistent currents in mesoscopic systems. I am also working on phase transitions in mesoscopic superconductors.

Invited talks at conferences

"Winter Institute on Foundations of Quantum Theory and Quantum Optics" at S.N.Bose National Centre in Calcutta from 1.1.2000 to 14.1.2000. Presented talk titled "A new phase of the electron wave function".

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LIST OF PUBLICATIONS OF FACULTY

(1 April 1999 – 31 March 2000)

1. **R. Banerjee** and P. Mukherjee, 1999, "Some comments on the spin of Chern Simons vortices", *Prog. Theor. Phys.* 101, 1189.

2. **R. Banerjee** and E.C.Marino, 1999, "A new approach for bosonisation of massive Thirring model in three dimensions", *Mod. Phys. Lett.* A 14, 593.

3. **R. Banerjee** and **B. Chakraborty,** 1999, "A new type of duality symmetry in the theory of N-form abelian fields", *J. Phys. A: Math. Gen.* 32, 4441.

4. **R. Banerjee** and Sarmistha Kumar,1999, "Self duality and soldering in odd dimensions", *Phys. Rev. D* 60, 085005.

5. **R. Banerjee,** H.J. Rothe and K.D. Rothe, 1999, "Hamiltonian approach to Lagrangian gauge symmetries", *Phys. Lett. B* 463, 248.

6. **R. Banerjee,** H.J. Rothe and K. D. Rothe, 2000, "Recursive construction of generator for Lagrangian gauge symmetries", *J.Phys. A:Math. Gen* 33, 2059.

7. **R. Banerjee,** H.J.Rothe and K.D.Rothe, 2000, "Master equation for Lagrangian gauge symmetries", *Phys. Lett. B* 479, 429.

8. **S. Banerjee,** K. Mogensen, E. Stenby and V. A. Barker, 1999, "Comparison of Iterative Methods for Computing the Pressure Field in a Dynamic Network Model", *Transport in Porous Media,* 37, Issue 3, 277-301.

9. **S.K. Chakrabarti,** 1999, "Estimation and Effects of the mass outflow from shock compressed flow around compact objects" *Astronomy and Astrophysics,* 351, 185.

10. B. Mukhopadhyay & **S.K. Chakrabarti,** 1999, "Semi-analytical Solution of Dirac Equation in Schwarzschild Geometry", *Classical and Quantum Gravity,* 16, 3165.

11. T. Das & **S.K. Chakrabarti,** 1999, "Computation of the Mass Outflow Rate from Neutron Star and Black Hole accretion disks", *Classical and Quantum Gravity,* 16(19), 3879.

12. **S.K. Chakrabarti** (Guest-editor), 1999, Proceedings of the 'Young Scientists of Today's India', *Indian Journal of Physics,* 73B(6).

13. **S.K. Chakrabarti,** 1999. "Latest trends in the study of accretion and outflows around compact objects", a Review Article in the Proceedings of 'Young Astrophysicists of Today's India', *Indian Journal of Physics,* 73B(6), 931.

14. S.G. Manickam & **S.K. Chakrabarti,** 1999, "On the nature of quasi-periodic oscillations in the black hole candidate GRS 1915+105", in Proceedings of 'Young Astrophysicists of Today's India', *Indian Journal of Physics,* 73B(6), 967.

15. B. Mukhopadhyay & **S.K. Chakrabarti,** 2000, "Nucleosynthesis in Accretion Flows Around Black Holes", *Astronomy & Astrophysics,* 353, 1029.

16. **S.K. Chakrabarti** & S.G. Manickam, 2000, "Discovery of a Correlation among QPO frequencies and Quiescence-state Duration in Black Hole Candidate GRS 1915+105", *Astrophysical Journal Letters,* 531, L41.

17. I.Chattopadhyay & **S.K. Chakrabarti,** 2000, "Effects of Radiative Acceleration on Topologies of Outflows", 2000, *Int. J. Mod. Phys D,* 9(1), 57.

18. S.Chakrabarti & **S.K. Chakrabarti,** 2000, "Can DNA bases be produced during molecular cloud collapse?" *Astronomy & Astrophysics Letters,* 354, L6—L8.

19. **B. Chakraborty** and **A.S. Majumdar,** 1999, "Effects of gauging on symplectic structure, the Hopf term coupled to CP^1 model and fractional spin", *Int. J. Mod. Phys.,* A14,1561.

20. **B.Chakraborty** and **A. S. Majumdar,** 2000, "Solitonic configurations and fractional spin in the gauged Landau-Lifshitz model", *Phys. Rev.* D61, 027702.

21. **R. Chaudhury** and **S. K. Paul,** 1999, "Possible Existence of Topological Excitations In Quantum Spin Models in Low Dimensions", *Phys. Rev.* B60, 6234.

22. **S. Dattagupta,** R. Ghosh and J. Singh, 1999, "Magneto-optic piston effect", *Physical Review Letters,* 83, 710-713.

23. **S. Dattagupta,** 1999, "A model magnetic glass", *Indian Journal of Physics,* 73(s), No. 1, 141-150.

24. J. Singh, R. Ghosh and **S. Dattagupta,** 2000,"Optical Hall Effect", *Phys. Rev. A,* 61, No. 2,025402-025404.

25. **D. Gangopadhyay** and S. Sengupta, 1999, "Duality Invariance of Cosmological Solutions with Torsion", *Int. Jour. Mod. Phys.* A14, 4953-4966.

26. **G. Gangopadhyay,** S. Ghosal and Y. Tanimura, 1999, "A thermal bath induced new resonances in linear and nonlinear spectra of a two-level system". *Chem. Phys.*, 242,367.

27. **G. Gangopadhyay,** 1999, "An operator approach to the construction of generating function of a molecule", *J. Phys. A. Math. and Gen.*, 32, L441.

28. **Partha Guha,** 1999, "τ-functions of AKS hierarchy and twistor correspondences" *Reviews in Mathematical Physics* 11, 981-1000.

29. **Partha Guha,** 1999, Quest for Universal Integrable Model (with Mikhail Olshanetsky), *Journal of Nonlinear Mathematical Physics* 6, no.3, 273-293.

30. **Partha Guha,** 2000, "Diffeomorphism, Periodic KdV and C. Neumann System" *Differential Geometry and its Applications* 12, 1-8.

31. D. Home and **A.S. Majumdar,** 1999, "On importance of the Bohmian approach for inter preting CP-violation experiments", *Foundations of Phys.* 30, 247.

32. **A. S. Majumdar,** 1999, "Inflationary universe in Kaluza-Klein theories", *Ind. J. Phys.*73 B, 843.

33. **C. K. Majumdar,** 1999 "Magnetic Properties of Solids: Krishnan's Contribution" in *Condensed Matter Physics* (editors B. K. Agrawal and H. Prakash, Narosa Publishing House, New Delhi) [Allahabad University, Physics Department Platinum Jubilee and K. S. Krishnan Birth Centenary meeting], pp. 269-273.

34. **C. K. Majumdar,** 'Walter Kohn: Nobel Prize in Chemistry in 1998' in *Current Science*, vol. 76, no.11,10 June 1999, pp. 1451-53.

35. **R. P. Malik,** 1999, "Topological features in non-Abelian gauge theory", *Mod. Phys. Lett.* A 14,1937-1949.

36. **R. P. Malik,** 2000, "Cohomological aspects of Abelian gauge theory", *J. Phys. A: Math Gen* 33, 2437-2446.

37. **R. P. Malik,** 2000, "BRST cohomnology and Hodge decomposition theorem", *Int. J. Mod. Phys.* A 15, 1685-1705.

38. **K. Mandal,** Th. Cramer and D. L. Atherton, 2000, "The study of a racetrack-shaped defect in ferromagnetic steel by magnetic Barkhausen noise and flux leakage measurements", *Journal of Magnetism and Magnetic Materials,* 212, 231-239.

39. **K. Mandal,** D. Dufour, D. L. Atherton, 1999, "Use of magnetic Barkhausen noise and magnetic flux leakage signals for analysis of defects in pipeline steels", *IEEE Transaction on Magnetics,* 35, 2007-2017.

40. T. W. Krause, **K. Mandal,** D. L. Atherton, 1999, "Modeling of magnetic Barkhausen noise in single and dual easy axis system in steel", *Journal of Magnetism and Magnetic Materials,* 195, 193-205.

41. **K. Mandal,** M. Tena, F. J. Castano, D. Gracia, M. Vazquez, a. Hernando, 2000, "The stress induced anisotropy in amorphous magnetic thin films", in Proc. Of "INTERMAG-2000" held at Toronto, Canada, paper no.-AR02.

42. **K. Mandal,** S. Puerta, M. Vazquez, A. Hernando, 2000, "The frequency and stress dependence of giant magneto impedance in amorphous microwires", in Proc. of "INTERMAG-2000" held in Toranto, Canade, Paper no. HD 05.

43. **S.S. Manna,** D. Chakrabarti and R. Cafiero, 1999, "Critical States in a Dissipative Sandpile Model", *Phys. Rev. E.,* 60, R5005.

44. **S. S. Manna,** 1999, "Sandpile Models of Self- Organized Criticality",*Current Science,* 77, 388.

45. **S.S. Manna** and H. J. Herrmann, 2000, "Intermittent Granular Flow and Clogging with Internal Avalanches", *Euro. Jour. Phys.,* E, 1, 341-344.

46. **S.S. Manna,** 1999, "Externally Driven Granular Systems", *Physica A,* 270, 105.

47. S. Krishnmamurthy, V. Loreto, H. J. Herrmann, **S. S. Manna** and S. Roux, 1999, "Self-structuring of Granular Media under Internal Avalanching", *Phys. Rev. Lett.* 83, 304.

48. **Manu Mathur** and Rajiv V. Gavai,1999, "Z_2 Monopoles, Vortices and the Universality of the SU(2) Deconfinement Transition" *Phys. Lett.* B 458,331.

49. **Anita Mehta,** 1999, "Smoothing of sandpiles after avalanche propagation", in *Structure and Dynamics of Materials in the Mesosco pie Domain,* eds. M. Lal, R. A. Mashelkar, B. D. Kulkarni and V.M. Naik (Imperial College Press and the Royal Society, London, pp 340-352.

50. **Anita Mehta** and Jean-Marc Luck, 1999, "Models of competitive learning: complex dynamics, intermittent conversions and oscillatory coarsening", *Physical Review* E 60, 5218-5230.

51. Rebecca Hoyle and **Anita Mehta,** 1999, "A two-species model for aeolian sand ripples" Physical Review Letters, 83, 5170.

52. L.Accardi and **A. Mohari,** 1999, "Time reflected Markov processes, Infinite dimensional Analysis and QP", vol. 2, no-3, pp 397-426, *World Scientific.*

53. **A. Mookerjee,** B. Sanyal and A. Mehta, 1999, "Growth and Electronic Structure of rough overlayers", *Physica A* 270, 143.

54. S. Ghosh, N. Das and **A. Mookerjee,** 1999 "TBLMTO-recursion: a tractable representation", Int. *J. Mod. Phys.,* B 13, 723 (1999).

55. A. Ray, P. Das, S. K. Saha, B. Sethi, **A. Mookerjee,** C. Basu Chaudhury and G. Pari, 1999," Observation of large change of 7Be decay rate in Au and Al–20–3 and its implications", *Phys. Lett.* B 455, 69.

56. C. Basu Chaudhury, G. Pari and **A. Mookerjee,** 1999, "High Pressure Studies of MgTe using first principles electronic structures calculations", *Phys. Rev. B 60,* 11846

57. S. Saga, T. P. Sinha and **A. Mookerjee,** 2000, "Structural and Optical Properties of SiTiO–3", *J. Phys. Cond. Matter* 12, 3325.

58. S. Ghosh and **A. Mookerjee,** 2000," Magnetic properties of disordered CoCu alloys: a theoretical study", *J. Mag. Materials* 214, 291

59. **S. Mukherjee,** 2000 "Structure and Properties of Atomic Clusters", in *Trends in Atomic and Molecular Physics,* Ed. K.K. Sud and S.N. Upadhyay (Kluwer Academic/Plenum Publisher, New York) pp 35-57.

60. **S.K. Sharma,** H.S. Shah and D.J. Somerford, 1999 "A new method to calculate Legendre coefficients for use in multiple scattering problems", *Journal of Optics (India),* 28, 123-131.

61. **S.K. Sharma** and A.K. Roy, 2000, "New approximate phase functions: test for non pherical particles", *J. Quant. Spectrosc. Radiative Transf.,* 64, 327-337.

62. **S.K. Sharma** and A.R. Jones, 2000 "On the validity of an approximate formula for absorption and scattering of light by a large sphere with highly absorbing spherical Inclusions", *J. Phys. (GB) D: Appl. Phys.,* 33, 584-588.

63. **S.K. Sharma** and D.J. Somerford, 1999 "Scattering of light in the eikonal approxima tion", in *Progress in Optics* (ed. E Wolf) vol 39, 213-290.

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PART B

BUDGET SUMMARY 1999-2000

The funds come from the Department of Science & Technology, New Delhi. The following is the summary of the budget estimates for the year 1999-2000.

FIG. IN LAKHS

	Actuals 1998-99	Budget Estimate 1999-2000	Revised Estimate 1999-2000
Non-Plan	50.77	64.47	*54.61
Plan	211.05	425.00	*416.15
Total	261.82	489.47	470.76

* Sanctioned by DST Rs.250 lakhs, Non-Plan Rs.33 lakhs and released as under :

Non Plan

1.	Sanction Letter No. AI/SNB/003/99 dated 08.04.99	Rs. 5.00 lakhs
2.	Sanction Letter No. AI/SNB/003/99 dated 24.05.99	Rs. 11.00 lakhs
3.	Sanction Letter No. AI/SNB/003/99 dated 22.09.99	Rs. 8.00 lakhs
4.	Sanction Letter No. AI/SNB/003/99 dated 24.02.2000	Rs. 9.00 lakhs
		Rs. 33.00 lakhs

Plan

1.	Sanction Letter No. AI/SNB/003/99 dated 26.04.99	Rs. 41.00 lakhs
2.	Sanction Letter No. AI/SNB/003/99 dated 24.05.99	Rs. 84.00 lakhs
3.	Sanction Letter No. AI/SNB/003/99 dated 22.09.99	Rs. 63.00 lakhs
4.	Sanction Letter No. AI/SNB/003/99 dated 06.03.2000	Rs. 62.00 lakhs
		Rs.250.00 lakhs

TOTAL **Rs.283.00 lakhs**

AUDITOR'S REPORT TO THE GOVERNING BODY

We have audited the Balance Sheet of Satyendra Nath Bose National Centre for Basic Sciences as at 31st March 2000, and also the annexed Income & Expenditure Account and Receipt & Payment Account for the year ended on that date and report that :

1. We have obtained all information and explanations and to the best of our knowledge and belief were necessary for the purpose of our audit.

2. The Balance Sheet and the Income & Expenditure Account and Receipt & Payment Account dealt with by the report are in agreement with the books of account.

3. In our opinion and to the best of our information and according to the explanation given to us, the statement together with the schedules attached and read with the Accounting Policies and Notes thereon, give a true and fair view :

   i) in the case of Balance Sheet of the state of affairs as at 31st March, 2000; and

   ii) in the case of the Income & Expenditure Account of the Surplus for General Fund and Deficit for Project Fund for the year ended on that date.

for **Dutta Sarkar & Co.**
Chartered Accountants

Sd/- **K. M. ROY**
Partner

Calcutta : 20.07.2000

S. N. BOSE NATIONAL CENTRE

Block JD, Sector III, Salt Lake,

BALANCE SHEET AS AT

As at 31.03.99 (Rs.)	FUNDS & LIABILITIES	Schedule	Amount (Rs.)	Amount (Rs.)
124178799	Capital Fund			
	Balance as per last account		124178799	
	Add: Grant-in-Aid received from Govt. of India for non-recurring expenditure		3304417	
				127483216
9090958	General Fund			
	Balance as per last account		9090958	
	Add: (Less) Excess of Income/ over Expenditure/ for the year transferred from Income & Expenditure Account		1851663	
				10942621
	Other Funds			
1069753	Gratuity Fund			1473243
5164864	Project Fund			
	Balance as per last account		5164864	
	Less: Excess of expenditure over income for the year transferred from Income & Expenditure	1	8545	5156319
	Current Liabilities & Provisions			
	a) Current Liabilities			
2181554	Liabilities for expenses		2694568	
78681	Other Liabilities		97685	
1349851	Deposits from Contractors		460590	
40150	Sundry Creditor for Capital Exp.		345288	3598131
	Liability for expenses (Project)			33000
	b) Provision			
39915	Provision for Adhoc Bonus			52980
50778	Provident Fund			28443
143245303				148767953

Notes On Accounts – Schedule 11
The Schedule referred to above form an integral part of the Balance Sheet

Calcutta : 20.7.2000

In terms of our attached report of even date

For **Dutta Sarkar & Co.**
Chartered Accountants

Sd/- **K.M. Roy**
Partner

FOR BASIC SCIENCES

Calcutta - 700 098

31ST MARCH 2000

As at 31.03.99 (Rs.)	PROPERTY & ASSETS	Schedule	Amount (Rs.)	Amount (Rs.)
113822727	Fixed Assets			
	As cost/capitalised value	2		131485624
	Investments	3		
	General Fund Investment			
17973516	Fixed Deposit with Scheduled Bank			7605154
	Gratuity Fund Investment			
613403	Fixed Deposit with Indian Overseas Bank, Salt Lake Branch			1089470
	Current Assets, Loans & Advances			
	a) *Current Assets*			
	Interest Accrued on Investment			
1632721	General Fund			162234
74926	Gratuity Fund			336182
61323	Stock of Printing & Stationery		Nil	
891500	Stock of Books			889700
166602	Stock of Engineering and Consumables		Nil	
	Cash & Bank Balances			
37173	Cash in hand			25031
4674167	Cash at Bank (with Scheduled Banks in Current Account)	4		5756211
	b) *Loans & Advances*			
121653	Security & Other Deposits			202153
753117	Advances recoverable in cash or in kind or for value to be received	5		1169319
2422475	Advances to Suppliers & Contractors			46875
143245303				148767953

Sd/- **A. Dattaswami**
Administrative Officer (Acting)
S.N. Bose National Centre for Basic Sciences

Sd/- **S. Dattagupta**
Director
S.N. Bose National Centre for Basic Sciences

S. N. BOSE NATIONAL CENTRE

Block JD, Sector III, Salt Lake,

INCOME AND EXPENDITURE ACCOUNT

Figures for the previous year		EXPENDITURE	Schedule	Project Account	General Account
Project Account (Rs.)	General Account (Rs.)			(Rs.)	(Rs.)
243233	9758048	Salaries & Allowances and Employees' Benefits	6	394939	11914188
12762	8260464	Other Expenses	7	5369	10210271
	2366753	Maintenance Expenses	8	30422	3286655
515906		Stipend to CSIR Fellows		300660	
33697		Travel		59056	
118154		Contingency & Raw Materials		109320	
	10000	Audit Fee			12000
31478		Refund of Grant-in Aid		105891	
		Guest House Rent		1250	
1781446	2359205	Excess of Income over Expenditure for the year carried down			2065525
2736676	22754470			1006907	27488639
		Excess of Expenditure over Income for the year brought down		8545	
	21473	Adjustment relating to prior period	10		241543
1781446	2372604	Excess of Income over Expenditure transferred to Balance Sheet/ General Fund			1851663
1781446	2394077			8545	2093206

Notes on Account – Schedule 11
The Schedule referred to above form an integral part of Income & Expenditure A/C

Calcutta : 20.07.2000

In terms of our attached report of even date

For **Dutta Sarkar & Co.**
Chartered Accountants
Sd/- **K.M. Roy**
Partner

FOR BASIC SCIENCES
Calcutta - 700 098

FOR THE YEAR ENDED 31ST MARCH 2000

Figures for the previous year		INCOME	Schedule	Project Account	General Account
Project Account (Rs.)	General Account (Rs.)			(Rs.)	(Rs.)
		Grant-in-Aid received :			
	3966000	Non-Plan			3300000
	16000000	Plan			21695583
		Miscellaneous Grant Received :			
2115631		For Projects		683092	
621045		For CSIR Fellows		315270	
		Other			755140
	246834	Miscellaneous Income	9		337788
	2541636	Interest on Fixed Deposit			1400128
		Excess of Expenditure over Income for the year carried down		8545	
2736676	22754470			1006907	27488639
1781446	2359205	Excess of Income over Expenditure for the year brought down			2065525
	34872	Adjustment relating to prior period	10		27681
		Excess of Expenditure over Income transferred to Balance Sheet		8545	
1781446	2394077			8545	2093206

Sd/- **A. Dattaswami**
Administrative Officer (Acting)
S.N. Bose National Centre for Basic Sciences

Sd/- **S. Dattagupta**
Director
S.N. Bose National Centre for Basic Sciences

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Calcutta - 700 098

SCHEDULE - 1

PROJECT FUND	31st March 2000 (Rs.)	31st March 1999 (Rs.)
Project Superconductivity	1952124	1952124
Quantum Transmittance	165928	165927
Numerical Studies of Transitions	300120	300120
Probing the Foundations ..... Theory	109850	109850
Theoretical High Energy Physics	37	2065
University of Warwick	459149	602098
Quasi Periodic Oscillations	462470	337706
Analytical and Numerical Studies	383670	490000
Creation of a Space Astronomy	794932	795682
Exploring Self Organised Criticly	389501	426216
Fundamental Aspects of Quantum	203050	Nil
Organising Resources	90000	Nil
Project CSIR	-154512	-60918
Preparation of Monograph	Nil	43994
	5156319	5164864

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Calcutta - 700 098

SCHEDULE - 2

FIXED ASSETS

	Balance as on 31/03/99 (Rs.)	Additions during the year (Rs.)	Adjustment during the year (Rs.)	Balance as on 31/03/2000 (Rs.)
a) General Account				
Office Equipment	366074	298014		664088
Guest House Furniture	1908189			1908189
Small Equipment	488957	94142		583099
Books & Journals	9225028	4622405	– 3150	13844283
Director's Research Equipment	275916			275916
Boundary Wall	1038937			1038937
Computer & Accessories	6510904	2298547		8809451
Construction of Building	67692968	8580704		76273672
Computer	1308681			1308681
Campus Land	10950694			10950694
Air Condition Machineriy	109475			109475
Campus Beautification	434976	154154		589130
Office Vehicle	104794	393808	– 104794	393808
U P S	217685	306600		524285
Acad. Staff Research Equipment	161876	116782		278658
Lbirary Computer	2899227			2899227
Furniture & Fixtures	3378294	406073		3784367
EPABX System	292334			292334
Open Office System	2281915			2281915
Installation of Computer	41880	133306		175186
	109688804	17404535	– 107944	126985395
b) Projects Account				
Equipment	4102579	371238		4473817
Books & Periodicals	14394	5218		19612
Furniture & Fixture	6800			6800
	4123773	376456	0	4500229
TOTAL (a) + (b)	**113812577**	**17780991**	**-107944**	**131485624**

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Calcutta - 700 098

SCHEDULE - 3

	31st March 2000 (Rs.)	31st March 1999 (Rs.)
GENERAL FUND INVESTMENT		
Fixed Deposit with :		
a) Indian Overseas Bank Salt Lake Branch, Calcutta	4808902	2784882
b) United Bank of India Mayukh Bhawan Branch, Calcutta	2796252	15188634
	7605154	17973516

SCHEDULE - 4

	31st March 2000 (Rs.)	31st March 1999 (Rs.)
CASH AND BANK BALANCE		
Cash at Bank with Scheduled Bank in Current Account		
a) Indian Overseas Bank Salt Lake Branch, Calcutta		
General Fund Account	2400895	1325306
Project Fund Account	765170	1144584
b) United Bank of India Mayukh Bhawan Branch, Calcutta		
General Fund Account	2590146	2204277
	5756211	4674167

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Calcutta - 700 098

SCHEDULE - 5

	31st March 2000 (Rs.)	31st March 1999 (Rs.)
LOANS & ADVANCES		
Advance to R.C. Das	Nil	455
Advance to S.K. Biswas	3000	Nil
Conveyance Advance (Plan)	113000	Nil
Conveyance Advance (Non Plan)	67075	Nil
House Building Advance	500000	Nil
Recoverable Insurance	499	Nil
Recoverable Expenses	10000	10000
Prepaid Expenses	360331	705895
Staff Advance	20690	14660
Advance against LTC	3106	9887
Festival Advance	55340	2740
Advance - S.K. Manna	4500	4500
Employee's Income Tax	2952	2952
	1140493	751089
Project Account	28826	2028
	1169319	753117

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Calcutta - 700 098

SCHEDULE - 6

		31st March 2000 (Rs.)	31st March 1999 (Rs.)
SALARIES & ALLOWANCES AND EMPLOYEES BENEFITS			
Salary and Allowances			
Non- Plan	2115191		
Plan	6678104		
Back salary	81098		
Temporary Status	971473	9845866	7639683
Wages - Casual Labour		451932	484813
Employer's Contribution to PF			
Plan	344928		
Non- Plan	107935		
Temporary Status	144535	597398	379061
Medical Expenses			
Plan	105996		
Non-Plan	83293		
Temporary Status	15715	205004	229496
Adhoc Bonus			
Plan	29028		
Non-Plan	14514		
Temporary Status	9438	52980	39915
Leave Travel Concession			
Plan	6575		
Non-Plan	5500	12075	91756
Provision for Gratuity			
Plan	319848		
Non-Plan	35787	355635	531010
Gratuity Contribution		6270	
Pension Contribution		8595	
Leave Salary			
Plan	6750		
Non-Plan	329704	336454	290130
Interest on PF (Deficit)			
Plan	30686		
Non-Plan	11293	41979	72184
		11914188	9758048
PROJECTS ACCOUNTS			
Salary & Allowances		394939	243233
		394939	243233

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Calcutta - 700 098

SCHEDULE - 7	31st March 2000 (Rs.)	31st March 1999 (Rs.)
OTHER EXPENSES		
Electricity Charges	3195587	2536155
Hire Charges of Transport	551521	238784
Misc. Expenses	413512	170249
Printing & Stationery	412800	234488
Postage & Telegrams	94648	88729
Insurance	1646	2639
Telephone & Trunk Calls	214310	289869
TA/DA to Non-Academic Staff	13800	3132
TA/DA to Academic Staff (India)	64436	110786
TA/DA to Academic Staff (Abroad)	142114	195278
Meeting Expenses	344205	148665
Bank Charges	16653	27248
Seminar & Other Academic Expenses	1195505	590239
Visiting Member Fellowship (Non-Plan)	8332	43910
Director Research Expenses	Nil	21564
Academic Staff Research Expenses	106227	101101
Publication of Seminar Proceedings	25000	37058
Library Expenses	6460	35599
TA/DA to TPSC Speakers	929650	792084
E-Mail	3050	100068
Municipal Tax	285290	275363
Consultation Fees	301441	Nil
Rent for Director's Premises	122000	Nil
Hostel Accom. Charges	171562	Nil
Internet Charges	432813	587500
Furnishing Accomm. of Visiting Scientist	143681	66307
SNBNCBS Fellows	13320	Nil
Legal Expenses	22633	456572
Visiting Scientist (Plan)	473731	721957
Education Programme	54633	Nil
Loss on Sale of discarded car	63894	Nil
Statphys - III	Nil	276932
Campus Beautification	Nil	108188
Winter Institute	385816	Nil
	10210271	8260464
PROJECT ACCOUNTS		
Bank Charges	1713	12762
Postage & Telegrams	3656	Nil
	5369	12762

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Calcutta - 700 098

SCHEDULE - 8

		31st March 2000 (Rs.)	31st March 1999 (Rs.)
MAINTENANCE EXPENSES			
Repairs to Equipment		24180	17268
Car Maintenance		5952	41811
Office Maintenance		156262	83847
Computer Maintenance		462901	485094
POL		19314	51399
Maintenance of Iron Removal Plant		54048	70367
Building Maintenance		437424	21828
Security Maintenance		543358	407312
Electrical Maintenance		600603	572770
A.C. Maintenance (Guest House)		29888	66369
A.C. Maintenance (Central)		280608	283169
A.C. Maintenance (Computer Room)		20006	37282
UPS Maintenance		26964	94293
EPABX Maintenance		97426	48757
Lift Maintenance		70620	64294
Fire Alarm Maintenance		20400	Nil
Canteen Maintenance		436701	20893
	(a)	3286655	2366753
Project Accounts:			
Computer Maintenance		30422	
	(b)	30422	–

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Calcutta - 700 098

SCHEDULE - 9

	31st March 2000 (Rs.)	31st March 1999 (Rs.)
MISCELLANEOUS INCOME		
Income from Guest House	151740	144540
Profit on Sale of Books	Nil	200
Other Receipts	7631	5
Hostel Charges	40173	14112
Realisation against lost book	Nil	1247
Recovery of Electricity	631	Nil
Sale of Tender Paper	4700	Nil
Canteen Coupon (Recovery)	112449	Nil
Transport (Recovery)	14300	Nil
Licence Fee	1664	Nil
Seminar room rent	4500	1000
Contribution from Statphys-III	Nil	80000
Income from Registration Fees	Nil	5730
	337788	246834

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Calcutta - 700 098

SCHEDULE - 10

	DEBIT		CREDIT	
	For the Year ended 31/03/2000 (Rs.)	For the Year ended 31/03/1999 (Rs.)	For the Year ended 31/03/2000 (Rs.)	For the Year ended 31/03/1999 (Rs.)
PRIOR PERIOD ADJUSTMENT A/C				
Printing & Stationery	61323			
Electrical Maintenance	139968			
Rent for Leasehold land			27681	
Adhoc Bonus	12821			
Casual Labour	455			
Electricity Charges		16066		4872
Audit Fees (Certification)		500		
Seminar & Other Academic Expenses	319	2200		
L T C		2637		
A.C. (Central) Maintenance	2192	70		
Building Maintenance	24465			
Refund of Contribution to Seminar				30000
	241543	21473	27681	34872

S. N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Calcutta - 700 098

SCHEDULE – 11

Notes on Accounts

1. Significant Accounting Policies :

   (a) Fixed Assets are stated at historical cost including amount payable on account of arbitration award. No depreciation is provided on fixed asset.

   Construction of Building Account is debited on passing of the running account bills of the contractors after adjustment of advance paid, if any.

   (b) Assets purchased for Projects out of grant of the Govt. of India are shown separately in the Balance Sheet. On completion of the projects, Govt. of India has the discretion to gift the assets to the Centre or transfer such assets to any other institute as considered appropriate.

   (c) Grants from the Department of Science & Technology, Govt. of India are accounted for on cash basis.

   (d) Leave Encashment is accounted for on cash basis.

   (e) Gratuity is estimated on the basis of guidelines of Central Govt.

   (f) Stock of Publication (S.N. Bose: The Man and His Work, Vol. I & II) are valued at discounted price as per GB resolution.

2. Physical verification of the movable fixed assets of the Centre was last done in 1997-98. Accordingly, adjustments for discrepancies, if any has not been effected.

3. Consequent upon the order of the Hon'ble Calcutta High Court, the Police authorities seized all the files and papers relating to construction of the buildings of the Centre and as such the relevant records are not presently available.

4. Necessary adjustments for equipment gifted has not been done.

5. Recovery of Licence Fee and Electricity charges from allotees of staff quarters has been effected from December 1999 & March 2000 respectively.

6. Previous year's figures has been regrouped and rearranged wherever necessary.

S. N. BOSE NATIONAL CENTRE

Block JD, Sector III, Salt Lake,

RECEIPT AND PAYMENT ACCOUNT

Figures for the previous year		RECEIPT	Project Account (Rs.)	General Account (Rs.)
Project Account (Rs.)	General Account (Rs.)			
		Opening Cash & Bank Balance		
437167	3261268	Indian Overseas Bank	1144584	1325306
	-275800	United Bank of India		2204277
	36261	Cash in hand		37173
		Grants-in-Aid		
	16000000	For Plan Expenditure		25000000
	3966000	For Non-Plan Expenditure		3300000
		Misc. Grant-in-Aid		
621045		For CSIR Fellows	315270	
2115631		For Projects	683092	
		Others		755140
		Encashment of Fixed Deposits		
	1017452	Indian Overseas Bank		
	3353157	United Bank of India		14537762
		Deposit from Contractors - E. Money		36360
36000		Recovery of Advance from Suppliers		

FOR BASIC SCIENCES

Calcutta - 700 098

FOR THE YEAR ENDED 31ST MARCH 2000

Figures for the previous year		PAYMENT	Project Account (Rs.)	General Account (Rs.)
Project Account (Rs.)	General Account (Rs.)			
		Salaries, Allowances & Employees Benefits		
243233	7466547	Salary & Allowances	394939	9368278
	484814	Wages		442632
	408227	Employer's Contribution to PF		542433
	155409	Medical Expenses		180520
	41317	Leave Travel Concession		9841
	225803	Leave Salary		336454
	30237	Adhoc Bonus		50317
		Pension Contribution		8595
		Gratuity Contribution		6270
		Other Expenditure		
	1289711	Electricity Charges		1683016
	231250	Hire Charges of Transport		494343
	216179	Miscellaneous Expenses		386758
	196382	Printing and Stationary		412800
	88729	Postage and Telegrams		91567
	3490	Insurance		2942
	336689	Telephone and Trunk Calls		178895
	3132	TA/DA to Non-Academic Staff		13508
	97540	TA/DA to Academic Staff (India)		62676
	195277	TA/DA to Academic Staff (Abroad)		142114
	146665	Meeting Expenses		342493
12762	26808	Bank Charges	1713	16653
	550262	Seminar and Other Academic Expenses		1181108
	275363	Municipal Tax		283305
	274674	StatPhys III		
	765867	Visiting Member Fellowship		463857
	126687	Academic Staff Research Expenses		106227
	37058	Publication of Seminar Proceedings		25000
	792084	TA/DA to TPSC Speakers		928050
	53248	E-Mail		3050
	251819	Furnishing Accom. for Visiting Scientist		281543
	443900	Legal Expenses		15259
	550000	Internet Charges		309612
		Winter School		353881

S. N. BOSE NATIONAL CENTRE

Block JD, Sector III, Salt Lake,

RECEIPT AND PAYMENT ACCOUNT

Figures for the previous year		RECEIPT		
Project Account (Rs.)	General Account (Rs.)		Project Account (Rs.)	General Account (Rs.)
		Deposits and Adjustable Rent Received		
15000		Deposits from K. Mondal		
		Deposits from M. Mathur		1650
		Deposits from S. Banerjee		7500
		Deposits from S.S. Manna		20000
		Deposits from A. Mohari		3000
		Miscellaneous Income		
140750		Income from Guest House		129575
		Sale Proceeds of discarded car		39900
8200		Sale of Books		1800
5		Other Receipts		1245
		Sale of tender paper		4700
11000		Recoverable (Sale of Books)		
324097		**Interest from Fixed Deposits**		309267
		Received from Project Account		143972

FOR BASIC SCIENCES

Calcutta - 700 098

FOR THE YEAR ENDED 31ST MARCH 2000 *(Contd)*

Figures for the previous year		PAYMENT	Project Account (Rs.)	General Account (Rs.)
Project Account (Rs.)	General Account (Rs.)			
		Maintenance Expenses		
	66721	Lift Maintenance		70967
		AC Maintenance (G.H.)		29547
	19600	Repairs to Equipment		21098
	41811	Car Maintenance		4696
	83847	Office Maintenance		148814
	569288	Computer Maintenance	30422	281393
	51399	POL		16154
	31302	Building Maintenance		303917
	360548	Security Maintenance		467015
	66151	Maintenance of Iron Removal Plant		51573
	65293	UPS Maintenance		334962
	559672	Electrical Maintenance		524409
	41371	EPABX Maintencnce		49593
	20893	Canteen Maintenance		431875
	278858	AC Maintenance (Central)		267992
		Fire Alarm Maintenance		20400
	56000	AC Maintenance (Computer)		
	391511	**Library Books**		857057
	2010112	**Library Journals**		2770986
		Equipment		
	7413	Small Equipment		94141
	110702	Office Equipment		
	913478	Computer & Accessories		2338397
	6750	Academic Staff Research Equipment		116782
	49288	Director's Research Equipment		
		Land and Building		
	108188	Campus Beautification		153680
	105322	Construction of Buildings		7927537
		Furniture and Fixtures		
	309752	Office Furniture		109995
		Library Almirah		74500
	193380	Advance to contractors & Suppliers		59675

S. N. BOSE NATIONAL CENTRE

Block JD, Sector III, Salt Lake,

RECEIPT AND PAYMENT ACCOUNT

Figures for the previous year		RECEIPT		
Project Account (Rs.)	General Account (Rs.)		Project Account (Rs.)	General Account (Rs.)
100000		Received from General Fund		
	5730	Income from Registration Fee		
	80000	Contribution for Seminar		
	1000	Seminar Room Rent		4500
	30000	Refund of Contribution to Seminar		
	9797	A. Banerjea		

FOR BASIC SCIENCES

Calcutta - 700 098

FOR THE YEAR ENDED 31ST MARCH 2000 *(Contd)*

Figures for the previous year		PAYMENT		
Project Account (Rs.)	General Account (Rs.)		Project Account (Rs.)	General Account (Rs.)
		Other Advance		
	47400	Festival Advance		138500
	50439	Advance against LTC (Net)		3106
	19856	Staff Advance	4326	53213
2028	11155	Misc. Advance		32499
		Conveyance Advance		192000
		House Building Advance		500000
		Deposits		
	16650	Deposits for Rent		82150
	27250	Refund of Security Deposits		
	1000	Refund of Earnest Money		37584
	23000	Security Deposits		
		Other Payments		
	77263	Project Accounts		
	1052256	Outstanding Liabilities - Revenue		1484949
	10609	Outstanding Liabilities - Capital		10150
	223969	Gratuity Fund Investment		456350
		Payment of Taxes		20934
	16066	Prior Period (Net)		2419
515906		Stipend to CSIR Fellows	300660	
33697		Travel	59056	
7314		Books and Periodicals	5218	
		Payment to Provident Fund (Net)		50778
	131400	Adjustable Rent		182800
	105469	Payments from Gratuity Fund		59170
119334		Contingency and Raw Materials	104313	
1199507		Equipment	371238	
31478		Refund of Grant-in-Aid	105891	
		Short Term Deposits with IOB (Net)		1782000
	2000	Refundable Recoveries		
	36795	Contractor Income Tax		242103
	2452	Contractor Sales Tax		155688
	1480	Payment to NSCH		
	41880	Installation of Computer		66198
	28043	EPABX System		

S. N. BOSE NATIONAL CENTRE

Block JD, Sector III, Salt Lake,

RECEIPT AND PAYMENT ACCOUNT

Figures for the previous year				
Project Account (Rs.)	General Account (Rs.)	**RECEIPT**	Project Account (Rs.)	General Account (Rs.)
3309843	27983917		2142946	47863127

In terms of our attached report of even date

For **Dutta Sarkar & Co.**
Chartered Accountants
Sd/- **K.M. Roy**
Partner

Calcutta : 20.07.2000

FOR BASIC SCIENCES

Calcutta - 700 098

FOR THE YEAR ENDED 31ST MARCH 2000 *(Contd)*

Figures for the previous year		PAYMENT	Project Account (Rs.)	General Account (Rs.)
Project Account (Rs.)	General Account (Rs.)			
	35599	Library General Expenses		6460
	18067	Payment to Contractors		
		Office Vehicle		393808
	153245	Consultation Fees		297850
		Rent for Director's Premises		122000
		Hostel Accom. Charges		155722
		SNBNCBS Fellows		13320
		Education Programme		54153
		Closing Cash & Bank Balance		
		Indian Overseas Bank	765170	2400895
		United Bank of India		2590146
1144584	1325306	Cash in Hand		25031
	2204277			
	37173			
3309843	27983917		2142946	47863127

Sd/- **A. Dattaswami**
Administrative Officer (Acting)
S.N. Bose National Centre for Basic Sciences

Sd/- **S. Dattagupta**
Director
S.N. Bose National Centre for Basic Sciences

ACTION TAKEN ON AUDITOR'S COMMENTS

The Auditor did not make any adverse comment in the Audit Report for the year 1999-2000. Hence, no action was contemplated.

S. Dattagupta
Director

PART C

बजट सारांश 1999-2000

विज्ञान और प्रौद्योगिकी विभाग, नई दिल्ली से निधियां प्राप्त हुई। वर्ष 1999-2000 का बजट सारांश निम्नलिखित प्रकार है।

संखा लाखों में

	वास्तविक आँकड़ा 1998-99	बजट आकलन 1999-2000	संशोधित आकलन 1999-2000
योजनेतर	50.77	64.47	*54.61
योजनागत	211.05	425.00	*416.15
योग	261.82	489.47	470.76

* डी. एस. टी. द्वारा योजनागत 250 लाख रुपये और योजनेतर 33 लाख रुपये स्वीकृत किए गए और निम्न प्रकार से दिए गए :

योजनेतर

1.	अनुदान स्वीकृति सं. ए आइ / एस एन बी / 003/99 दिनांक 08.04.99	5.00 लाख रु.
2.	अनुदान स्वीकृति सं. ए आइ / एस एन बी / 003/99 दिनांक 24.05.99	11.00 लाख रु.
3.	अनुदान स्वीकृति सं. ए आइ / एस एन बी / 003/99 दिनांक 22.09.99	8.00 लाख रु.
4.	अनुदान स्वीकृति सं. ए आइ / एस एन बी / 003/99 दिनांक 24.02.2000	9.00 लाख रु.
		33.00 लाख रु.

योजनागत

1.	अनुदान स्वीकृति सं. ए आइ / एस एन बी / 003/99 दिनांक 26.04.99	41.00 लाख रु.
2.	अनुदान स्वीकृति सं. ए आइ / एस एन बी / 003/99 दिनांक 24.05.99	84.00 लाख रु.
3.	अनुदान स्वीकृति सं. ए आइ / एस एन बी / 003/99 दिनांक 22.09.99	63.00 लाख रु.
4.	अनुदान स्वीकृति सं. ए आइ / एस एन बी / 003/99 दिनांक 6.03.2000	62.00 लाख रु.
		250.00 लाख रु.
	योग	**283.00 लाख रु.**

शासी निकाय के प्रति लेखापरीक्षकों का प्रतिवेदन

हमने सत्येन्द्र नाथ बसु राष्ट्रीय मौलिक विज्ञान केन्द्र के, 31 मार्च, 2000 तक के, संलग्न तुलन पत्र एवं उसके साथ 31 मार्च, 2000 को समाप्त वर्ष के, आय तथा व्यय लेखों की जाँच की है, एवं निम्नप्रकार अपनी रिपोर्ट देते हैं :

(1) हमनें वे सभी प्रयोजनीय सूचनाएँ और स्पष्टीकरण प्राप्त किये हैं, जो हमारी जानकारी और विश्वास के अनुसार लेखा-परीक्षा के लिऐ आवश्यक थे।

(2) इस रिपोर्ट के साथ प्रस्तुत तुलनपत्र एवं आय व व्यय लेखा और प्राप्ति व भुगतान लेखा, लेखा-खाताओं के अनुरुप हैं।

(3) हमारी राय में हमें प्राप्त जानकारी और दिये गये स्पष्टीकरण के अनुसार, लेखा विवरण और इसके साथ संलग्न की गयी अनुसूचियाँ एवं टिप्पणियाँ एकाउन्ट नीतियों पर आधारित वास्तव और स्पष्ट चित्र प्रस्तुत करती हैं।

(i) 31 मार्च 2000 तक के तुलनपत्र के विषय में, कार्य-निष्पादन की स्थिति, और

(ii) आय व व्यय लेखा के बारे में उपरोक्त तारीख को समाप्त वर्ष के लिये सामान्य निधि का अधिशेष एवं परियोजना निधि की कमी (घाटा)।

वास्ते **दत्ता सरकार एण्ड कं**
सनदी लेखापाल

ह॰ **के. एम. राय**
साझेदार

कलकत्ता : 20.7.2000

सत्येन्द्रनाथ बसु राष्ट्रीय

ब्लाक जे. डी., सेक्टर III,

31 मार्च 2000 तक

31 मार्च 1999 तक (रु०)	निधि एवं देयताएं	अनुसूची	(रु०)	(रु०)
124178799	**पूँजी गत निधि**			
	विगत लेखानुसार शेष		124178799	
	जोड़ें: अनावर्ती व्यय के लिये			
	भारत सरकार से प्राप्त सहायता भुगतान		3304417	
				127483216
9090958	**सामान्य निधि**			
	विगत लेखानुसार शेष		9090958	
	जोड़ें/(घटायें): आय एवं व्यय			
	लेखे से अंतरित वर्ष के लिये			
	व्यय/(आय) से अधिक आय/(व्यय)		1851663	
				10942621
	अन्य निधियाँ			
1069753	**ग्रेच्यूटी निधि**			1473243
5164864	**परियोजना निधि**			
	विगत लेखानुसार शेष		5164864	
	घटायें: वर्ष की आय के मुकाबले			
	किया गया अतिरिक्त खर्च -			
	आय व व्यय लेखा से अंतरित	1	8545	
				515631
	चालू देयताएं और प्रावधान			
	क) **चालू देयताएं**			
2181554	खर्च के वास्ते देयताएं		2694568	
78681	अन्य देयताएं		97685	
1349851	ठेकेदारों से प्राप्त जमा राशि		460590	
40150	पूँजीगत खर्च के लिए विविध लेनदार		345288	3598131
	खर्च के वास्ते (परियोजना) देयताएं			33000
	ख) **प्रावधान**			
39951	तदर्थ बोनस हेतु प्रावधान			52980
50778	भविष्य निधि			28443
143245303				148767953

लेखे पर टिप्पणी - अनुसूची 11 उपरोक्त अनुसूचियाँ तुलन-पत्र का अभिन्न अंग हैं।

हमारी सम संख्यक तारीख की संलग्न रिपोर्ट के संदर्भ में
वास्ते दत्ता सरकार एण्ड कं
सनदी लेखापाल
ह० **के. एम. राय**
साझेदार

कलकत्ता, 20.7.2000

मौलिक विज्ञान केन्द्र

सॉल्ट लेक, कलकत्ता 700 098

का तुलन पत्र

31 मार्च 1999 तक (रु०)	संपत्ति एवं आस्तियाँ	अनुसूची	(रु०)	(रु०)
113822727	अचल आस्तियाँ			
	लागत/पूँजीकृत मूल्य के रूप में	2		131485624
	निवेश	3		
	सामान्य निधि निवेश			
17973516	अनुसूचित बैंकों में मियादी जमा			7605154
	ग्रेच्यूटी निधि निवेश			
613403	इण्डियन ओवरसीज बैंक, सॉल्ट लेक शाखा में मियादी जमा			1089470
	चालू आस्तियाँ, ऋण और अग्रिम			
	क) *चालू आस्तियाँ*			
	निवेश पर प्रद्भूत ब्याज			
1632721	सामान्य निधि			162234
74926	ग्रेच्यूटी निधि			336182
61323	मुद्रण व लेखन सामग्री का भंडार			–
891500	खताओं का भंडार			889700
166602	इंजिनीयरिंग एवं खपतयोग्य सामान का भंडार			शून्य
	नकद एवं बैंक शेष			
37173	हस्तगत् नकदी			25031
4674167	बैंक में नकदी (अनुसूचित बैंकों के चालू खाते में)	4		5756211
	ख) *ऋण और अग्रिम*			
121653	अमानत व अन्य रकम			202153
753117	नकद या सामान या पावना रकम के एवज में वसूली योग्य	5		1169319
2422475	वितरक और ठेकेदारों को दी गयी अग्रिम रक़म			46875
143245303				148767953

ह० **ए. दत्तास्वामी**
प्रशासनिक अधिकारी (कार्यकारी)
एस. एन. बसु राष्ट्रीय मौलिक विज्ञान केन्द्र

ह० **एस. दत्तागुप्ता**
निर्देशक
एस. एन. बसु राष्ट्रीय मौलिक विज्ञान केन्द्र

सत्येन्द्रनाथ बसु राष्ट्रीय

ब्लाक जे. डी., सेक्टर III,

31 मार्च, 2000 को समाप्त वर्ष की

विगत वर्ष के आँकड़े		व्यय	अनुसूची	परियोजना लेखा (रु)	सामान्य लेखा (रु)
परियोजना लेखा (रु)	सामान्य लेखा (रु)				
243233	9758048	वेतन एवं भत्ते तथा कर्मचारी लाभ	6	394939	11914188
12762	8260464	अन्य व्यय	7	5369	10210271
	2366753	रख-रखाव व्यय	8	30422	3286655
515906		सी.एस.आई.आर के छात्रों को वज़ीफा		300660	
33697		यात्रा		59056	
118154		अनुषंशिक एवं कच्चा माल		109320	
	10000	लेखा परीक्षा शुल्क			12000
31478		सहायता अनुदान को वापसी		105891	
		अतिथिगृह का भाड़ा		1250	
1781446	2359205	वर्ष के दौरान व्यय से अधिक आय को अग्रेनीत किया			2065525
2736676	22754470			1006907	27488639
		वर्ष में आय से अधिक व्यय को अग्रनीत किया		8545	
	21473	पूर्वावधि संम्बन्धित समायोजन	10		241543
1781446	2372604	व्यय पर आय के आधिक्य को तुलन पत्र में अंतरित किया गया सामान्य निधि			1851663
1781446	2394077			8545	2093206

लेखाओं पर टिप्पणियाँ - अनुसुची 11
उपर्युक्त अनुसूचियाँ आय एवं
व्यय लेखे का अभिन्न अंग हैं।

कलकत्ता 20.07.2000

हमारे इसी तिथि के संलग्न प्रतिवेदन के संदर्भ में
कृते दत्ता सरकार एण्ड कं
सनदी लेखापाल
ह०: के. एम राय
साझेदार

मौलिक विज्ञान केन्द्र

सॉल्ट लेक, कलकत्ता 700 098

आय एवं व्यय लेखा

विगत वर्ष के आँकड़े		आय	अनुसूची	परियोजना लेखा (रु)	सामान्य लेखा (रु)
परियोजना लेखा (रु)	सामान्य लेखा (रु)				
		सहायता अनुदान			
	3966000	गैर आयोजना			3300000
	16000000	आयोजना			21695583
		विविध प्राप्त अनुदान :			
2115631		परियोजनाओं के हेतु		683092	
621045		सी. एस. आई. आर. छात्रों के हेतु		315270	
		अन्य			755140
	246834	विविध आय	9		337788
	2541636	सावधि जमा रसीद पर ब्याज			
		वर्ष में आय से अधिक व्यय अग्रेनीत किया गया		8545	
2736676	22754470			1006907	27488639
1781446	2359205	वर्ष में व्यय से अधिक आय को अग्रानीत किया गया			2065525
	34872	पूर्वावधि सम्बंन्धित समायोजन	10		27681
		आय से अधिक व्यय को तुलन पत्र में अंतरित किया गया		8545	
1781446	2394077			8545	2093206

ह०: ए. दत्तास्वामी
प्रशासनिक अधिकारी (कार्यकारी)
एस. एन. बसु राष्ट्रीय मौलिक विज्ञान केन्द्र

ह०: एस. दत्तागुप्ता
निर्देशक
एस. एन. बसु राष्ट्रीय मौलिक विज्ञान केन्द्र

सत्येन्द्रनाथ बसु राष्ट्रीय मौलिक विज्ञान केन्द्र

ब्लाक जे. डी., सेक्टर III, सॉल्ट लेक, कलकत्ता 700 098

अनुसूची-1

	31 मार्च 2000 (रु.)	31 मार्च 1999 (रु.)
परियोजना निधि		
परियोजना सुपरकन्डक्टविटी	1952124	1952124
परिमाप प्रेषकता	165928	165927
संक्रमप का सांख्यिकीय अध्ययन	300120	300120
स्थापनाओं का अन्वेषप - सिद्धांत	109850	109850
सैद्धांतिक उच्च-ऊर्जा भौतिकी	37	2065
वारविक विश्वविद्यालय	459149	602098
अर्द्ध आवधिक दोलन	462470	337706
विश्लेषणात्मक और सांख्यिकीय अध्ययन	383670	490000
अंतरिक्ष खगोल की रचना	794932	795682
स्वत: संगठित आलोचना आकलन	389501	426216
परिमाप के मौलिक पक्ष	203050	शून्य
संसाधनों का संघटन	90000	शून्य
परियोजना सी.एस.आई.आर.	-154512	60918
प्रतीकचिह्न की तैयारी	शून्य	43994
	5156319	5164864

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अनुसूची-2

अचल परिसम्पत्ति	31 मार्च 1999 तक का शेष (रु)	वर्ष के दौरान योग (रु)	वर्ष के दौरान समायोजन (रु)	31 मार्च 2000 तक का शेष (रु)
क) सामान्य खाता				
कार्यालय उपकरण	366074	298014		664088
अतिथि गृह फर्नीचर	1908189			1908189
छोटे उपकरण	488957	94142		583099
पुस्तक व पत्रिकायें	9225028	4622405	-3150	13844283
निर्देशक के लिए अनुसंधान उपकरण	275916			275916
चहारदीवारी	1038937			1038937
कम्प्यूटर और अनुषंगी	6510904	2298547		8809451
भवन-निर्माण	67692968	8580704		76273672
कम्प्यूटर	1308681			1308681
कैम्पस की जमीन	10950694			10950694
वातानुकूल यंत्र	109475			109475
कैम्पस की परिसज्जा	434976	154154		589130
कार्यालय वाहन	104794	393808	-104794	393808
आवश्यक डाक सेवा (यू.पी.एस.)	217685	306600		524285
शैक्षिक स्टॉफ अनुसंधान उपकरण	161876	116782		278658
पुस्तकालय कम्प्यूटर	2899227			2899227
फर्नीचर और पुरजे	3378294	406073		3784367
इ पी ए बी एक्स प्रणाली	292334			292334
मुक्त कार्यालय प्रणाली	2281915			2281915
कम्प्यूटर प्रतिस्थापन	41880	133306		175186
	109688804	17404535	-107944	126985395
ख) परियोजना लेखा				
उपकरण	4102579	371238		4473817
पुस्तक और पत्रिकायें	14394	5218		19612
फर्नीचर और पुरजे	6800			6800
	4123773	376456	0	4500229
योग (क) + (ख)	113812577	**17780991**	**-107944**	**131485624**

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अनुसूची-3

	31 मार्च 2000 (रु)	31 मार्च 1999 (रु)
सामान्य निधि निवेश		
मियादी जमा		
क) इण्डियन ओवॅरसीज बैंक		
सॉल्ट लेक शाखा, कलकत्ता	4808902	2784882
ख) यूनाईटेड बैंक ऑफ इण्डिया		
मयूख भवन शाखा, कलकत्ता	2796252	15188634
	7605154	17973516

अनुसूची-4

	31 मार्च 2000 (रु)	31 मार्च 1999 (रु)
नकद और बैंक शेष		
अनुसूचित बैंक के चालू खाते में बैंक नकदी		
क) इण्डियन ओवॅरसीज बैंक		
सॉल्ट लेक शाखा, कलकत्ता		
सामान्य निधि खाता	2400895	1325306
परियोजना निधि खाता	765170	1144584
ख) यूनाईटेड बैंक ऑफ इण्डिया		
मयूख भवन शाखा, कलकत्ता		
सामान्य निधि खाता	2590146	2204277
	5756211	4674167

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अनुसूची-5

	31 मार्च 2000 (रु)	31 मार्च 1999 (रु)
ऋण और अग्रिम		
आर. सी. दास को अग्रिम	शून्य	455
एस. के. दास को अग्रिम	3000	शून्य
सवारी खर्च अग्रिम (आयोजना)	113000	शून्य
सवारी खर्च अग्रिम (गैर-आयोजना)	67075	शून्य
गृह निर्माण अग्रिम	500000	शून्य
वसूलीयोग्य बीमा	499	शून्य
वसूलीयोग्य खर्चे	10000	10000
पूर्वप्रदत्त खर्चे	360331	705895
कर्मचारियों को अग्रिम	20690	14660
एल.टी.सी. के लिए अग्रिम	3106	9887
त्योहार अग्रिम	55340	2740
अग्रिम - एस. के. मन्ना को	4500	4500
कर्मचारी आयकर	2952	2952
	1140493	751089
	28826	2028
परियोजना खाते	1169319	753117

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अनुसूची-6		31 मार्च 2000 (रु)	31 मार्च 1999 (रु)
वेतन व भत्ते एवं कर्मचारी लाभ			
वेतन एवं भत्ते			
गैर आयोजना	2115191		
आयोजना	6678104		
बकाया वेतन	81098		
अस्थाई प्रकृति	971473	9845866	7639683
मज़दूरी - अस्थाई मज़दूर		451932	484813
भ.नि. में संस्थान का अंशदान			
आयोजना	344928		
गैर आयोजना	107935		
अस्थाई प्रकृति	144535	597398	379061
चिकित्सा खर्च			
आयोजना	105996		
गैर आयोजना	83293		
अस्थाई प्रकृति	15715	205004	229496
तदर्थ बोनस			
आयोजना	29028		
गैर आयोजना	14514		
अस्थाई प्रकृति	9438	52980	39915
अवकाश यात्रा रिआयत			
आयोजना	6575		
गैर आयोजना	5500	12075	91756
ग्रेच्यूटी के लिए प्रावधान			
आयोजना	319848		
गैर आयोजना	35787	355635	531010
ग्रेच्यूटी अंशदान		6270	
पेनशन अंशदान		8595	
अवकाश वेतन			
आयोजना	6750		
गैर आयोजना	329704	336454	290130
भ.नि. पर ब्याज (कमी)			
आयोजना	30686		
गैर आयोजना	11293	41979	72184
		11914188	9758048
परियोजना लेखा			
वेतन और भत्ते		394939	243233
		394939	243233

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अनुसूची-7

	31 मार्च 2000 (रु)	31 मार्च 1999 (रु)
अन्य खर्च		
विद्युत शुल्क	3195587	2536155
वाहन किराया शुल्क	551521	238784
विविध खर्च	413512	170249
छपाई और लेखन सामग्री	412800	234488
डाक और तार	94648	88729
बीमा	1646	2639
टेलीफोन और ट्रंक कॉल	214310	289869
गैर-शैक्षिक स्टॉफ का यात्राभत्ता/दैनिक भत्ता	13800	3132
शैक्षिक स्टॉफ का या.भ./दै.भ. (देश में)	64436	110786
शैक्षिक स्टॉफ का या.भ./दै.भ. (विदेश में)	142114	195278
बैठकों पर खर्च	344205	148665
बैंक शुल्क	16653	27248
गोष्ठी और अन्य शैक्षिक खर्च	1195505	590239
विजिटिंग मेम्बर फेलोशिप (गैर-आयोजना)	8332	43910
निर्देशक अनुसंधान खर्च	शुन्य	21564
शैक्षिक स्टॉफ अनुसंधान खर्च	106227	101101
सेमिनार की कार्यवाही छपाने पर खर्च	25000	37058
पुस्तकालय खर्च	6460	35599
टी.पी.एस.सी. वक्ताओं को या.भ./दै.भ.	929650	792084
ई-मेल	3050	100068
निगम को कर भुगतान	285290	275363
परामर्श शुल्क	301441	शुन्य
निर्देशक के परिसर का किराया	122000	शुन्य
हॉस्टल आवास शुल्क	171562	शुन्य
इंटरनेट शुल्क	432813	587500
परिदर्शन पर आए वैज्ञानिकों पर खर्च	143681	66307
एस एन बी एन सी बी एम फेलोगण	13320	शुन्य
कानूनी खर्च	22633	456572
परिदर्शनकारी वैज्ञानिक (आयोजना)	473731	721957
शिक्षा कार्यक्रम	54633	शुन्य
परित्यक्त कार की बिक्री पर नुकसान	63894	शुन्य
स्टैटफिजीक्स-III	शुन्य	276932
परिसर परिसज्जा	शुन्य	108188
शीत संस्थान	385816	शुन्य
	10210271	8260464
परियोजना लेखा		
बैंक शुल्क	1713	12762
डाक व तार	3656	शुन्य
	5369	12762

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अनुसूची-8

		31 मार्च 2000 तक (रु)	31 मार्च 1999 तक (रु)
रख-रखाव व्यय			
उपकरण की मरम्मत		24180	17268
कार रख-रखाव		5952	41811
कार्यालय रख-रखाव		156262	83847
कम्प्यूटर रख-रखाव		462901	485094
पी.ओ.एल.		19314	51399
लोह निष्काशन संयंत्र का रख-रखाव		54048	70367
भवन रख-रखाव		437424	21828
सुरक्षा रख-रखाव		543358	407312
विद्युत रख-रखाव		600603	572770
वातानुकूल रख-रखाव (अतिथि गृह)		29888	66369
वातानुकूल रख-रखाव (केन्द्रीय)		280608	283169
वातानुकूल रख-रखाव (कम्प्यूटर कमरा)		20006	37282
यू.पी.एस. रख-रखाव		26964	94293
ई.पी.ए.बी.एकस रख-रखाव		97426	48757
लिफ्ट रख-रखाव		70620	64294
अग्नि चेतावनी रख-रखाव		20400	शून्य
कैंटीन रख-रखाव		436701	20893
	(क)	3286655	2366753
परियोजना लेखा :		30422	
कम्प्यूटर रख-रखाव	(ख)	30422	-

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अनुसूची-9

	31 मार्च 2000 तक (रु)	31 मार्च 1999 तक (रु)
विविध आय :		
अतिथि गृह से आय	151740	144540
पुस्तकों की विक्री से लाभ	शून्य	200
अन्य प्राप्तियाँ	7631	5
क्षात्रावास शुल्क	40173	14112
खोई पुस्तक की भरपाई	शून्य	1247
विद्युत वसूली	631	शून्य
निविदा पत्रों की बिक्री	4700	शून्य
कैंटीन कूपन (वसूली)	112449	शून्य
परिवहन (वसूली)	14300	शून्य
लाईसेंस शुल्क	1664	शून्य
गोष्ठी कमरा किराया	4500	1000
स्टेटफिज़-III से अंशदान	शून्य	80000
पंजीकरण शुल्क के आय	शून्य	5730
	337788	246834

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अनुसूची-10

	नामे		जमा	
	31.3.2000 को समाप्त वर्ष का (रु)	31.3.1999 को समाप्त वर्ष का (रु)	31.3.2000 को समाप्त वर्ष का (रु)	31.3.1999 को समाप्त वर्ष का (रु)
पूर्वावधि समायोजन लेखा				
मुद्रण एवं लेखन सामग्री	61323			
विद्युत रख-रखाव	139968			
पट्टे पर भूमि का भाड़ा			27681	
तदर्थ बोनस	12821			
अनियत मज़दूर	455			
विद्युत व्यय		16066		4872
लेखा परीक्षा शुल्क (प्रमाणीकरण)		500		
संगोष्ठी एवं अन्य शैक्षिक व्यय	319	2200		
एल.टी.सी.		2637		
वातानुकूल (केन्द्रीय) रख-रखाव	2192	70		
भवन रख-रखाव	24465			
गोष्ठी में दिए गए अंशदान की वापसी				30000
	241543	21473	27681	34872

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अनुसूची-11

लेखा पर टिप्पणी

1. महत्वपूर्ण लेखा नीतियाँ :

   (क) अचल परिसम्पत्तियों में 'ऑर्बिट्रेशन' पर देय रकम को शामिल करते हुए ऐतिहासिक मूल्य पर दर्शाया गया है। अचल परिसम्पत्तियों पर ह्रास नहीं किया गया है।
   भवन निर्माण खाते को, अग्रिम यदि हो, उसका समायोजन कर, ठेकेदारों के चालू बिलो को पास कर नामें किया जाता है।

   (ख) भारत सरकार से प्राप्त अनुदान से परियोजनाओं के लिए क्रय की गई अचल परिसम्पत्तियों को तुलन पत्र में अलग से दर्शाया गया है। परियोजना के पूर्ण होने पर भारत सरकार अपनी इच्छा से परिसम्पत्तियाँ केन्द्र को उपहार दे, अथवा अन्य किसी ऐसे संस्थान को हस्तांतरित कर सकती है।

   (ग) विज्ञान एवं प्रोद्यौगिकी विभाग, भारत सरकार से, प्राप्त अनुदान को नक़द आधार पर हिसाब में शामिल किया गया है।

   (घ) छुट्टी नकदीकरण को नक़द आधार पर हिसाब में शामिल किया गया है।

   (ङ) ग्रैच्यूइटी का आकलन केन्द्रीय सरकार के निर्देशानुसार किया जाता है।

   (च) शासी निकाय के संकल्पानुसार (एस. एन. बोस. - द मैन एण्ड हिज़वर्क, खण्ड I&II) के प्रकाशन के स्टॉक की कीमत रियायती मूल्य पर निर्धारित की गई है।

2) केन्द्र की चल-अचल परिसम्पत्तियों का पिछली बार प्रत्यक्ष सत्यापन 1997-98 में किया गया था। तद्नुसार विसंगतियों का समायोजन यदि कोई हो, उसको प्रभावी नहीं किया गया है।

3) माननीय कलकत्ता उच्च-न्यायालय के आदेश पर पुलिस अधिकारियों ने केन्द्र के भवन निर्माण से सम्बन्धित सभी फाइलें व कागज़ात जब्त कर लिए हैं, इस कारण सम्बद्ध अभिलेख फिलहाल उपलब्ध नहीं हैं।

4) उपहार में दिए गए उपकरण के लिए आवश्यक समायोजन नहीं किया गया है।

5) लाईसेंस शुल्क व विद्युत ख़र्च की वसूली स्टॉफ क्वार्टर्स के एलाटियों से क्रमश: दिसम्बर 1999 व मार्च 2000 से प्रभावशील हुई है।

6) आवश्यकतानुसार विगत् वर्ष के आँकड़ो का पुन: वर्गीकरण व पुर्नव्यवस्थित किया गया है।

सत्येन्द्रनाथ बसु राष्ट्रीय

ब्लाक जे. डी., सेक्टर III,

31 मार्च 2000 को समाप्त हुए वर्ष की

विगत वर्ष के आँकड़े		प्राप्ति	परियोजना लेखा (रु)	सामान्य लेखा (रु)
परियोजना लेखा (रु)	सामान्य लेखा (रु)			
		आरम्भिक नकद व बैंक शेष		
437167	3261268	इंडियन ओवॅरसीज बैंक शेष	1144584	1325306
	-275800	यूनाइटेड बैंक ऑफ इंडिया		2204277
	36261	नकद हाथ में		37173
		सहायता अनुदान		
	16000000	आयोजना व्यय के लिए		25000000
	3966000	गैर आयोजना के लिए		3300000
		विविध सहायता अनुदान		
621045		सी.एस.आई.आर फेलीज़ के लिए	315270	
2115631		परियोजनाओं के लिए	683092	
		अन्य		755140
		मियादी जमा रसीदों का नकदीकरण		
	1017452	इंडियन ओवॅरसीज बैंक		
	3353157	यूनाइटेड बैंक आफ इंडिया		14537762
		ठेकेदारों से प्राप्तियाँ - प्रमिभूत राशि		36360
36000		**आपूर्तिकर्त्ताओं से अग्रिम की वसूली**		

मौलिक विज्ञान केन्द्र

सॉल्ट लेक, कलकत्ता 700 098

प्राप्तियाँ एवं भुगतान लेखा

विगत वर्ष के आँकड़े				
परियोजना लेखा (रु)	सामान्य लेखा (रु)	भुगतान	परियोजना लेखा (रु)	सामान्य लेखा (रु)
		वेतन, भत्ते व कर्मचारी लाभ		
243233	7466547	वेतन व भत्ते	394939	9368278
	484814	मज़दूरी		442632
	408227	भविष्य निधिमें कर्मचारियों का अंशदान		542433
	155409	चिकित्सा व्यय		180520
	41317	छुट्टी रियायत यात्रा		9841
	225803	छुट्टी वेतन		336454
	30237	तदर्थ बोनस		50317
		पेंशन अंशदान		8595
		आनुतोषिक अंशदान		6270
		अन्य व्यय		
	1289711	विद्युत व्यय		1683016
	231250	परिवहन भाड़ा पर व्यय		494343
	216179	विविध व्यय		386758
	196382	मुद्रण व लेखन सामग्री		412800
	88729	डाक एवं तार		91567
	3490	बीमा		2942
	336689	टेलीफोन व ट्रंक काल		178895
	3132	गैर शैक्षिक कर्मचारीगण को यात्रा भत्ता		13508
	97540	शैक्षिक कर्मचारीगण (भारत) को यात्रा भत्ता		62676
	195277	शैक्षिक कर्मचारीगण (विदेश) को यात्रा भत्ता		142114
	146665	सभा खर्च		342493
12762	26808	बैंक खर्च	1713	16653
	550262	संगोष्ठी तथा अन्य शैक्षिक व्यय		1181108
	275363	निगम कर		283305
	274674	स्टेट फिस-III		
	765867	अभ्यागत सदस्य फेलोशिप		463857
	126687	शैक्षिक कर्मचारीगणों का अनुसंधान व्यय		106227
	37058	संगोष्ठी कार्यवाही से सम्बद्ध प्रकाशन		25000
	792084	टी.पी.एस.सी वक्ताओं को यात्रा भत्ता		928050
	53248	ई-मेल		3050
	251819	अभ्यागत वैज्ञानिकों को सुसज्जित आवास सुलभ करना		281543
	443900	विधि व्यय		15259

सत्येन्द्रनाथ बसु राष्ट्रीय

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विगत वर्ष के आँकड़े		प्राप्ति	परियोजना लेखा (रु)	सामान्य लेखा (रु)
परियोजना लेखा (रु)	सामान्य लेखा (रु)			
		जमा एवं समायोज्य किराया प्राप्ति		
	15000	के. मण्डल से प्राप्त जमा		
		एम. माथुर से प्राप्त जमा		1650
		एस. बनर्जी से प्राप्त जमा		7500
		एस. एस. मन्ना से प्राप्त जमा		20000
		ए. मोहारी से प्राप्त जमा		3000
		विविध आय		
	140750	अतिथि गृह से आय		129575
		परित्यक्त स्टॉफ कार की विक्रय हेतु कार्यवाही		39900
	8200	पुस्तकों की बिक्री		1800
	5	अन्य प्राप्तियाँ		1245
		निविदा पत्रों की बिक्री		4700
	11000	वसूली योग्य (पुस्तकों की बिक्री)		
	324097	मियादी जमा पर ब्याज		309267
		परियोजना लेखा से प्राप्त		143972

मौलिक विज्ञान केन्द्र

सॉल्ट लेक, कलकत्ता 700 098

प्राप्तियाँ एवं भुगतान लेखा *(क्रमशः)*

विगत वर्ष के आँकड़े				
परियोजना लेखा (रु)	सामान्य लेखा (रु)	**भुगतान**	**परियोजना लेखा (रु)**	**सामान्य लेखा (रु)**
	550000	इन्टरनेट व्यय		309612
		शीतकालीन विद्यालय		353881
		रख-रखाव खर्च		
	66721	लिफ्ट रख-रखाव		70967
		वातानुकूल का रख-रखाव (अतिथि गृह)		29547
	19600	उपकरण की मरम्मत		21098
	41811	कार रख-रखाव		4696
	83847	कार्यालय रख-रखाव		148814
	569288	कम्प्यूटर रख-रखाव	30422	281393
	51399	पी. ओ. एल		16154
	31302	भवन रख-रखाव		303917
	360548	सुरक्षा रख-रखाव		467015
	66151	लौह निष्कासन संयंत्र का रख-रखाव		51573
	65293	यू.पी.एस. रख-रखाव		334962
	559672	विद्युतीय रख-रखाव		524409
	41371	इ.पी.ए.बी.एक्स रख-रखाव		49593
	20893	कैन्टीन रख-रखाव		431875
	278858	वातानुकूलन (केन्द्रीय) रख-रखाव		267992
		आग चेतावनी रख-रखाव		20400
	56000	वातानुकूलन (कम्प्यूटर) रख-रखाव		
	391511	पुस्तकालय पुस्तकें		857057
	2010112	पुस्तकालय पत्रिकाएँ (जर्नल्स)		2770986
		उपकरण		
	7413	लघु उपकरण		94141
	110702	कार्यालय उपकरण		
	913478	कम्प्यूटर व अनुषंगी		2338397
	6750	शैक्षिक कर्मचारी अनुसंधान उपकरण		116782
	49288	निदेशक अनुसंधान उपकरण		
		भूमि व भवन		
	108188	प्रांगण सौन्दर्यकरण		153680
	105322	भवन निर्माण		7927537

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विगत वर्ष के आँकड़े		प्राप्ति	परियोजना लेखा (रु)	सामान्य लेखा (रु)
परियोजना लेखा (रु)	सामान्य लेखा (रु)			
100000		सामान्य निधि से प्राप्त		
	5730	पंजीयन शुल्क से आय		
	80000	सेमीनार के लिए अंशदान		
	1000	सेमीनार के लिए कमरा किराया		4500
	30000	सेमीनार के लिए अंशदान की वापसी		
	9797	ए. बनर्जी		

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सॉल्ट लेक, कलकत्ता 700 098

प्राप्तियाँ एवं भुगतान लेखा *(क्रमश:)*

विगत वर्ष के आँकड़े				
परियोजना लेखा (रु)	सामान्य लेखा (रु)	भुगतान	परियोजना लेखा (रु)	सामान्य लेखा (रु)
		फर्नीचर व साज सामान		
	309752	कार्यालय फर्नीचर		109995
		पुस्तकालय आलमारी		74500
	193380	ठेकेदारों व आपूर्तिकर्त्ताओं को अग्रिम		59675
		अन्य अग्रिम		
	47400	त्यौहार अग्रिम		138500
	50439	एल.टी.सी.के लिए अग्रिम (शुद्ध)		3106
	19856	कर्मचारी अग्रिम	4326	53213
2028	11155	विविध अग्रिम		32499
		वाहन अग्रिम		192000
		गृह-निर्माण अग्रिम		500000
		जमा		
	16650	किराया के रूप में जमा		82150
	27250	प्रतिभूति जमा की वापसी		
	1000	बयाना राशि की वापसी		37584
	23000	प्रतिभूति जमा		
		अन्य भुगतान		
	77263	परियोजना लेखा		
	1052256	अदत्त देयिताएँ - राजस्व		1484949
	10609	अदत्त देयिताएँ पूँजी		10150
	223969	आनुतोषिक (ग्रेच्यूइटी) निधि निवेश		456350
		करों का भुगतान		20934
	16066	पूर्वावधि (विशुद्ध)		2419
515906		सी.एस.आई.आर. छात्रों को वज़ीफा	300660	
33697		यात्रा	59056	
7314		पुस्तक व पाक्षिक पत्रिकाएँ	5218	
		भविष्य निधि में भुगतान (विशुद्ध)		50778
	131400	समायोज्य किराया		182800
	105469	आनुतोषिक निधि से भुगतान		59170
119334		आकस्मिक व कच्चे माल	104313	
1199507		उपकरण	371238	
31478		सहायता अनुदान की वापसी	105891	

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विगत वर्ष के आँकड़े				
परियोजना लेखा (रु)	सामान्य लेखा (रु)	**प्राप्ति**	परियोजना लेखा (रु)	सामान्य लेखा (रु)
3309843	27983917		2142946	47863127

हमारे इसी तिथि के संलग्न प्रतिवेदन के संदर्भ में
कृते **दत्ता सरकार एण्ड कं**
सनदी लेखापाल
ह०: **के. एम. राय**
साझेदार

कलकत्ता 20.07.2000

मौलिक विज्ञान केन्द्र

सॉल्ट लेक, कलकत्ता 700 098

प्राप्तियाँ एवं भुगतान लेखा *(क्रमशः)*

विगत वर्ष के आँकड़े		भुगतान	परियोजना लेखा (रु)	सामान्य लेखा (रु)
परियोजना लेखा (रु)	सामान्य लेखा (रु)			
		आई.ओ.बी. (विशुद्ध) में अल्पावधिक जमा		1782000
	2000	वसूली की वापसी		
	36795	ठेकेदारों का आयकर		242103
	2452	ठेकेदारों का विक्रय कर		155688
	1480	एन.एस.सी.एच. को भुगतान		
	41880	कम्प्यूटर स्थापन		66198
	28043	ई.पी.ए.बी.एक्स. व्यवस्था		
	35599	पुस्तकालय सामान्य व्यय		6460
	18067	ठेकेदारों को भुगतान		
		कार्यालय वाहन		393808
	153245	परामर्श शुल्क		297850
		निर्देशक आवास का भाड़ा		122000
		छात्रावासीय खर्च		155722
		एस.एन.बी.एन.सी.बी.एस. सदस्य		13320
		शिक्षण कार्यक्रम		54153
		नक़द व बैंक अंतशेष		
		इंडियन ओवॅरसीज बैंक	765170	2400895
		यूनाइटेड बैंक ऑफ इंडिया		2590146
1144584	1325306	नक़दी हाथमें		25031
	2204277			
	37173			
3309843	27983917		2142946	47863127

ह०: **ए. दत्तास्वामी**
प्रशासनिक अधिकारी (कार्यकारी)
एस. एन. बसु राष्ट्रीय मौलिक विज्ञान केन्द्र

ह०: **एस. दत्तागुप्ता**
निर्देशक
एस. एन. बसु राष्ट्रीय मौलिक विज्ञान केन्द्र

लेखा परीक्षकों की रिपोर्ट पर अनुपालन कार्रवाई

लेखा परीक्षकों ने वर्ष 1999-2000 की अपनी रिपोर्ट में कोई विपरीत टिप्पणी नहीं की है। अतएव, इस संदर्भ में कोई कार्यवाही नहीं सोची गई है।

एस. दत्तागुप्ता
निर्देशक

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