

ANNUAL REPORT

1997-98



SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

(ESTD. 1986)

BLOCK JD, SECTOR III, SALT LAKE
CALCUTTA 700 091 INDIA



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APRIL 1, 1997 TO MARCH 31 1998

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OBJECTIVES

The S. N. Bose National Centre for Basic Sciences was established in June 1986 as a registered society functioning under the umbrella of the Department of Science and Technology, Government of India. Its objectives are :

to foster, encourage and promote the growth of advanced studies in selected branches of basic sciences;

to conduct original research in theoretical and mathematical sciences and other basic sciences and frontier areas including challenging theoretical studies of future applications;

to provide a forum for personal contacts and intellectual interaction among scientists within the country as well as between them and their counterparts abroad; and

to train young scientists for research in basic sciences.

CONFERENCES/WORKSHOPS/SYMPOSIA

1. **Summer School in Mathematics : Introductory Lectures in Algebraic Geometry at SNBNCBS, Calcutta (April 15-25, 1997)**

The Centre organized a course of lectures for researchers in Mathematics and Mathematical Physics - 17 scholars from all over India participated. Professor V. Srinivas, TIFR, Mumbai and Professor Kapil H. Paranjape, IMSc., Chennai conducted the School. Professor Sujit K. Bose of SNBNCBS was the Convener.

2. **Workshop on Multiwavelength Studies of Stars and Compact Objects which included a Conference on Observational Evidence for Black Holes in the Universe at SNBNCBS, Calcutta (January 1-17, 1998)**

The workshop was conducted at the Centre. The entire programme was divided into three parts. Parts one and two were basically workshops; the third part was a conference. There were 50 participants and of them 31 from aboard. Professor S. K. Chakrabarti of SNBNCBS was the Convener. Proceedings will be brought out. A report was published in Science 279 (1998) pp 1321-2.

3. **XII International Conference on Computer in Chemical Research and Education (XII ICCCRE) at Pune University (January 5-9, 1998)**

The Centre collaborated with the Pune University in running the above conference. It had 105 participants - 45 from aboard and 60 from all over India. It is expected that the conference would provide impetus to the research programme in this important area, especially those by the young Indian researchers. Professors Shridhar R. Gadre was the Convener. Prof N Satyamurthy, Honorary Fellow of the Centre, participated in the Conference.

4. **Vth Workshop on High Energy Physics Phenomenology (WHEPP-5) at the Inter-University Centre for Astronomy and Astrophysics, Pune (January 11-25, 1998)**

The Centre was an important co-sponsor while additional funds were provided by TIFR and ICTP jointly. There were 80 participants, 19 from aboard, 19 from Indian Universities and the rest were from various Indian Institutes, such as IISc., IMSc., IUCAA, PRL, MRI, NPL, SINP and TIFR. A special feature of this

workshop was its emphasis on the new and growing area of Astroparticle physics. It is hoped that the interaction in this interdisciplinary area will thrive in future workshops and in the country as a whole. Professor R.V. Gavai was the Convener.

5. Condensed Matter Days, in 1997 (CMDAYS97) at Santiniketan, Visva Bharati (August 29-31, 1997)

The programme, now an annual feature, collected all workers interested in the study of condensed matter in eastern India, including the north eastern states. There were about seventy participants exchanging their ideas and discussing their work. The next meeting will be in Bhagalpur University.

6. Physics of Black Holes at Indian Institute of Science, Bangalore (December 9-11, 1997)

The meeting organised by Prof J Pasupathy of IISc had lectures on the subject by distinguished physicists from India and abroad. The proceedings will be published.

7. Nature of Reality in Arts and Science at Visva Bharati (March 20-22, 1998)

The meeting was sequel to one on Aesthetics and Motivations in Science and Arts held in Santiniketan in November 1992. Philosophers and artists came to discuss their ideas in relation to those of the scientists. The subject will continue to interest these people in future.

8. National Seminar on X-ray, Laser, Optico-acoustic and Electrical Studies of Solids including Minerals and Coal at Indian School of Mines, Dhanbad (March 25-26, 1998)

The convener of this meeting was P S Gupta. D K Paul, Director of ISM, and A R Chetal, Head of the Applied Physics Dept., ISM, took good care of the visiting scientists. About 80 delegates from all over the country attended the seminar which was cosponsored by GSI, Calcutta; IBM, Nagpur; and CSIR, New Delhi. Various modern analytical techniques were talked about for the study of naturally occurring solids.

9. Electron Correlation at Indian Association for the Cultivation of Science, Calcutta (January 10-12, 1998)

Many body problem in chemistry deals with electron correlation; theoretical studies concerned with this subject were discussed in this meeting which was timed to take advantage of the XII international conference in item 3.

10. XII National Convention of Indian Association of Physics Teachers at Midnapore (October 22-25, 1997)

This was the annual convention of the association concerned with the problems of teaching and research in physics education. This time it was the task of the Regional Council X of the Association to organise it; C K Majumdar (SNBNCBS) was the regional president (1995-97), and the principal of Midnapore college Sri M R Roy and his colleagues agreed to share the burden with him. Prominent speakers included A. Ghosh and C. L. Roy (IIT, Kharagpur), L. Satpathy (IOP, Bhubaneswar), and P. Chaudhuri (Dept of Education, West Bengal). A report of this convention was published in the monthly bulletin of the association.

Support was also given to some smaller programme where the Centre's scientists had some interest : (i) Post-independence Indian Progress in Mathematics and Mathematical sciences (Calcutta Mathematical Society) ; (ii) Young Physicists Colloquium (Indian Physical Society) ; (iii) Continuum in Mathematical Education from Primary to Postgraduate level (Visva Bharati); (iv) Discussion meeting in Ultrafast Chemical Phenomena (JNCASR, Bangalore); (v) 4th Seminar on Biochemistry and Biophysics (WBAS&T, Bose Institute) and (vi) Felicitation of Prof D. L. Bhattacharya (Physics Dept., Calcutta Univ.).

SEMINARS ORGANISED AT THE CENTRE

1. Chakrabarti, S. K. SNBNCBS, Calcutta : Stable and Unstable Solutions of Radiative Hydrodynamic Equations in Presence of Compact Objects (April 17, 1997).
2. Wu, Kinwah, University of Sydney, Australia : Stability of Accretion Shocks with Multiple Cooling Processes (April 17, 1997).
3. Gade, Prashant, Jawaharlal Nehru Centre, Bangalore : Self-organised criticality in myopic and models and interfacial roughening (May 21, 1997).
4. Bhawal, Biplab, National Astronomical Observatory, Tokyo, Japan : In Search of Einstein's Waves (October 24, 1997).
5. Chakrabarti, S. K., SNBNCBS, Calcutta : New Twists in Gravitational Wave Studies from Coalescing Binaries (October 24, 1997).
6. Fyfe, W. S., University of Western Ontario, Canada : A world crisis : The need for truly sustainable technologies (November 11, 1997).
7. Burinski, A., Nuclear Institute, Moscow : Derivation of Kerr-Shield BH Metrics (December 26, 1997).
8. Mukhopadhyay, Ranjan, Simon Fraser University, Vancouver, Canada : Non Equilibrium Properties of Normal Superfluid Interface (January 13, 1998).
9. Adams, David, Trinity College, Dublin : Discretisation of non-abelian topological gauge theories in a perturbative framework (February 2, 1998).
10. Sen, R. N., Department of Mathematics, Ben Gurion University, Israel : On Wigner's unreasonable effectiveness of mathematics in the natural sciences (February 4, 1998).
11. Abdalla, E., University of Sao Paulo, Brazil : Liouville theory and large scale structure of matter distribution (February 6, 1998).
12. Half-a-day Seminar on Some aspects of liquid crystals on topics given below by the Polish Group of Scientists from Military University of Technology,

Warsaw, Poland (February 20, 1998).

- (i) Dabrowski, R : Antiferroelectric liquid crystals : Bases and materials.
 - (ii) Klosowicz, S. : Polymer dispersed liquid crystal structures with differentiated structure.
 - (iii) Czuprynski, K. : The classification on basic liquid crystal phases : New liquid crystal orthogonal phases.
13. Kruskal, Martin, Rutgers University/Princeton University : Surreal numbers : Bigger, better, bolder and more basic (March 3, 1998).
 14. Mathur, Manu, SNBNCBS, Calcutta : Magnetic monopoles in SU (N) gauge theories : An abelian understanding (March 9, 1998).

VISITORS AT THE CENTRE

1. Dr. Kinwah Wu, University of Sydney, Australia : visited the Centre (April 17, 1997).
2. Dr. Prashant Gade, Jawaharlal Nehru Centre, Bangalore visited the Centre (May 21, 1997).
3. Mr. Rajib Rokhit, IIT Kanpur : visited the Centre in a student visitor's programme (from June 1, 1997 to July 15, 1997).
4. Arnab Majumdar, IIT Kanpur : visited the Centre and has been collaborating with Dr. Anita Mehta during June-August, 1997.
5. Apell, Peter, Department of Applied Physics, Chalmers University of Technology, Gothenberg, Sweden : Geometrical influence on collective excitations (August 22, 1997).
6. Dr. Biplab Bhawal, National Astronomical Observatory, Tokyo, Japan : visited the Centre (October 24, 1997).
7. Mr. K. P. Surendran visited Prof. S. K. Chakrabarti during October, 1997.

8. Professor W. S. Fyfe, FRS, Univeristy of Western Ontario, Canada : visited the Centre (November 11, 1997).
9. Mr. Biswajit Paul , Astrophysics Group of TIFR, Mumbai : visited the Centre (November 6-7, 1997).
10. Professor Mike Powell and Mrs. M. MacMohon, University of Western Ontario, Canada : visited the Centre (November 1997).
11. Professor A. Burinski, Nuclear Institute, Mosco : visited the centre (December 26, 1997).
12. Mr. Samik Dasgupta, Pune University : visited the Centre to work with S. K. Chakrabarti.
13. Dr. B. K. Ghose, Physics Dept., Allabhad University (December 17, 1977 to January 4, 1998)
14. Dr. Ranjan Mukhopadhyay, Simon Fraser University, Vancouver, Canada : visited the Centre (January 13, 1998).
15. Mr. S. Manickam, Pune visited S. K. Chakrabarti (December 30, 1997-February 15, 1998).
16. Dr. David Adams, Trinity College, Dublin : visited the Centre (February 2, 1998).
17. Professor R. N. Sen, Ben Gurion University, Israel : visited the Centre (February, 4, 1998).
18. Professor E. Abdalla, University of Sao Paulo, Brazil : visited the Centre (February 6, 1998).
19. Professor R. Dabrowski, Dr. S. Klosowicz and Dr. K. Czuprynski, Military University of Technology, Warsaw, Poland : visited the Centre (February 19-23, 1998).
20. Professor Martin Kruskal, Rutgers University/Princeton University : visited the Centre (March 3, 1998).

RESEARCH ACTIVITIES AT THE CENTRE

The Centre has active groups in Physics, Mathematics, Applied Mathematics, Theoretical Chemistry and Astrophysics.

A. Physics

The work in physics is concentrated on quantum field theory, condensed matter physics, quantum optics, foundational problems in quantum mechanics and astrophysics.

With E.C Marino (UFRJ, Brasil), R. Banerjee has developed different approaches for Bosonization in higher dimensions, based on a path integral formulation or on a comparison among current correlators. The connection among these approaches has been elucidated. Using the above techniques, R. Banerjee and E. Abdalla (USP, Brasil) have shown that contrary to classical expectation there is a screening phase in these dimensional QED for arbitrary values of the fermion mass parameter. C. Watzesek (UFRJ, Brasil) and R. Banerjee have developed a novel technique of soldering Lagrangeans displaying dual aspects of the same symmetry to obtain new results : they have proposed a method for obtaining duality symmetric actions in quantum mechanics or field theory. These ideas enable them to analyse the chiral decomposition of 2D fermion determinants and the role of Bose symmetry.

R. Banerjee and S. Ghose (D. Andrews College) have realised that the chiral oscillator, instead of the usual harmonic oscillator, is sometimes more useful in studying quantum mechanics of field theory. The quantum invariants of such an oscillator have been calculated and a simple derivation of the Zeeman effect has been provided. The general method of obtaining the spin of relativistic Chern-Simons vortices has been extended by R. Banerjee and P. Mukherjee (ABN Seal college, Cooch Behar) to include the non-relativistic case. Certain ambiguities in the existing results have been pointed out and clarified. Ms. S. Kumar and R. Banerjee have observed some new features in the constrained analysis of the duality symmetric form of the electromagnetic action.

The details of the symmetry breaking in the Salam-Weinberg model are not known; the Higgs particle has not been found. A. Hahiri showed sometime ago that it was possible to generate masses for vector bosons by coupling a dynamical two-form (antisymmetric tensor) potential to the gauge field. It is necessary to show that this mechanism is renormalizable and unitary. Lahiri has constructed a BRST invariant action of the dynamical non-abelian two form, and has been working on the proof of renormalizability and unitarity.

D. Gangopadhyay, with R. Bhattacharya, is investigating a general formalism for setting up duality invariant Lagrangian. With R. Chaudhury, he has been exploring possible applications of their exact solution for two and three colours a la Van der Waerden's colouring theorem.

In the field of high temperature superconductivity along with B. K. Chakraverty (LEPES, CNRS, Grenoble, France), R. Chaudhury has been probing the ordered phase exhibiting Off-diagonal-short-range-order (ODSRO) in two dimensions. A 'pseudo-gap' due to the existence of the real space (local) fermionic particle-particle pair may appear in this phase and there may be deviation from the Fermi liquid behaviour. R. Chaudhury has justified the use of BCS like square well model in his previous calculation on the phase fluctuations in the ordered state of a layered BCS superconductor and has developed a new approach for solving the self consistent equation for the temperature-dependent anisotropic gap function. On the experimental side K. Mandal and U. De (VECC) have been looking at the effect of alpha particle irradiation of high T_c materials.

K. Mandal has been analysing with D.L. Atherton (Queen's Univ., Canada), experimental data on magnetic Barkhausen noise and magnetic flux leakage from polycrystalline steel.

Magnetic and electrical properties of nanoparticles have become important in recent years. K. Mandal has prepared nanocrystalline manganese zinc ferrite by chemical methods (in the MLS laboratory of IACS). M. Sengupta and C. K. Majumdar carried out Moessbauer spectroscopic studies on nanocrystalline magnetite powders, obtained from the Warwick University. Further work on Fe-Cr oxide powders has been planned. M. Sengupta has also studied current-voltage characteristics of alkali halide single crystals coloured by electron injection.

S. Paul and S. Bhattacharya have been studying the Ising model on a Fibonacci chain. In statistical mechanics of the bootstrap percolation model, the culling dynamic is actually abelian i.e. the ordering in the sequence in which the different sites are culled is immaterial. A very efficient algorithm for obtaining the final configuration or the percolation threshold has been devised by S. S. Manna : it rates at L^2 with the system size L compared to the $L^3 \log L$ in the ordinary methods. A generalized bootstrap model has been defined where the restriction that a site can be occupied by at most one particle is relaxed ; here a continuous transition is found. S. S. Manna is exploring self organised criticality in granular medium and the project is likely to be funded by the Indo-French Centre for Promotion of Advanced Research.

A. Mehta, J. K. Bhattacharjee (IACS) and P. Biswas have concentrated on the kinetic stochastic growth of surfaces and interfaces. P. Thakur, P. Biswas and T. Mitra have studied the nature of electronic states and transport in a perfect and an imperfect quasiperiodic Fibonacci chain.

A Mookherjee and his students B. Sanyal and S. Ghose have been refining the computational techniques for the tight binding linearized muffin tin orbital (TBLMTO) method coupled with augmented space recursion (ASR) method. Surface magnetism with Fe overlayers (both plane and rough) on noble metal substrates (Cu, Ag, Pd) was studied. Binary alloys like NiFe and $Ni_{1-x} Mo_x$ ($x = 0.02$ to 0.1) and also oxides and chalcogenides of a Ca-Sr series were studied systematically.

P. Ghose has been looking at the question where quantum mechanics could be a limiting case of classical mechanics. A critical test to distinguish between standard quantum mechanics and the de Broglie-Bohm theory has been proposed by P. Ghose and C. S. Unnikrishnan (TIFR). A. Majumdar and D. Home (BI) have been looking at paths to quantum chaos, using the Bohminan approach, through numerical solutions of the time dependent Schroedinger equation for non-relativistic particles scattering from both static and dynamic potentials.

B. Chakraborty and A.S. Majumdar studied the symplectic structure of the nonlinear sigma model and CP^1 model coupled to both the Chern-Simons and

the Hopf term ; existence of solitons and fractional spins has been seen.

The analysis of micromaser action has been continued by N. Nayak. It is possible that, for some cases, the atom can be in a pure state and the cavity in the approximate number state. The same kind of the disentanglement can happen in the optical counterpart - the so called one - atom laser. Nayak has initiated the study of the photonic band-gap materials, an optical analog of semiconductors.

C. Das simulated the problem of the spontaneous generation of defects in a 2D vorticity field in a square cavity using a multilevel vortex method. Using vortex dynamics she studied evolution of magnetic field in laboratory and astrophysical bodies.

J. Saha, B. Sanyal and S. Banerjee have made progress in using the Monte Carlo simulation technique on nematic - isotropic transition in polymer-dispersed liquid crystals.

A. S. Majumdar has been trying to implement viable inflationary cosmology through a dimensional compactification of a Kaluza-Klein model. It is in the category of scalar -tensor theories - Brans - Dicke type with variable 'omega' which can be constrained by the results of the COBE experiments.

B. Mathematics

A. Mohari has been considering non-commutative Markov shift associated with an irreversible system assumed to be governed by Lindblad's equation on a von-Neumann algebra. The asymptotic limit of the Markov shift when time goes to infinity is investigated and a necessary and sufficient condition for the Markov shift to be a Kolmogorov's shift is found. A notion of Lyapunov's exponent associated with an observable is introduced.

P. Guha has been considering Kirillov's orbit method for infinite dimensional Lie groups and its application to integrable systems, since orbit method provides a great number of symplectic manifolds and Poisson commuting families of functions.

C. Applied Mathematics

C. Gorain , CSIR, SRF with Professor S. K. Bose studying the stability of solutions of partial differential equations in R^n arising from vibrations in visioelastic solids has been able to prove a stability theorem form the wave equation corresponding to standard linear model :

$$y' + \lambda y'' = c^2 (\Delta y + \mu \Delta y')$$

with viscous boundary damping on a part of the boundary. This generalises a recently published theoren for the Voigt model. Working in his project "Vibration control of continuous systems" with Prof. S. K. Bose he has been able to establish exact controllability through boundary control force and stabilisation through viscous boundary damping, for the flexural vibration control of an internally damped flexible structure obeying Voigt model of viscoelasticity. S. K. Bose investigating discrete nonlinear dynamical system $x_{n+1} = f(x_n)$ f – polynomial, showing chaotic oscillations has been able to show that it is possible to extract that part off which causes chaotic oscillations. It has also been shown that systematic mappings of the chaotic sequence can be obtained which are nonchaotic or convergent.

D. Mathematical Modelling

In continuation of the previous work jointly with C. K. Majumdar on tidal flow in the Hooghly estuary, S. Banerjee has been examining the problem of bedload transport in alluvial channels and its effect on tidal flow. S. Banerjee and V. A. Barker (DTU, Denmark) have analysed, in view of the Newton map, the results of network modelling of two phase flow in a porous medium.

In his light scattering work, related to radiative transfer equation, S. K. Sharma has proposed two new phase functions : one for particles of size less than the wavelength of the scattering radiation and the other for large sized particles. For small particle, the predicted phase function coincides with exact results over the entire angular domains. For large particles, the phase function reproduces the forward lobe efficiently and other angles reasonably. A Roy (ISI) and S. K. Sharma are examining the validity of these phase functions for cylindrical and spheroidal particles.

S. K. Sharma and D. J. Somerford (Univ of Wales College of Cardiff, UK) have reviewed the work on the eikonal approximation in Progress in Optics.

E. Theoretical Chemistry

Electromagnetically induced transparency (EIT) of IR radiation has been predicted for a multiply-coupled four - level system which is easily accessible to experimental investigation. The effect of closely spaced levels on the IR absorption and dispersion lineshape connected by a single IR radiation field, is studied using Double Resonance (DR) technique. The results of S. Ghoshal Bhattacharya show IR transparency around RF resonance for very low RF pumping ($I \sim 0.04 \text{ mw/cm}^2$) in contrast to earlier works where a strong coupling field ($I \sim 10^7 \text{ w/cm}^2$) is applied to observe EIT a three level system.

G. Gangopadhyaya and S. Ghosal Bhattacharya have constructed a system-bath theory for a two-level system coupled to the coloured bath in the Born approximation at finite temperature. It is shown that depending on the band width and temperature of the bath, a coherent dynamics may set in the reduced system, when the reduced system is already driven by a strong field. In the absence of the driving field the reduced system assumes the Boltzmann distribution in the steady state. They have shown the effect of colored bath on the strong field induced resonance fluorescence spectra. When the driven system is probed by a weak field the absorption and dispersion profile show up some dramatic effect due to finite temperature on the colored bath.

F. Astrophysics

The astrophysics activity was centred round S. K. Chakrabarti and his students. Active galaxies and quasars are believed to have black holes at their centres. T. K. Das and S. K. Chakrabarti here developed a new model which can compute the absolute value of the mass outflow rates from the advective accretion disks. The nucleosynthesis in advective accretion disk is studied by B. Mukhopadhyay and S. Chakrabarti. The problem of radiative transfer in black hole accretion and winds is investigated by I. Chattopadhyay. A. Roy is working on the effects of nucleosynthesis on the stability of the accretion flow.

RESEARCH PROJECTS

1. Structure-Property Correlation in the Phase Transitions of Metallomesogens (liquid crystals)

This project was carried out by Prof. Monisha Bose and Prof. C. K. Majumdar and was completed on 21 June 1997. The last phase concentrated on the structure and dynamics of the discotic liquid crystals of substituted aryl beta diketonates of Cu (II), and has been continued since the end. Unlike the EPR spectra the proton NMR spectra of the alkyl and alkoxy complexes are very similar. Fluidity is clearly established in the discotic and isotropic mesophases. Relaxation time measurements at different frequencies and temperatures reveal interesting facets of intermolecular interaction. Apart from reorientation effects of the groups in the chain, magnetic exchange effects seem to dominate spin dynamics, as revealed in the short T_1 in C_6Cu which is in contrast to the rather long relaxation time in C_7Cu . This difference in dynamics results from the fact that though both crystallize in the same space group PT, the molecular arrangement of C_7Cu is very different from that of C_6Cu and other even numbers of the series. Thus in C_7Cu no exchange interaction is possible in the crystalline phase. The work was presented by Prof. Bose at the Special Symposium on Liquid Crystal NMR and National Symposium on Magnetic Resonance held at IISc Bangalore (Feb 4-7, 1998). A paper "Anomalies within alkyl and alkoxy substituted *bis* (1, 3-diphenyl propane - 1, 3 dionato) Cu (II) metallomesogen from x-ray and EPR studies" will be published.

2. Nuclear Fission and Nuclear Structure Calculations

This Emeritus Scientist's project sponsored by CSIR with Prof. M. K. Pal was concluded on 31 October 1997. The antisymmetrized theory of drip-line halo nuclei was published (pub A 50). Further a calculation through hyperspherical three body functions for the same nuclei was published (pub A 39). Some progress on the preparation of monographs has been made.

3. Preparation of monograph on Prevention and Combating Mine Fires

This project supported by DST, New Delhi, with Dr. S. Banerjee has made

substantial progress, and the first draft of the monograph will be ready soon.

4. Probing the Foundations of Quantum Theory.

This project supported by DST with Prof. P. Ghose, Dr. D. Home (BI), Dr. A. Datta (JU) and Dr. A. S. Majumdar, Research Associate, was concluded on 19.9.1997. During the last phase work was focused on :

- (a) Application of Bohmian mechanics to various systems. A consistent relativistic quantum mechanics of bosons was formulated. The necessity of Bohmian trajectories for interpreting results of CP-violation experiments of particle physics was pointed out.
- (b) Dirac quantization of some constrained models using the canonical Hamiltonian formalism. New results on fractional spin in two versions of the CP model coupled to the Hopf term were obtained.

The results were published : pub A 27 and 28. Two more papers are in preparation. D. Home (BI) published a book : "Conceptual Foundations of Quantum Physics" (Plenum Press, New York. 1997).

5. Collaborative Project With Warwick University

The project has concentrated on three aspects : quantum mechanical calculation on clusters, photovoltaic devices and surfaces and thin films. The project on clusters developed the full and potential L.M.T.O. molecular dynamic codes for transition metal clusters and studied Cu & Ni clusters upto sizes of 20 atoms. The catalytic properties of these clusters in absorbing O^- & OH^- has been studied. In surface and thin films the effect of surface roughness on the magnetic properties of thin overlayers has been looked at. We have also developed a theory of deposition of rough overlayers. The electronic structure of rare earth doped Alumina & Garnets have been studied as potential candidates for photovoltaic devices. The project work was done by Dr. R.P. Datta, Dr. G. Pari & Mr. Biplab Sanyal under the supervision of Prof. A. Mookerjee.

6. Theoretical High Energy Physics

This research project with Prof. H. Banerjee is sponsored by INSA. The main

thrust of the investigations this year has been to provide a 'clean' derivation of the chiral anomaly in lattice framework. The difficulty here is that lattice Feynman integrals are not usually amenable to closed analytic estimate. Even in the case of the most popular Wilson model for lattice fermion, the derivations available in literature are not flawless. The novel approach proposed by us is to consider instead of the lattice Feynman integral, its derivative with respect to the fermion mass which may yield a convergent result in the continuum limit. In the case of the lattice Feynman integral for the amplitude of the collaborated triangle diagram for the axial vector current, the proposed approach yields directly a bose-symmetric, gauge-invariant convergent result. The familiar form for the chiral anomaly emerges in this approach as the 'constant of integration', which is fixed by the requirement that in the limit of a very large mass the fermion gets decoupled from the gauge field.

7. Quasi-periodic oscillation of Black Hole Candidates

This ISRO project was granted to Prof. S. Chakrabarti on 24.2.98. The work has started.

PUBLICATIONS

A. JOURNAL

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4. Banerjee, A., Datta, R.P., Mookerjee, A. and Bhattacharya, A. : Determination of the ground state geometries of copper clusters by simulated annealing - *Int. J. Mod. Phys.*, 1997, **B11**, 2333-2341.
5. Banerjee, R., Rothe, H. J. and Rothe, K. D. : Hamiltonian embedding of a self dual model and equivalence with Maxwell-Chern-Simons theory - *Phys. Rev.* 1997. **D55**, 6339-6343.
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B. PROCEEDINGS OF CONFERENCES & SYMPOSIA

1. Chakrabarti, S. K. : Unified accretion disk models around black holes and neutron stars and their spectral properties - *Proceedings of IAU - 163 Symposium on Accretion phenomenon and related outflows*, Ed. D. Wickramasinghe, L. Ferrario and G. Bicknell, 1997, 427 - 438.
2. Chakrabarti S. K., Ryu, D., Molteni, D., Sponholz, H., Lanzafame, G. and Eggum, G. : Numerical simulations of advective flows around black holes - *ibid*, 1997, 690 - 691.
3. Chakrabarti, S. K. : Recent progresses of Accretion Disk models around black holes : *Eighteenth Texas Symposium on Relativistic Astrophysics*

- & *Cosmology* (eds. A. Clinto, J. A. Frieman and D. N. Schvanan) 1998, 229 - 232.
4. Chakrabarti, S. K. : Accretion disks around black holes and neutron stars : advective disk paradigm - *High energy Astronomy and Astrophysics* (eds. P.C. Agarwal and P. R. Viswanath), 1998, 75 - 87.
 5. Das, C. and Venkatesan, S. K. : On the decay of 2D turbulence in plasma - *Proceedings of International Topical conference in Plasma*, ICTP, Trieste, Italy (November 9-13, 1997), to appear in *Physica Scripta*.
 6. Das, C., Janaki, M.S., and Dasgupta, B. : Electrostatic on cyclotron instability in the presence of dust charge fluctuations - *Proceedings of International Topical Conference in Plasma*, ICTP, Trieste, Italy (November 9-13, 1997), to appear in *Physica Scripta*.
 7. Ghosh, S. : Magnetism of disordered Ni-Mo system *Proceedings of Condensed Matter Days*, Visva Bharati University, Santiniketan 1997, p. 33.
 8. Ghoshal, S. : Estimating transparency of infrared radiation in a four-level system using double resonance - *Proc. of National Seminar on Spectroscopy, Lasers and Laser applications* at Cochin University of Science and Technology, Kochi, March 23-26, 1998.
 9. Majumdar, C. K. : Problems in Physics Teaching - in *Proc. XIIth Annual Convention of Indian Association for Physics Teachers (IAPT)* at Midnapore (October 23-25, 1997).
 10. Mookerjee, A. : Growth and magnetism in rough transition metal overlayer - in *Frontiers of Materials Modelling and Design*, ed. V. Kumar, S. Sengupta and B. Raj (Springer - Verlag, Berlin, 1998) 293-304.
 11. Mookerjee, A. : Phase formation & phase stability - *Electron correlations in atoms & solids*, eds. Tripathi and Srivastava (Phoenix Publications, New Delhi, 1998) 178 - 193.
 12. Sanyal, B. : Growth and magnetism of rough surfaces, *Proc. DAE Solid*

State Physics Symposium, Cochin, December 27 - 31, 1997.

13. Sanyal, B. : Statistical and quantum mechanical study of rough surface, Condence Matter Days, Visva Bharati University, Santiniketan, August, 29-31, 1997, p. 19.
14. Sanyal, D., Mandal, K and De, Udayan, L. : Alpha-irradiation damage in Josephson-coupled superconductors - Proc. of *Conference on Physics, and Technology of Accrelerators* at Saha Institute of Nuclear Physics, Calcutta (February 11-13, 1998).
15. Sengputa, M. : Discussion of high pressure effects on trap depth and its role in SCL conductivity of insulating crystals, in *Advances in High Pressure, Science and Technology, Proceeding of the IV NCHST, IGCAR, Kalpakkam, 1997*, pp. 196-198.
16. Sinha T.P., Roy, R. and Majumdar, C. K. : Moessbauer quadrupole of Fe (2⁺) ions in NH₄ CoCl₃ under vibronic coupling - *Proc. DAE Sol. St. Phys. Symp.* held at Cochin University of Sc. & Tech. (December, 27-31, 1997) **40C**, p. 424.

C. MISCELLANEOUS

1. Chakrabarti, S. K. : *Will the existence of Black Holes be determined in Calcutta?* an article in Bengali in Aajkaal (November 26, 1997).
2. Chakrabarti, S. K. : *Mysterious Black Holes*, an article in the Statesman on 22.12.97.
3. Dasgupta, I., Saha, T. and Mookerjee, A. : *Augmented space recursion method for the calculation of the electronic structure of random alloys* - Properties of complex inorganic solids (Prenum Press), 1997, 63-68.
4. Dasgupta, I, and Mookerjee, A : *Alloy Phase Stability* - Properties of complex inorganic solids (Plenum Press), 1997, 25-31.
5. Guha, Partha, : *Volume Preserving multidimensional integrable systems and Nambu-Poisson Geometry* - Warwick Preprint 16/1997.

6. Majumdar, C. K. : review of *composite Materials* by J. P. Agarwal (DESTDOC. Metcalfe House, Delhi) in *Everymans' Science*, Vol. XXXI (5), 1996-97, 170.
7. Majumdar, C. K. : *Newton versus Einstein : How matter interacts with matter* by P. and N. Graneau (Affiliated East Press Pvt. Ltd., New Delhi) Bookreview in *Evedryman's Science*. Vol XXX I (6), 1997, p. 203.
8. Majumdar, C. K. : *Bignan O Prajukti (Science and Technology)* in Bengali magazine '*Desh*' August 9, 1997 (issue on 50 years of independence) 167-180.
9. Mehta, Anita : *Chalking Out - a review of Steven Weinberg's Dreams of final theory* (The Telegraph on September 12, 1997).
10. Mehta, A. : *Function spelt out in the sand* (book review) in the Times Higher Educational Supplement (London) on 12.12.97. .

D. HONOURS, FELLOWSHIPS, MEMBERSHIPS

1. Professor Partha Ghose was nominated a member of the first National Steering Committee for the Indian National Physics Olympiad by the Department of Atomic Energy, Board of Research in Nuclear Sciences.
2. Dr. Debashis Gangopadhyay has been mentioned in Biographical data citation in (Marquis) Who's Who in the World, 15th edition, 1998.

VISITS BY CENTRE'S STAFF TO ATTEND CONFERENCES/SEMINARS ETC.

1. Banerjee, H. : visited (i) Institute of Theoretical Physics, University of Bern, Switzerland (May 12-23, 1997), (ii) Department of Physics Jammu University as a member of the Advisory Committee of the COSIST Programme of UGC (November 27-29, 1997).
2. Banerjee R : attended workshop and gave and invited lecture at the Brasilian National Meeting on H.E.P., Caxambu, Minas Gerais (September-October, 1997).

3. Banerjee, S. : attended (i) two week Micro CDS/ISIS application course, organised by Calibnet (November 17-28, 1997); (ii) National Seminar on Liquid Crystals at the University of Jammu (December 18-20, 1997),
4. Bose, M. : attended (i) the 5th International Symposium on Metallomesogens at Switzerland (June 3-6, 1997) ; (ii) the National Seminar on Liquid Crystals at University of Jammu ; Bose was the Chairperson of the First Scientific Session of the Seminar (December 18-20, 1997); (iii) the special Symposium on Liquid Crystal NMR and the National Symposium and on Magnetic Resonance held at the Indian Institute of Science, Bangalore (February 4-7, 1998)
5. Bose, S. K. : attended (i) Annual Meeting of Indian Academy of Science at Hyderabad (November 1-3, 1997); (ii) International Seminar on South Indian Medicinal Plants at Patna (November 14-17, 1997); (iii) Indian Society of Theoretical & Applied Mechanics, 42nd Congress at Surat (December, 28-31, 1997); (iv) National Seminar on Recent Advances in Seismology at Rohtak (January 15-16, 1998).
6. Chakrabarti, S. K. and Das, T. K. attended (i) Black holes theory & observations - a Summer school at Bad Honnef, Germany (August 17-23, 1997) ; (ii) organized a workshop on Multiwave length studies of stars and compact objects, which included a conference on Observational evidence for black holes in the universe at SNBNCBS, Calcutta (January 1-17, 1998).
7. Chattopadhyay, I., Das, T. K. and Mukhopadhyay, B. : attended the International Workshop on Multiwave length studies of Stars and Compact Objects, which included a conference on Observational Evidences for Black Holes in the Universe at SNBNCBS, Calcutta (January 1-17, 1998).
8. Chaudhury, R. : visited LEPES, CNRS, Grenoble, France to continue his research collaboration with Prof. B. K. Chakraverty (December 31, 1997 - February 4, 1998).
9. Das, C. : visited (i) Indian Institute of Astrophysics, Bangalore for some collaborative work (Dynamo effect, vortex dynamics) with Prof. V. Krishnan (September 1-19, 1997) ; (ii) Autumn College on Plasma Physics at ICTP, Trieste, Italy (October 13 to November 6, 1997) ; (iii) International Topical Conference

on Plasma Physics at ICTP, Trieste, Italy (November 9-13, 1997); (iv) National Institute of Fusion Science, Nagoya, Japan.

10. Das, T. K. : attended (i) 179 We-Heraens - Seminar on Black Holes : Theory and observations at Physikzentrum Bad Honnef, Germany as invited participant. The seminar was organized by the Institute for Theoretical Physics, University of Cologne, Germany (August 18-22, 1997).
11. Ghosh, Partha, : attended the (i) BCSPIN Summer School in Current Trends in High Energy Physics and Cosmology at Kathmandu (May 26 - June 4, 1997); (ii) Werner Heisenberg Colloquium : the quest for unity : perspectives in physics and philosophy at the Indian Institute of Advanced Study, Shimla, organized by NISTADS, Max Muller Bhawan and IAS (August 4-7, 1997) ; (iii) International Symposium Uncertain Reality : The Quantum World-View at Seventy at the Indian International Centre, organised by NISTADS and Max Muller Bhawan (January 5-9, 1998) ; (iv) Seminar on Nature of Reality in Arts and Science at Visva Bharati, Santiniketan (March 20-21, 1998).
12. Ghosh, S. and Sanyal, B. : attended Workshop on Response functions in metals and alloys at Dhaka University, Bangladesh (March 1998).
13. Ghosal, S. : attended (i) the National Seminar on Spectroscopy, Lasers and Laser Application at Cochin University of Science and Technology (March 23-26, 1998); (ii) Prof. B. B. Roy memorial Lecture at department of Physics, Calcutta University, Calcutta.
14. Guha, Partha visited : (i) Isaac Newton Institute for Mathematical Sciences, Cambridge, UK (May 3-15, 1997) ; (ii) Mathematics Department, University of Hull, UK (May 16-26, 1997), (iii) Mathematical Institute, University of Oxford, UK (May 26-31, 1997).
15. Majumdar, C. K. : visited (i) IIT Kanpur and talked on Moessbauer Spectra of Fe-Minerals in Eastern Indian at the National Seminar on Nuclear Physics and Engineering : Frontiers and Applications (April 17-18, 1997); (ii) the Operation Physics through Experiments under MHRD Scheme (IAPT orientation programme) at David Hare Training College, Calcutta (April 21-26, 1997) ; (iii) the XXth Annual Convention of Indian Association for Physics Teacher (IAPT)

- at Midnapore and conducted the Inaugural Session (October 22-25, 1997); (iv) Prof. D. L. Bhattacharya felicitation meeting at Physics Dept., Calcutta University (March 30, 1998); (v) the National Symposium on Contemporary Physics held at Presidency College, Calcutta (November 6-8, 1997), (vi) the TPSC Conveners Meeting at PRL, Ahmedabad (December 4-5, 1997), and (vii) attended Condensed Matter Days at Visva-Bharati University (August 29-31, 1997).
16. Mandal, Kalyan : attended the Conference on Physics and Technology of Accelerators at Saha Institute of Nuclear Physics, Calcutta (February 11-13, 1998).
 17. Mehta, Anita visited : (i) Cavendish Laboratory, Cambridge, UK (May 25-27, 1997); (ii) Clarendon Laboratory, Oxford, UK (May 28-29, 1997) ; (iii) attended Steering Committee Meeting of 4th Royal Society Indo-UK Forum Meeting at CSIR, New Delhi (August 17, 1997); (iv) invitation to the Workshop on Jamming and Rheology at the institute of Theoretical Physics, University of California Santa Barbara (September 3 to November 1, 1997); (v) invitation to the Workshop on Frustrated System at the International Centre for Theoretical Physics, Trieste, Italy (September 26 to October 11, 1997), (vi) attended 4th Royal Society Indo-UK Forum meeting on Materials in the Mesoscopic Domain at Pune (December 8-12, 1997).
 18. Mookerjee, A. : visited ICTP, Trieste, Italy (April 5-May 10, 1997).
 19. Mukherjee, C. D. and Saha, J. : Phase alternation in liquid crystals with terminal Phenyl ring - Poster presented at the Condensed Matter Days at Visva-Bharati University, 1997.
 20. Mukhopadhyay, P. K., Ghosh, S., Mookerjee A., Sanyal, B. and Das, N. : attended 3rd Network in Dhaka University, Bangladesh (March 19-26, 1998).
 21. Nayak, N. : attended (i) the National Symposium on Contemporary Physics : Some Aspects at the Presidency College, Calcutta (November 6-8, 1997) ; (ii) the TPSC Conveners' meeting at PRL, Ahmedabad (December 4-5, 1997) ; (iii) the Third Meeting on Frontier Areas in Physics, Optics, : Modern Trends organised by Kumari L. A. Meera Memorial Trust at the Dhvanyaloka, Mysore (January 31-February 5, 1998) ; (iv) visited the Jawaharlal Nehru Centre for

- Advanced Scientific Research, Bangalore to collaborate in Research work concerning microcavities (December 20, 1997- January 16, 1998).
22. Pal, M. K. : visited IIT Kanpur to deliver invited talk on "3-body calculation on neutron-halo nuclei -is it Justified?" at the National Seminar on Nuclear Physics and Engineering : Frontiers and Applications (April 17-18, 1997).
 23. Paul S. K. attended Introductory lectures in Algebraic Geometry at SNBNCBS, Calcutta (April 15-25, 1997).
 24. Sanyal, B. : attended Condensed matter days at Visva-Bharati University, Santiniketan (August 29-31, 1997).
 25. Sengupta, Manjusri : attended (i) Fourth National Conference on High Pressure Science and Technology at IGCAR, Kalpakkam (September 11-13, 1997); (ii) National Workshop on Electron Microscopy : Its application in Biological and Material Science at USIC, Jadavpur Univeristy, Calcutta (November 10-13, 1997).

SEMINARS / TALKS BY THE CENTRE'S STAFF

1. Banerjee H. : (i) 'Lattice fermion and chiral gauge theory' at the Institute of Theoretical Physics, University of Bern, Switzerland (May 16, 1997); (ii) Problems with fermion on lattic at Department of Physics, Jammu University (November 28, 1997) ; (iii) 'Lattic Fermions and the Chiral Anomaly' at MATSCIENCE, Madras (February 18, 1998).
2. Banerejee, R. : (i) 'Duality and bosonisation in higher dimension', UFRJ, Brasil (May 1996); (ii) 'Hamiltonian approach to duality at the University of Sao Paulo, Brasil (August 1996); (iii) 'Nonabelian bosonisation of the massive Thirring model in three dimensions - USP, Sao Paulo, Brasil (April 1997); (iv) 'Reducible systems in the canonical formalism' at the State University of Rio (UFRJ), Brasil (August 1997); (v) 'Bosonisation in higher dimensions : different approaches and applications' at the Brazilian National Workshop on H.E.P. , Caxambu, Minas Gerais (October 1, 1997); (vi) 'Gauge independent reduction of a quantum mechanical model with Gribov like ambiguity' at University of Fluminense, RJ, Brasil (October 7, 1997) ; (vii) 'Quantisation of the particle on a d-dimensional sphere', IFT, UFRJ, Brasil (October 14, 1997).

3. Bose M. : (i) 'Magnetic and high pressure studies of lithium intercalates V_2O_5 ,' at Zurich (June 2, 1997) ; (ii) 'Anomalies within discogenic alkyl and alkoxy substituted aryl diketonates of Cu (II)' at the National Seminar on Liquid Crystals at University of Jammu (December 18-20, 1997); (iii) 'Structure and dynamics of the discotic liquid crystals of substituted aryl diketonates of Cu (II) from H NMR' at IISc., Bangalore (February 4-7, 1998).
4. Chakrabarti, S. K. : (i) 'Astrophysics around black holes' at Bethune College, Calcutta (March 25, 1998); (ii) 'Astrophysics around black holes' at Birla Planetarium, Calcutta (May 24, 1997); (iii) 'Astrophysical flows around talks at the Summer School at Bad Honnef, Germany (August 1997); (iv) 'Astrophysical flows around black holes', a TPSC seminar at the Physics Department of Visva-Bharati, Santiniketan ; (v) 'A crash course on advective accretion disk' - 3 lectures at SNBNCBS, Calcutta (January 1-3, 1998) ; (vi) 'Nonaxisymmetric and magnetized advective flows' at SNBNCBS, Calcutta (January 10, 1998) ; (vii) 'Accretion disk models around black holes Twenty five years later at SNBNCBS, Calcutta (January 12, 1998).
5. Das, Chandra : (i) 'Self generated magnetic field and its evolution in Plasma' at Autum College, ICTP, Trieste, Italy (October 28, 1997) ; (ii) 'On the decay of 2D turbulence on International Topical Conference on Plasma Physics at ICTP, Trieste, Italy (November 10, 1997); (iii) 'Electrostatic ion cyclotron instability in the presence of dust charge fluctuation on International Topical Conference on Plasma Physics at ICTP, Trieste, Italy (November, 12, 1997).
6. Das, Tapas, Kumar : (i) 'Computation of outflow rates from the advective accretion disks around galactice and extra galactic black holes' at the International Conference on the Observational Evidences for Black Holes in the Universe at SNBNCBS, Calcutta (January 11-17, 1998); (ii) 'The Role of internet on mass education at the workshop on Computer & communication technology in Education at ISI, Calcutta (January 19-20, 1998).
7. Ghose, Partha : (i) 'Could quantum mechanics be a limiting case of classical mechanics at TIFR', Mumbai (September 9, 1997); (ii) Uncertain reality : The quantum world view at Seventy' at IIC, Delhi (January 6, 1998) ; (iii) Invited talk on 'The History of the Development of Science & Technology in India'

- at CMERI, Durgapur on the occasion of National Science Day (March 1, 1998); (iv) Invited talk on 'The Mysteries of the Physical World' at ISM, Dhanbad (March 30, 1998).
8. Ghosh S. : Magnetism of disordered Ni-Mo : theory and experiments at Dhaka University, Bangladesh (March 25, 1998).
 9. Guha, Partha : (i) Nambu-Poisson Geometry and its applications at Mathematics Department, University of Hull, UK (May 231, 1997); (ii) Nonlinear graviton construction Ashtekar equation & diffeomorphism at the International Symposium on Mathematical Physics at Calcutta Mathematical Society (December 29, 1997) ; (iii) Twister Theory (series of lectures) at the Department of Mathematics, Dhaka University (February 24-March 1, 1998); (iv) Science and Today (3 lectures) at a management course entitled PANORAMA conducted by the Centre for management Education at the Bengal Chamber of Commerce (February 11-13, 1998).
 10. Lahiri, A. : 'Higgs-free mass generation for vector bosons' (TPSC seminar) at TIFR, Mumbai (February 27, 1998).
 11. Majumdar, C. K. : (i) Convocation Address at Indira Gandhi National Open University, Calcutta Centre (March 7, 1998); (ii) Reality in Science in National Seminar on Nature of Reality in Arts and Science at Visva Bharati, March 20-21, 1998) ; (iii) Study of Naturally Occurring Solids in National Seminar on X-ray, Laser Optico-acoustic and Electrical Studies of Solids including Minerals and Coal at ISM, Dhanbad (March 25-26, 1998); (iv) Condensed Matter Physics by Accelerators at IUC-DAEF, Calcutta Centre (June 23, 1997) ; (v) Science and Technology in the last 50 years : the Indian Context (P.C. Mahalanobis lecture) (June 29, 1997); (vi) Evening lecture : Condensed Matter Physics in CM DAYS - 97 at Visva-Bharati (August 29, 1997) ; (vii) Valedictory address in UGC sponsored orientation course for University/College Techers 'Mathematics in Life Science Modelling Approach at Sivatosh Mookherjee Science Centre (Asutosh Mookerjee Memorial Institute) (November 8, 1997); (viii) Lecture on 'Some problems of interest in Geophysics and Metallurgy in the 73rd Ann. Gen. Meeting of the Geological, Mining and Metallurgical Society of Indian, Calcutta (November 20, 1997) ; (ix) Keynote address on 'Matter in Science and

Philosophy' in the Workshop on Matter in Science and Philosophy held in Jadavpur University (December 23-24, 1997) (Inauguration of the Calcutta Centre for Advanced Study in Science and Philosophy).

12. Mandal, Kalyan : (i) 'Magnetic Barkhausen Noise : A new dimension in magnetic measurement techniques' at Bose Institute, Calcutta (March 18, 1998) ; (ii) Magnetic Barkhausen Noise at IACS, Jadavpur, Calcutta (November 7, 1997).
13. Manna, S. S. : 'Abelian Cascade Dynamic in Bootstrap Percolation' in the workshop Soft-Condensed Matter at SINP, Calcutta (February 18, 1998).
14. Mehta, A : (i) 'Multiple Length Scales in Interfacial Systems' at Jawaharlal Nehru University, New Delhi (April 2, 1997) ; (ii) 'Probing sand : the physics of granular flow' at University of Washington - Microsoft Research Joint Seminar, Scattle (September 19, 1997); (iii) 'Jamming in pre-avalanche flow : the surface after' at the Institute of Theoretical Physics, Santa Barbara - Jamming and Rheology Seminar (September 22, 1997); (iv) 'Frustration in granular systems' at ICTP. Trieste, Italy (October 11, 1997) (v) 'Dynamics of granular flow : bridging the perspectives' at Institute of Theretical Physics, Santa Barbara - Conference talk on Jamming and Rheology (October 16, 1997); (vi) 'Smoothing of Sandpiles after intermittent an continuous avalanches' at Department of Physics, University of California at Santa Cruz (October 24, 1997); (vii) 'Roughness at Post - avalanche surfaces' at the 4th Royal Society Indo-UK Forum meeting at Pune (December 8-12, 1997).
15. Mookerjee, A. : (i) Response Functions - 3 talks at Dhaka University Network Conference ; (ii) Series of Eight Lectures on Computational Physics at ICTP, Trieste, Italy (April 7-30, 1997); (iii) A lectures Course on Computational Physics (36 lectures) at IIT Kanpur (July 1997 onward) ; (iv) Colloquium on Growth and Electronic Structure of Rough Surfaces at IIT Kanpur (September 22, 1997); (v) ' Four Lectures on Electronic Structure Methods in the Summer School on Computational Methods in PHYSICS at ICTP, Trieste, Italy (May 5-9, 1997); (vi) Study of the growth and electronic structure of rough interfaces at the Colluquium at IIT Kanpur (December 9, 1997) ; (vii) Response Function and the Recursion Method (series of lectures) at SNBNCBS, Calcutta (February 4, 6, 9, 11, 1998).

16. Mukhopadhyay, Banibrata : 'Nucleosynthesis in advective accretion disks around black holes' at the International conference on Observational evidence for black holes in the universe at SNBNCBS, Calcutta (January 11-17, 1998).
17. Mukhopadhyay, P. K. : A discourse on Relaxation in Glassy Systems at 3rd Network Workshop, Dhaka University, Bangladesh (March 23, 1998).
18. Nayak N. : (i) 'Cavity QED and the Micromaser' at the National Symposium on Contemporary Physics : Some Aspects at the Presidency College, Calcutta (November 6-8, 1997); (ii) Observation of Cavity-QED in a Micromaser Device at PRL, Ahmedabad (December 4, 1997); (iii) 'Cavity QED' (3 talks) at the Meeting on Optics : Modern Trends at Mysore (January 31-February 5, 1998).
19. Saha, J. : Molecular mean field model for phase alternation in liquid crystals at the National Seminar on Liquid Crystals at University of Jammu (December 20, 1997).
20. Sanyal, B. : (i) Statistical modelling of growth of rough epitaxial overlayers at Dhaka University (March 1998); (ii) Statistical and quantum mechanical study of rough surface, Visva-Bharati University, Santiniketan (August 29-31, 1997).
21. Sengupta, M. : (i) Study of defects in single crystals of alkali halides at high temperature by electron injection at Material Science Division of IGCAR, Kalpakkam, Tamilnadu (July 12, 1997); (ii) High pressure effect on trap depth and its role in SCL conductivity of insulation crystals at IVth National Conference on High Pressure Science and Technology at IGCAR, Kalpakkam (September 13, 1997).

THEORETICAL PHYSICS SEMINARS CIRCUIT

1. Dr. B.P. Mandal, Institute of Physics, Bhubaneswar ; Renormalization in superspace formulation of gauge theories (June 25, 1997).
2. Dr. Srikanth Raghavan, ICTP, Trieste, Italy : Macroscopic quantum self-trapping in Bose Condensates and polarons : A surprising connection (July 15, 1997).
3. Professor Probir Roy, TIFR, Mumbai : Supersymmetry in the TeV Scale at SNBNCBS, Calcutta (August 18, 1997).

4. Mr. Saurabh Basu, IIT Kanpur : Two Magnon Raman scattering in an antiferromagnet at SNBNCBS, Calcutta August 20, 1997)
5. Mr. Kiran M. Kolwankar, University of Poona, Pune, : From fractional differentiability to fractional Fokker - Planck equations at SNBNCBS, Calcutta (October 21, 1997).
6. Dr. Bindu A. Bambah, University of Hyderabad : Non-equilibrium phase transition in particle physics : A paradigmatical approach (November 3, 1997).
7. Professor A. Rai Choudhury, Indian Institute of Science, Bangalore : Why does the sun have a corona? (November 4, 1997).
8. Professor S. N. Behera, Institute of Physics, Bhubaneswar : Interplay of structural transition and spin density wave (SWD state) in superconductors (November 10, 1997).
9. Professor Chandan Dasgupta, IISc, Bangalore : Statistical Mechanics of Randomly Pinned Vortices in High Temperature Superconductivity at SNBNCBS, Calcutta (December 1, 1997).
10. Dr. R. P. Mallik, Dubna, Russia : (i) Dual BRST Symmetry in QED and (ii) BRST Cohomology in Gauge Theories at SNBNCBS, Calcutta (February 10 & 12, 1998).
11. Professor S. M. Bhattacharjee, Institute of Physics, Bhubaneswar : Spin Peierls Transition in CuGeO_3 : A case of Deja vu at SNBNCBS, Calcutta (February 17, 1998).
12. Professor Deepak Kumar, Jawaharlal Nehru University, New Delhi : Renormalisation group methods for electrons on lattice at SNBNCBS, Calcutta (February 18, 1998).
13. Professor T. R. Govindarajan, Institute of Mathematical Science, Chennai : Three dimensional Black holes and Chern Simons theory at SNBNCBS, Calcutta (February 24, 1998).
14. Dr. A. Lahiri of SNBNCBS visited TIFR, Mumbai and gave a talk on Massive Gauge Bosons without Higgs (February 27, 1998).

15. Professor S. Chaturvedi, University of Hyderabad : (i) Exact solution of master equations describing coupled nonlinear dissipative oscillators; (ii) Statistics of identical and indistinguishable particles at SNBNCBS, Calcutta (March, 17 & 18, 1998).
16. Dr. R. Adhikari, Institute of Mathematical Sciences, Chennai : Matter anti-matter asymmetry of the universe at SNBNCBS, Calcutta (March 24, 1998).

EDUCATION ACTIVITIES

Dr. C. K. Majumdar taught a portion of Solid State Physics (special paper) in the combined M.Sc. Classes of Calcutta University and Presidency College, Calcutta, during November 1997 to April 1998. Prof. A. Mookerjee taught a course on Computational Physics (36 Lectures) in IIT, Kanpur, during his stay there on leave.

LIBRARY

The Library now subscribes to the following journals :

A. Foreign Journals

1. Computer Journal
2. Computer in Physics (AIP)
3. Economic Theory
4. Journal of Modern Optics
5. International Journal of Modern Physics A
6. Journal of Physics A : Mathematics and General
7. Modern Physics Letters A
8. Modern Physics Letters B
9. Monthly Notices of Royal Society of Astronomy
10. Nature
11. Physical Review A
12. Physical Review B
13. Physical Review C

14. Physical Review D
15. Physical Review E
16. Physical Review Letter
17. Physical Letters A
18. Physics Letters B
19. Physics Reports
20. Review of Modern Physics
21. Fractals
22. The Astrophysical Journal

The Library gets APS News, CERN Courier and Bulletin of American Physical Society.

B. Indian Journals

1. Bulletin of Material Science
2. Current Science
3. Indian Journal of Pure & Applied Physics
4. Journal of Astrophysics and Astronomy
5. Journal of Bioscience
6. Journal of Genetics
7. Pramana
8. Proc. Ind. Acad. of Sc. (Chemical Sciences)
9. Proc. Ind Acad. of Sc. (Earth & Planetary Sciences)
10. Proc. Ind. Acad. of Sc. (Engineering Sciences) - Sadhana
11. Prof. Ind Acad. of Sc. (Mathematical Sciences)
12. Resonance

The Library is expanding slowly and trying to link up to the CALBNET facilities. Its own computer HP 715 has been commissioned and is connected to the internal network and the internet.

COMPUTER CENTRE

The process of putting the campus wide machine in the Internet was continued with a CISCO Router and a CISCO Switch. The plans of further expansion of the centre got a boost with a grant from ISRO to develop a DATA Bank at the centre with a Jukebox of about half a Terrabyte capacity. This would store all the X-ray and Gamma-Ray observation data obtained by all the Satellites and would allow observers around the world to have access to them through Internet. Another ISRO project grants the purchase of a DEC-alpha Computer to study the Quasi-Periodic Oscillation of X-rays around black holes.

In future is planned to have computers on the desks of all the Faculty members

CAMPUS

The Centre's Guest House is now very popular and the Centre is receiving more requests for accommodations for various academic programmes than it can handle. This year approximately 950 guets stayed in the Guest House.

MEETINGS OF THE GOVERNING BODY AND VARIOUS COMMITTEES (1997-98)

Governing Body

There were three meetings of the Governing Body during the period 1997-98 : the 14th Meeting was held on 24 April 1997 at DST, New Delhi : the 15th Meeting was held on 9 August 1997 at the Centre in Calcutta ; the 16th Meeting was held on 22 January 1998 at DST, New Delhi.

In the 14th meeting the programme of astrophysics at the Centre was given a boost. Expansion of the academic staff with new members and research scholars was reported in the 15th meeting. The Governing Body in the 16th meeting adopted new pay scales in accordance with the recommendations of the Fifth pay Commission.

Finance Committee

Members of the Committee met at the Centre in Calcutta for its tenth meeting on

27 March 1998. They felt that the progress in building the campus should be faster and the plan budget should be increased. A computer terminal on the desk of every scientist should be provided and further general expansion of computational facilities should be pursued. While welcoming the introduction of new scales under the Fifth Pay Commission, the Finance Committee members felt that further considerations might be necessary when the pay scales for IIT's and universities would be announced.

Building Committee

The Committee held its first meeting on 4 April 1997 at the Centre and discussed the maintenance problem and laid down the procedures to be adopted.

Academic Programme Advisory Committee

The Academic Programme Advisory Committee met on October, 17, 1997, and considered the academic programme — symposia, conferences etc. for support and other academic activities.

Administrative Matters

The Centre is following the provisions of the Official Language Policy to the extent possible. A person from the Official Language Department visited the Centre. All letters received in Hindi are replied to in Hindi, Hindi fonts available are in the computers of the Centre.

The reservation policies of the Government are being followed by the Centre. One member of the staff has been entrusted with the liaison work and the maintenance of relevant Rosters on reservation keeping in touch with the National Commission on Schedule Castes and Schedule Tribes, Mayukh Bhavan, Salt Lake.

CONSTITUENTS OF THE COMMITTEES

Governing Body

The composition of the Governing Body of the Centre during the year was as under :

- | | | |
|----|--------------------------------------|--|
| 1. | Professor V S Ramamurthy
Chairman | Secretary
Department of Science &
Technology, Government of
India, New Delhi |
| 2. | Professor G S Agarwal
Member | Director
Physical Research Laboratory
Ahmedabad |
| 3. | Professor S N Behera
Member | Director
Institute of Physics
Bhubaneswar |
| 4. | Professor Probir Roy
Member | Senior Professor
Tata Institute of Fundamental
Research, Mumbai |
| 5. | Shri Rahul Sarin
Member | Joint Secretary & Financial
Advisor, Department of Science
& Technology, Government of
India, New Delhi |
| 6. | Shri Anish K Majumdar
Member | Chief Secretary
Government of West Bengal
Calcutta |
| | Shri Manish Gupta | - do - [From 1 February 1998] |
| 7. | Dr. C. K. Majumdar
Member | Director
S N Bose National Centre for
Basic Sciences, Calcutta |

Sri Abhijit Gupta, Administrative Officer, is 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 19 July, 1996]. Others are ex-officio members.

Finance Committee

The following members constituted the Finance Committee during the year :

1	Dr C K Majumdar	Chairman	[Director, SNBNCBS]
2	Professor M Chowdhury	Member	[IACS, Calcutta]
3	Professor V Krishnan	Member	[IISC, Bangalore]
4	Shri Rahul Sarin	Member	[JS & FA, DST, New Delhi]
5.	Sri Abhijit Gupta	Member-Secretary	[AO, SNBNCBS]

Building Committee

The Construction Committee of the Centre was renamed as 'Building Committee' by the Governing Body and constituted anew. The members of the Committee are :

1	Dr C K Majumdar	Chairman	[Director, SNBNCBS]
2	Professor T K Chattopadhyay	Member	[Dept of Architecture, Jadavpur University]
3	Shri S C Padhi	Member	[SSW (EZ), CPWD]
4	A nominee of DST, New Delhi	[Yet to be nominated]	
5	Sri Abhijit Gupta	Member-Secretary	[AO, SNBNCBS]

Academic Programme Advisory Committee

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

1.	Professor N Mukunda	[Chairman] IISc. & JNCASR, Bangalore
2	Professor M Chowdhury	[Member] IACS, Calcutta
3	Professor N Sathyamurthy	[Member] IIT Kanpur
4	Professor P K Maitra	[Member] Agharkar Res. Inst, Pune
5	Professor S M Chitre	[Member] TIFR, Mumbai
6	Professor S K Bose	[Member] SNBNCBS
7	Professor A Mookerjee	[Member] SNBNCBS
8	Dr S K Sharma	[Member] SNBNCBS
9	Dr N Nayak	[Member] SNBNCBS
10	Dr C K Majumdar	[Member] Director, SNBNCBS

The tenure of the Committee expired on 12 December, 1997. Steps for reconstituting the Committee were taken.

STAFF OF THE CENTRE AS ON 31 MARCH, 1998

Academic

Dr Chanchal Kumar Majumdar	Director
Dr Sujit Kumar Bose	Professor
Dr Partha Ghose	Academic Programme Coordinator/Profesor
Dr Abhijit Mookerjee	Professor
Dr Sandip Chakrabarti	Associate Professor
Dr Subodh Kumar Sharma	Reader
Dr Nilkantha Nayak	Reader
Dr Rabin Banerjee	Reader
Dr Anita Mehta	Reader

Dr Debashis Gangopadhyay	Reader	[From 1.11.1997]
D Srilekha Banerjee	Reader	[From 1.11.1997]
Dr Subhrangshu Sekhar Manna	Reader	[From 1.1.1998]
Dr Manu Mathur	Fellow	
Dr Samir Kumar Paul	Fellow	
Dr Partha Guha	Fellow	[From 3.11.1997]
Dr Anilesh Mohari	Fellow	[From 3.11.1997]
Dr Pratip Kumar Mukhopadhyay	Fellow	[From 1.11.1997]
Dr Ranjan Chaudhury	Fellow	[From 1.11.1997]
Mrs. Rina Das	Scientific Officer (Computer)	
Dr Gautam Gangopadhyay	Lecturer	
Dr Biswajit Chakraborty	Lecturer	[From 1.11.1997]
Dr Amitabha Lahiri	Lecturer	[From 1.11.1997]
Dr Kalyan Mandal	Lecturer	[From 4.11.1997]
Mr Biplab Sanyal	Senior Research Fellow	[From 15.4.1997]
Mr Tapas Mitra	Senior Research Fellow	[From Apr 15 to May 11, 1997]
Mr Tapas Mukar Das	Junior Research Fellow	[Joined on 15.4.1997]
Mr Subhradip Ghosh	Junior Research Fellow	
Mr Indranil Chattopadhyay	Junior Research Fellow	[Joined on 1.8.1997]
Mr Banibrata Mukhopadhyay	Junior Research Fellow	[Joined on 13.8.1997]
Mr Tomy Scaria	Junior Research Fellow	[Joined on 3.11.1997]

Ms Sharmistha Kumar Junior Research Fellow
[Joined on 24.7.1997]

Scientists on Projects/Research Scholars/Visiting Scientists

Professor Manoj Kumar Pal Emeritus Scientist, CSIR
[Retired in October 1997]

Professor Monisha Bose Co-Principal Investigator
in a DST Project

Professor Haridas Banerjee INSA Senior Scientist

Dr Sudhish Chandra Banerjee Principal Investigator in a DST Project

Dr Radhika Prasad Datta Research Associate, Univ of Warwick
Project [Resigned on 14.2.1998]

Dr Govindarajan Pari Post Doctoral Fellow, Univ of Warwick
Project

Dr Chandra Das Research Associate, CSIR

Dr Jayashree Saha Research Associate, CSIR

Dr Manjusree Sengupta Research Associate, CSIR

Mr Partha Pratim Biswas Senior Research Fellow, CSIR

Mr Prantick Dey Senior Research Fellow, CSIR

Ms Chhanda Basu Chaudhuri Senior Research Fellow, CSIR

Mr Arnab Kumar Ray Junior Research Fellow, CSIR
[Joined on 4.8.1997]

Dr Rudra P Malik Visiting Reader
[Joined on 27.2.1998]

Dr Prabhat Kumar Thakur Visiting Lecturer

Dr Sharmistha Ghosal Visiting Lecturer

Dr Archan S Majumdar Visiting Lecturer
[From 1.11.1997]

Administrative, Technical and Auxiliary

Mr Abhijit Gupta Administrative Officer

Mr Apurba Kanti Sarkar	Administrative Assistant [Accounts]
Mr Dipti Prakash Banerjee	Office Superintendent [Till 1.5.1997]
Mr Sunish Kumar Deb	Stenographer
Mr Sukanta Mukherjee	Assistant (General)
Mr Tapan Kumar Sen	Upper Division Clerk
Mr Anjan Bhattacharya	Upper Division Clerk [Joined on 3. 7. 1997]
Mr Jaydeep Kar	Junior Assistant
Mr Prasenjit Talukdar	Junior Assistant
Mr Sanad Kumar Shukla	Junior Assistant
Mr Santosh Kumar Singh	Junior Assistant
Mr Gopal Chandra Ghosh	Driver
Mr Shib Prasad Nayak	Pump Operator [Joined on 1. 7. 1997]
Mr Pradip Kumar Bose	Helper
Mr Partha Chakraborty	Helper
Personnel on Campus Construction	
Mr Samar Kumar Sur	Sub-Assistant Engineer [Expired on 23.11.1997]
Mr Aditya Pal Choudhury	Project Assistant

BUDGET SUMMARY

1997-98

The funds come from the Department of Science & Technology New Delhi. The Following in the summary of the budget estimates for the Year 1997-98

	Actuals	Budget estimate	Revised estimate
	1996-97	1997-98	1997-98
Non-Plan	39.79	43.35	17.00*
Plan	96.67	239.43	144.00*
Total	136.46	282.78	161.00

* sanctioned by DST Plan Rs. 240 lakhs, Non-Plan Rs. 32.30 lakhs but released as under :

Non Plan

1. Grant No. 296 (11.6.97) sanction AI/SNB/003/97(2.6.97)	Rs. 6 lakh
Grant No. 587 (17.7.97) sanction AI/SNB/003/97(3.7.97)	Rs. 11 Lakh
	Rs. 17 Lakh

Plan

1. Grant No. 776 (8.8.97) sanction AI/SNB/003/97(21.7.97)	Rs. 120 lakh
2. Grant No. 2136 (30.3.98) sanction AI/SNB/003/97(26.3.98)	Rs. 24 lakh
	Rs. 144 lakh
Total	Rs. 161 lakh

AUDITOR'S REPORT

To

The Director

Satyendra Nath Bose National Centre for Basic Sciences

Block JD, Sector III, Salt Lake

Calcutta - 700091

We have audited the attached Balance Sheet as at 31st March, 1998 of Satyendra Nath Bose National Centre for Basic Sciences and the annexed Income & Expenditure Account for the year ended 31st March, 1998, we report as follows :

1. a) Depreciation on fixed assets has not been ascertained and charged in the accounts since inception - refer to Note Nos. 1(a) and 2 of Schedule 16.
- b) Capital work-in-progress has not been separately disclosed - refer to Note No. 1(b) of Schedule 16.
- c) Liquidated damages/penalty not imposed on the contractors and Bonus provided in the accounts as the jobs not completed and final bills yet to be submitted/approved - refer Note No.1(i) of Schedule 16.
- d) Adjustments not made, for damaged / missing items found on completion of physical verification of fixed assets - (refer Note No. 5 of Schedule 16) and assets lying with third parties awaiting confirmation (refer Note No.7 of Schedule 16).
- e) Provision not made in the Accounts for :
 - i) Old advances of Rs.17,880 (refer to Note No.13(a) of Schedule 16.
 - ii) Lost draft of Rs.8,099 (refer to Note No.13(b) of Schedule 16.
- f) Stock of publication of "S.N. Bose : The Man and His Work" - Vol.I & II as on 31/3/98 has been valued at discounted selling price in terms of Accounting Policy clause No. 1(m) and also as mentioned in Note No.20 of Schedule 16 instead of at cost price.
- g) Licence fees and Electricity charges not recovered from the persons to whom staff quarters have been allotted - amount indeterminate (refer to Note No.14 of Schedule 16).

- h) Confirmation of balances as on 31st March, 1998 have not been obtained from parties to whom advances were made (refer to Note No.15 of Schedule 16).
 - i) Leave encashment are accounted for on cash basis (refer to 1(j) of Schedule 16).
 - j) Claims of contractors - refer to Note No.16(a) & (b) of Schedule 16.
 - k) Non-provision of Rs. 3,67,500 for arrear salary & allowances etc. on implementation of Fifth Pay Commission's recommendation - refer to Note No.19 of Schedule 16
2. All files and papers relating to construction of the buildings could not be produced to us - refer to Note No.12 of Schedule 16.
3. Writ Petition under Article 226 of the Constitution of India has been filed before the Hon'ble High Court, Calcutta by an employee against the 'Centre' and other for certain alleged irregularities in connection with construction of buildings of the 'Centre'. As the matter is sub-judice, the effect, if any, of the proceedings on the accounts of the 'Centre' is indeterminate.
4. Subject to paragraphs 1(a) and 1(k), 2 and 3 above, and to the best of our information and explanations given to us, in our opinion, the said Balance Sheet and the Income & Expenditure Account read together with Schedules 1 to 16 reflect a true and fair view -
- i) in case of Balance Sheet as to the state of affairs of the 'Centre' as at 31st March, 1998
- and
- ii) in case of the Income and Expenditure Account of General Fund as to the excess of Expenditure over Income and in the case of Project Account as to the excess of Income over Expenditure for the year ended 31st March 1998.

for **Mookherjee, Biswas & Pathak**
Chartered Accountants

Sd/- S. P. Mukherjea
Partner

Calcutta : 30th November 1998

SATYENDRA NATH BOSE NATIONAL CENTRE
Block JD, Sector III, Salt Lake

BALANCE SHEET AS AT

As at 31st March '97 Rs.	FUNDS & LIABILITIES	Schedule	Rs.	Rs.
	Capital Fund :			
	Balance as per last account		12,03,06,664.00	
	Add : Grant in aid received from Govt. of India for non-recurring expenses		<u>34,58,413.00</u>	12,37,65,077.00
12,03,06,664.00				
	General Fund :			
	Balance as per account		77,47,217.00	
	Add/(Less) - Excess of Income/ (Expenditure) over Expenditure/ (Income) for the year transferred from Income & Expenditure Account		<u>(10,28,863.00)</u>	67,18,354.00
47,217.00				
	Other Funds			
	Computer Fund - Donation received from J. Bose as per last account		3,75,001.00	
3,75,001.00	Add : Received during the year		<u>25,000.00</u>	4,00,001.00
7500.00	Library Fund (Donation)			7,500.00
6,221.00	Corpus Fund			6,221.00
3,76,635.00	Gratuity Fund			5,97,301.00
21,35,976.00	Employees' Provident Fund			34,47,381.00
	Project Fund			
	Balance as per last account		32,37,619.00	
	Add : Excess of Income over Expenditure for the year transferred from Income & Expenditure Account		<u>1,45,799.00</u>	33,83,418.00
32,37,619.00				
	Current Liabilities and Provisions			
	a) Current Liabilities			
11,07,160.00	Liabilities for expenses	1	17,34,870.00	
33,227.00	Other Liabilities	2	43,320.00	
13,86,634.00	Deposits from contractor	3	13,62,444.00	
52307.00	Sundry Creditors for Capital Expenditure	4	1,17,426.00	32,58,060.00
	b) Provision		Nil	—
<u>13,67,72,161.00</u>				<u>14,15,83,313.00</u>

Notes on accounts - Schedule 16

The Schedules referred to above form an integral part of the Balance sheet

In the terms of our attached report of even date
for **MOOKHERJEE, BISWAS & PATHAK**
Chartered Accountants

Calcutta : 30th November 1998

Sd/- S. P. Mookherjee
Partner

FOR BASIC SCIENCES

Calcutta - 700 091

31ST MARCH, 1998

As at 31st March '97 Rs.	PROPERTY & ASSETS	Schedule	Rs.
10,10,97,143.00	Fixed Assets : As cost/capitalised value	5	10,53,90,230.00
9,16,897.00	Investments General Fund Investment Fixed Deposits with Schedule Banks	6	2,08,36,607.00
2,00,519.00	Gratuity Fund Investment Fixed Deposit with Indian Overseas Bank, Salt Lake Branch		3,73,332.00
17,13,778.00	Provident Fund Investment Fixed Deposit with Indian Overseas Bank, Salt Lake Branch		28,71,634.00
	Current Assets, Loans and Advances		
	a) Current Assets		
5,286.00	Interest accrued on Investment General Fund		922,700.00
27,157.00	Gratuity Fund		35,472.00
3,08,920.00	Provident Fund		3,44,351.00
49,474.00	Stock of Printing and Stationery		92,146.00
9,14,500.00	*Stock of Books		8,99,500.00
35,713.00	Stock of Engineering Consumable Material		1,41,120.00
10,983.00	Cash and Bank Balance – Cash in hand		36,261.00
2,47,24,048.00	Cash at Bank with Schedule Banks in Current Account	7	35,88,230.00
	b) Loan and Advances		
3,900.00	Advance to Employees from Provident Fund		16,600.00
4,69,568.00	Security and Other Deposits	8	82,003.00
6,88,177.00	Advance recoverable in cash or in kind or for value to be received	9	7,84,797.00
56,06,098.00	Advances to Suppliers & contractors	10	51,68,330.00
<u>13,67,72,161.00</u>			<u>14,15,83,313.00</u>

* Note : Refer to Note 20 of Schedule 16

Sd/- R. Banerjee
Administrative Officer (Acting)S. N. Bose National Centre
for Basic SciencesSd/- C. K. Majumdar
DirectorS. N. Bose National Centre
For Basic Sciences

SATYENDRA NATH BOSE NATIONAL CENTRE
Block JD, Sector III, Salt Lake

INCOME AND EXPENDITURE ACCOUNT

E X P E N D I T U R E	Schedule	For the year ended 31st March, 1998		For the year ended 31st March 1997	
		Projects Account Rs.	General Account Rs.	Projects Account Rs.	General Account Rs.
Salaries & Allowances and Employees Benefits	11	3,56,226	68,44,147	4,05,048	39,68,708
Other Expenses	12	1,838	68,96,097	6,511	49,69,834
Maintenance Expenses	13	—	21,67,632	13,500	15,29,587
Stipend to CSIR Fellows		2,89,584	—	3,34,898	—
RSIC Charges		—	—	5970	—
Travel		62,746	—	1,00,757	—
Contingency & Raw Materials		1,20,189	—	1,83,840	—
Audit Fee		—	10,000	—	10,000
Refund of Grants-in-aid		5,900	—	48,473	—
Loss on Sale of Books		—	200	—	—
Excess of Income over Expenditure for the year carried down		1,45,799	—	1,52,930	4,95,039
		<u>9,82,282</u>	<u>1,59,18,076</u>	<u>12,51,927</u>	<u>1,09,73,168</u>
Excess of Expenditure over Income for the year brought down		—	11,41,073	—	—
Adjustment relating to prior period	14	—	—	—	5,50,049
Excess of Income over Expenditure transferred to Balance Sheet/ General Fund		1,45,799	—	1,52,930	8,83,048
		<u>1,45,799</u>	<u>11,41,073</u>	<u>1,52,930</u>	<u>14,33,097</u>

Notes on Accounts - Schedule

The Schedules referred to above form an integral part of the
Income and Expenditure Account.

In the terms of our attached report of even date
for **MOOKHERJEE, BISWAS & PATHAK**
Chartered Accountants

Calcutta : 30th November 1998

Sd/- S. P. Mookherjee
Partner

FOR BASIC SCIENCES

Calcutta - 700 091

FOR THE YEAR ENDED 31ST MARCH, 1998

I N C O M E	Schedule	For the year ended 31st March, 1998		For the year ended 31st March 1997	
		Projects Account Rs.	General Account Rs.	Projects Account Rs.	General Account Rs.
Grant-in-aid received :					
Non-Plan		—	17,00,000	—	32,00,000
Plan		—	1,09,41,587	—	71,95,479
Miscellaneous		—	—	—	1,78,000
Miscellaneous Grant Received :					
For Projects		6,61,663	—	8,07,264	—
For CSIR Fellows		3,20,619	—	4,44,663	—
Miscellaneous Income	15	—	3,89,289	—	1,19,624
Interest on Fixed Deposits		—	17,46,127	—	2,80,065
Excess of Expenditure over Income for the year carried down		—	11,41,073	—	—
		<u>9,82,282</u>	<u>1,59,18,076</u>	<u>12,51,927</u>	<u>1,09,73,168</u>
Excess of Income over Expenditure for the year brought down		1,45,799	—	1,52,930	4,95,039
Adjustment relating to prior period	14	—	1,12,210	—	9,38,058
Excess of Expenditure over Income transferred to General Fund		—	10,28,863	—	—
		<u>1,45,799</u>	<u>11,41,073</u>	<u>1,52,930</u>	<u>14,33,097</u>

Sd/- R. Banerjee
Administrative Officer (Acting)

S. N. Bose National Centre
for Basic Sciences

Sd/- C. K. Majumdar
Director

S. N. Bose National Centre
For Basic Sciences

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Calcutta - 700091

SCHEDULE - 1

	31st March 1998 (Rs.)	31st March 1997 (Rs.)
LIABILITIES FOR EXPENSES		
Electricity Charges (Shortfall in AMGR Charges)	13,15,112	5,76,195
Salary and Allowances	1,16,331	59,622
Medical Expenses	52,256	31,829
Maintenance of Iron Removal Plant	1,862	—
Maintenance of Computers	—	1,72,500
Printing and Stationery	—	396
Electrical Maintenance	803	31,847
A.C. Maintenance	19,540	19,540
Academic Staff Research Expenses	8,443	9,690
Postage and Telegrams	3,486	2,389
Hire Charges of Transport	—	4,657
Legal Expenses	33,783	—
Meeting Expenses	—	5,069
Audit Fee	10,000	10,000
Bonus	30,237	28,620
Rent of Leasehold Land	27,681	27,681
Municipal Tax	68,841	68,841
Office Contingency Expenses	—	16,422
Telephone & Trunk Calls	34,209	125
Seminar & Other Academic Expenses	3,679	6,056
Visiting Member Fellowship	—	560

	31st March 1998 (Rs.)	31st March 1997 (Rs.)
Security Maintenance	—	29,843
Repairs to Equipment	—	1,278
TA/DA to Academic Staff (Abroad)	3,460	—
Director's Research Expenses	3,947	—
	<u>17,33,670</u>	<u>11,03,160</u>
A/C PROJECT		
Contingency - Certification Fees	1,200	2,000
Payable to Auditor		
Binding Charges	—	2,000
	<u>17,34,870</u>	<u>11,07,160</u>

SCHEDULE - 2

OTHER LIABILITIES

Contractors' Income Tax	2899	2,066
Contractors' Sales Tax	417	2,534
Employees' Professional Tax	246	357
Employees' Contribution to P.F.	1454	3,309
Adjustable Rent	—	3,750
Deposit from N. Nayak	1650	1,650
Deposit from R. Choudhury	12,000	12,000
C.M.C. Ltd.	4,911	4911
ARCON	30	30
Insurance Premium Recovered	20	20
G.S.L.I.	2,040	600
Deposit from NSCH	2,000	2,000
INSA	2,756	—
Deposit from K. Mondal	9,935	—
Refundable Recoveries	2,962	—
	<u>43,320</u>	<u>33,227</u>

	31st March	31st March
	1998	1997
	(Rs.)	(Rs.)

SCHEDULE - 3

DEPOSITS FROM CONTRACTORS

a) Earnest Money Deposit

Pradhan and Associates	60,500	60,500
Nabin Designers and Constructors P.Ltd.	20,000	20,000
Larica (India) Pvt. Ltd.	5,000	5,000
B.B. Construction	—	750
Ajit Enterprise	1,100	1,100
B. Roy Chowdhury	1,469	1,469
BPL Telecom Ltd.	—	5,000
Larsen & Toubro Ltd.	—	5,000
Crompton Greaves Ltd.	—	5,000
Uptron India Ltd.	—	5,000
Siemens (India) Ltd.	—	5,000
Rohan Communication Pvt. Ltd.	5,000	5,000
Appolo Engineering	—	500
Project Electricals	—	500
Paul Rolling Shutter	500	—
Reiz India	1,000	—
TEE Camac	1,000	—
Suraj Venitian Blinds	1,000	—
Annams Engineering	1,000	—
	<u>97,569</u>	<u>1,19,819</u>

b) Security Deposit

Pradhan and Associates	3,23,994	3,23,994
Nabin Designers & Constructors P.Ltd.	5,52,159	5,52,159
Ghose Bose & Associates	1,26,769	1,26,769

	31st March 1998 (Rs.)	31st March 1997 (Rs.)
C.M.C. Ltd.	1,79,440	1,79,440
Asco Stromech (P) Ltd.	10,714	10,714
T.I.L. Ltd.	40,638	40,638
Larica (India) Pvt. Ltd.	8,740	8,740
B.P. Construction	330	330
Annanas Engineering	7,393	7,393
Arcon	—	9,149
B.B. Construction	375	6,354
Roy & Chowdhury	—	1,135
Dew Drops (India) Ltd.	570	—
Project Electricals	9,070	—
B. Roy Chowdhury	1,963	—
Ajit Enterprises	2,352	—
Paul Rolling Shutters	228	—
Weather Meakers	140	—
	<u>12,64,875</u>	<u>12,66,815</u>
Total (a) + (b)	<u>13,62,444</u>	<u>13,86,634</u>

SCHEDULE - 4

SUNDRY CREDITORS FOR CAPITAL EXPENDITURE

a) Campus Beautification	5,985	—
Construction of Building	4,624	1,787
Furnish. Accom. for Visiting Scientists	76,817	—
Library Journal	—	20,520
	<u>87,426</u>	<u>22,307</u>
b) Project A/c :		
Equipment	30,000	30,000
	30,000	30,000
TOTAL (a) + (b)	<u>1,17,426</u>	<u>52,307</u>

SCHEDULE - 5

FIXED ASSETS	Balance as on 01/04/97 (Rs.)	Additions during the year (Rs.)	Adjustment during the year (Rs.)	Balance as on 31/03/98 (Rs.)
a) General Account				
Office Equipment	2,55,371	—	—	2,55,371
Guest House Furniture	15,77,434	1,37,817	—	17,15,251
Small Equipment	4,29,221	9,305	—	4,38,526
Books & Journals	48,40,273	17,25,504	—	65,65,777
Director's Research equip.	2,48,192	—	—	2,48,192
Boundary Wall	10,38,937	—	—	10,38,937
Computer Accessories	37,00,480	18,49,357	—	55,49,837
Construction of Building	6,73,28,567	1,27,411	—	6,74,55,978
Computer	13,08,681	—	—	13,08,681
Campus Land *	1,09,50,694	—	—	1,09,50,694
Air Condition Machineries	1,09,475	—	—	1,09,475
Campus Beautification	3,69,237	65,739	—	4,34,976
Office Car (WNW 8486)	1,04,794	—	—	1,04,794
U.P.S.	2,17,685	—	—	2,17,685
Acad.Staff Research Equip.	75,298	54,240	—	1,29,538
Library Computer	28,99,227	—	—	28,99,227
Furniture & Fixtures	27,33,055	3,23,714	—	30,56,769
	<u>9,81,86,621</u>	<u>42,93,087</u>	<u>—</u>	<u>10,24,79,708</u>
b) Projects Account				
Equipment	28,96,642	—	—	28,96,642
Books & Periodicals	7,080	—	—	7,080
Furniture & Fixture	6,800	—	—	6,800
	<u>29,10,522</u>	<u>—</u>	<u>—</u>	<u>29,10,522</u>
Total (a) + (b)	<u>10,10,97,143</u>	<u>42,93,087</u>	<u>—</u>	<u>10,53,90,230</u>

* Note : Refer to Note 3 of Schedule 16

	31st March 1998 (Rs.)	31st March 1997 (Rs.)
SCHEDULE - 6		
GENERAL FUND INVESTMENT		
Fixed Deposit With :		
a) Indian Overseas Bank Salt Lake Branch, Calcutta	56,57,762	—
b) United Bank of India Mayukh Bhawan Branch, Calcutta	1,51,78,845	9,16,897
	<u>2,08,36,607</u>	<u>9,16,897</u>

Note : Fixed Deposit of Rs.394700 held as margin by the Bank against Bank Guarantee issued in favour of WBSEB in lieu of Security Deposit earlier shown under Security Deposit with WBSEB in Schedule 8.

SCHEDULE - 7

CASH AND BANK BALANCES

Cash at Bank with Scheduled Banks' in Current Account		
a) Indian Overseas Bank Salt Lake Branch, Calcutta General Fund Account	32,61,268	2,39,72,089
Project Fund Account	4,37,167	2,97,443
Provident Fund Account	1,65,595	64,671
b) United Bank of India Mayukh Bhawan Branch, Calcutta (Book Overdraft)		
General Fund Account	(-) 2,75,800	3,89,845
	<u>35,88,230</u>	<u>2,47,24,048</u>

	31st March	31st March
	1998	1997
	(Rs.)	(Rs.)
SCHEDULE - 8		
SECURITY AND OTHER DEPOSITS		
a) Security Deposits		
WestBengal State Electricity Board	59,618	4,54,318
Department of Telecommunciation	<u>1,600</u>	<u>1,600</u>
	<u>61,218</u>	<u>4,55,918</u>
b) Depsoit for Rent		
Rama De	1,650	1,650
S. Sen	12,000	12,000
Swapan Banerjee	<u>7,135</u>	<u>—</u>
	<u>20,785</u>	<u>13,650</u>
Total (a) + (b)	<u>82,003</u>	<u>4,69,568</u>

SCHEDULE - 9
LOANS AND ADVANCES

Advances recoverable in cash or in
kind or for value to be received :

Recoverable expenses on Seminar (PATPAA)*	10,000	10,000
Prepaid expenses (Schedule 9A)	7,16,521	4,11,263
Staff advances (* Rs.3,380)	23,050	1,17,080
Advance against L.T.C.	12,524	23,462
Festival Advance	2,200	2,680
S. Manna *	4,500	4,500
Indian Physical Society *	—	6,729
Employee's Income Tax	2,952	2,152
S. Roy	—	10,000
I A P T	—	282
T. Das (ECRA)	—	20,634
INSA	—	79,395
Receivables (Sale of Books)	11,000	—
Adjustable Rent	<u>2,050</u>	<u>—</u>
	<u>7,84,797</u>	<u>6,88,177</u>

* (Outstanding over one year -
Rs.17880, Previous Year Rs.24609)

	31st March	31st March
	1998	1997
	(Rs.)	(Rs.)
SCHEDULE - 9A		
PREPAID EXPENSES		
Computer Maintenance	2,80,688	2,05,177
Lift Maintenance	28,287	15,077
Repair for Equipment	6,583	10,830
A.C. (Guest House) Maintenance	65,130	60,179
UPS Maintenance	48,333	20,000
Internet Rental Charges	2,87,500	1,00,000
	<u>7,16,521</u>	<u>4,11,263</u>

SCHEDULE - 10

ADVANCES TO SUPPLIERS & CONTRACTORS

a) General Account		
Godrej & Boyce Mfg. Co. Ltd.	22,81,915	23,34,504
Manna Marine Service	2,200	2,200
Jubilee Enterprise	—	6,043
Pradhan Associates	68,313	68,313
Allied Publishing Agency	12,44,158	10,10,028
Ghosh, Bose & Associates	2,50,000	2,50,000
Nabin Designers & Constructors P. Ltd.	10,02,424	10,02,424
Tata Elexi Ltd.	—	100,000
Rohan Communication (P) Ltd.	2,52,390	2,52,390
Business Link	—	97,250
Asub	—	14,460
Data Craft	—	3,09,876
Valtar Electronics	—	40,200
Rainbow System	—	51,480
	<u>51,01,400</u>	<u>55,39,168</u>
b) Project Accounts		
HMC Infotech Ltd.	66,930	66,930
Total (a) + (b)	<u>51,68,330</u>	<u>56,06,098</u>

	31st March 1998 (Rs.)	31st March 1997 (Rs.)
SCHEDULE - 11		
SALARIES & ALLOWANCES AND EMPLOYEES BENEFITS		
Salary and Allowances	54,61,038	32,29,475
Wages	3,31,169	2,70,734
Employer's Contribution to P.F.	5,95,730	1,01,230
Medical Expenses	1,66,345	1,28,194
Adhoc Bonus	30,237	28,620
Leave Travel Concession	29,345	24,726
Provision for Gratuity	1,88,496	122,431
Interest on P.F. (Deficit)	34,011	13,293
Leave Salary	7,776	50,005
	68,44,147	39,68,708
PROJECTS ACCOUNTS		
Salary & Allowances	3,56,226	4,05,048
	<u>3,56,226</u>	<u>4,05,048</u>

SCHEDULE - 12

OTHER EXPENSES

Electricity Charges (Includes shortfall of AMGR Rs.8,08957, Previous Year Rs.506155)	19,84,085	13,00,932
Hire Charges of Transport	1,61,108	1,25,601
Office contingency expenses	1,14,626	1,22,503
Printing & Stationery	1,85,903	1,66,510
Postage & Telegrams	72,672	53,835

	31st March 1998 (Rs.)	31st March 1997 (Rs.)
Insurance	1,510	12,079
Telephone & Trunk Calls	2,63,754	1,97,609
TA/DA to Non-Academic Staff	1,946	3,591
TA/DA to Academic Staff (India)	18,762	15,616
TA/DA to Academic Staff (Abroad)	1,66,272	1,96,040
Meeting Expenses	2,61,741	86,297
Bank Charges	8,195	3,135
Seminar & Other Academic Expenses	11,55,274	6,25,629
Visiting Member Fellowship	2,94,755	3,30,137
Director Research Expenses	36,718	29,397
Academic Staff Research Expenses	1,61,797	1,19,823
Publication of Seminar Proceedings	43,448	50,000
Library Expenses	—	531
TA/DA to TPSC Speakers	7,00,711	6,24,467
E-Mail	3,23,192	1,55,901
Municipal Tax	2,75,364	3,44,205
Furnishing Accom. of Visiting Scientist	1,31,831	8,214
Legal Expenses	71,098	1,07,981
Water Supply	13,772	37,847
PAC Meeting	—	37,954
Internet Charges	376,923	2,14,000
Other Expenses for Court	70,640	—
	<u>68,96,097</u>	<u>49,69,834</u>

PROJECT ACCOUNTS

Bank Charges	1,808	2,141
Postage & Telegrams	30	4,370
	<u>1,838</u>	<u>6,511</u>

	31st March 1998 (Rs.)	31st March 1997 (Rs.)
SCHEDULE - 13		
MAINTENANCE EXPENSES		
Repairs to Equipment	21,547	7,526
Car Maintenance	32,352	26,071
Office Maintenance	67,458	41,787
Computer Maintenance	3,05,696	2,46,704
P.O. L	60,052	50,762
Building Maintenance	52,780	20,416
Security Maintenance	3,68,311	3,62,659
Maintenance of Iron Removal Plant	66,058	34,571
Electrical Maintenance	5,16,407	4,44,942
A.C. Maintenance	4,82,141	2,69,072
UPS Maintenance	29,667	10,000
Lift Maintenance	48,357	15,077
Fire Alarm Maintenance	3,624	—
A.C. Maintenance (Guest House)	57,182	—
A.C. Maintenance (Computer Room)	56,000	—
	<u>21,67,632</u>	<u>15,29,587</u>
PROJECT ACCOUNTS		
Computer Maintenance	<u>—</u>	<u>13,500</u>

SCHEDULE - 14

	DEBIT		CREDIT	
	For the Year ended 31/3/98	For the Year ended 31/3/97	For the Year ended 31/3/98	For the Year ended 31/3/97
	(Rs.)	(Rs.)	(Rs.)	(Rs.)
PRIOR PERIOD ADJUSTMENT A/C				
Adhoc Bonus	—	5,713	—	—
Printing & Stationary	—	4,259	—	—
Saminar & Other Academic Expenses		7,904	—	—
Electrical Charges	—	5,32,173	—	—
S.N. Bose Birth Centenary	—	—	—	9,14,500
Building Maintenance	—	—	—	118
Electrical Maintenance	—	—	—	23,440
Interest on STD			1,12,210	
	<u>—</u>	<u>5,50,049</u>	<u>1,12,210</u>	<u>9,38,058</u>

SCHEDULE - 15

	31st March 1998 (Rs.)	31st March 1997 (Rs.)
MISCELLANEOUS INCOME		
Income from Guest House	170520	63,120
Sale of Books*	—	39,900
Other Receipts	984	3,929
Hostel Charges	12750	12,675
Income from Registration Fees	1500	—
Contribution for Seminar on Black Hole	177775	—
Receipts from Participants (Black Hole)	25760	—
	<u>389289</u>	<u>1,19,624</u>

* Refer to Note No.20 of Schedule 16

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

SCHEDULE - 16

Notes on Accounts

1. Significant Accounting Policies

- (a) Fixed Assets are stated at the cost of acquisition exclusive of freight and clearing charges without making any provision for depreciation.
- (b) All Capital Works-in-Progress including buildings under construction, plant & machinery, equipment pending installation and architect's fees are directly debited to the respective asset heads instead of segregating the total amount between work completed and Capital work-in-progress.
- (c) Construction of Building Account is debited on passing of the running account bills of the contractors after adjustment of advances paid, if any. For other suppliers/service agencies payments against pro-forma bills are debited to Advance Account and charged to Assets on receipt of the final bills.
- (d) 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. Pending exercise of such option by the Govt. of India, adjustments are not made in the Accounts.
- (e) Subscription paid for Library Journals upto the end of the financial year are capitalised and subscriptions paid for the subsequent financial year, if any, is shown under Advances.
- (f) Grants from the Department of Science & Technology, Govt. of India are accounted for on cash basis.
- (g) Surplus of Grants received from Govt. of India for both Non-Plan and Plan Recurring Expenditure during the financial year is transferred to General Fund Account.
- (h) Out of the total grant of Plan Expenditure, the amount budgeted for Plan-Recurring Expenditure is accounted for in the Income and Expenditure Account.
- (i) Liquidated Damages/Penalty/Bonus are accounted for on cash basis after

completion of the jobs and submission of final bills.

- (j) Guest House Income and Leave Encashment are accounted for on cash basis.
 - (k) Gratuity liability is not determined by actuarial valuation. However, liability for gratuity is estimated on the basis of guidelines of Central Govt. and provided for in the Accounts.
 - (l) Stock of engineering consumable materials are valued at cost.
 - (m) Stock of Publication (S.N. Bose : The Man and His Work, Vol.I & Vol.II) are valued at discounted price of Rs.500 per volume (the printed price is Rs.600 per volume).
2. No depreciation has been provided in the Accounts (refer to Accounting Policy No.1(a).).

3. Campus Land	
Land allocated by Govt. of West Bengal free of cost to the Dept. of Science & echnology, Govt. of India who transferred this parcel of land by Deed of Gift to the Centre	10.0017 acres
Lease granted by Salt Lake Reclamation & Development Circle, Govt. of West Bengal for 999 years to the Centre	5.0384 acres
Total	15.0401 acres

Premium for leasehold land for 5.0384 acres of land paid by the Centre	Rs. 60,694	
Paid by DST, Govt.of India	Rs. 36,29,920	Rs. 36,90,614
Value of land capitalised : Lease Premium paid by The Centre		Rs. 60,694
Notional Value applying the rate of premium for leashold land with credit to Capital Fund		Rs 1,08,90,000
Total		Rs 1,09,50,694

4. Fixed Assets of Rs.10,53,90,230 as disclosed in the Balance Sheet includes Library Books & Journals valued at Rs.65,65,777 (previous year Rs.48,40,273).
5. Physical verification of the movable fixed assets of the Centre has been done and adjustments for damaged/missing items will be made in the Accounts in the next year.

6. Progressive total as on 31/3/98 for certain items of fixed assets in the Register of Fixed Assets for General Account is under preparation. Itemwise value of the assets is not entered in the Register of Fixed Assets for both General and Project Accounts.
7. Movable fixed assets lying with third parties awaiting confirmation :
- | | | | | |
|-----------------|---|-------------------------------|-----|----------|
| General Account | : | Director's Research Equipment | Rs | 1,62,054 |
| | | Acad.Staff Research Equipment | Rs. | 53,359 |
| Project Account | : | Superconductivity Project | Rs. | 1,30,863 |
8. In terms of Accounting Policy Clause 1(d) no adjustments have been made in the Accounts in respect of four completed project viz. "Superconductivity", "Quantum Transmittance", "Numerical Studies of Transition" and "Probing the Foundation of Quantum Theory" pending exercise of discretion by the Govt. of India.
9. Gratuity Fund balance as on 31/3/98 is Rs.5,97,301 (previous year Rs.3,76,635) out of which Rs.3,73,332 (previous year Rs.2,00,519) is invested in Fixed Deposit with Indian Overseas Bank, Salt Lake Branch, and the balance Rs.2,23,969 (previous year Rs.1,76,116) is lying in the Current Account of the General Fund in the Indian Overseas Bank, Salt Lake Branch.
10. Provident Fund of the Centre has been approved by the Govt. of India under the Provident Fund Act, 1925 on 19/12/94 with effect from 1st March, 1991 subject to certain 'stylistic changes'.
- Pending constitution of the Board of Trustees, the control over the funds including investment and its encashment and administration is being exercised by the Centre.
11. Bye-Laws of the Centre has been approved by the Ministry of Science & Technology, Govt. of India in July 1995 subject to certain 'stylistic changes'.
12. 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 could not be produced to the Auditor.
13. No provision have been made in the Accounts for
- Old Advances of Rs.17,880 (Previous year Rs.24,609) as the amounts are expected to be recovered from the concerned persons.
 - Lost Bank Draft of Rs.8,099 issued in favour of Professor N. Mukunda - as the amount will be realised from the Bank after completion of the formalities for cancellation of Bank Draft.
14. Recovery of Licence Fees and Electricity charges from the persons to whom staff quarters have been allotted has not been made.

15. Balance confirmation certificates at the end of the year have not been obtained from parties to whom advances were made.
16. (a) The Centre has received an arbitration notice from M/s Nabin Designers & Constructors (P) Ltd., the Contractor awarded with work of construction of superstructure of the Centre at its new campus. The claims of the contractor as in the arbitration notice includes payment towards balance of work done, escalation bills, bonus etc. plus interest @ 24% p.a. on dues from the date of completion to till the date of realisation. Liability, if any, will be accounted as and when finally determined.

Arbitration proceeding since started.

- (b) The claims of the Contractors engaged in other jobs such as installation of 320 KVA Diesel Generator Set, Central Air Conditioning System, Iron Removal Plant and Fire Alarm and Public Addressing Systems against their final bills are yet to settled and accounted by the Centre, as the matter is sub-judice.
17. The Centre has been consuming less power than what was agreed with the West Bengal State Electricity Board. This resulted in additional liability of Rs.808,957 on account of AMGR (Average Minimum Guaranteed Requirement) in this year.
18. Rectification/cost adjustment action will be taken by the Centre at the time of the passing of the pending bills of the concerned contractors.
19. The Centre has paid in March 1998 Rs. 18,92,845 towards arrear salary & allowances including Provident Fund contribution w.e.f. 1.1.96 on adoption of the Fifth Pay Commission's Recommendation by debiting current year's account. No provision has been made in the accounts for the 2nd instalment of the Arrear payments amounting to Rs. 3,67,500 paid in 1998-99. Excess/short payments made to employees, if any, will be adjusted next year.
20. In terms of Accounting Policy Clause No.1(m) the Stock of Publication of S.N. Bose : The Man and His Work as on 31/3/98 has been valued at Rs.500 per volume as per details below.

	Vol 1		Vol 2	
	no.	Rs.	no.	Rs.
Stock as on 1.4.97	892	446,000	937	468,500
Less : Sales in 97-98	03	1,400	27	13,400
Loss on sale of books			100	100
Stock as on 31.3.98	889	444,500	910	455,000

SATYENDRA NATH BOSE NATIONAL CENTRE

Block JD, Sector III, Salt Lake

RECEIPTS AND PAYMENTS ACCOUNT

Figures for the previous year				
Project Account Rs.	General Account Rs.	R E C E I P T S	Project Account Rs.	General Account Rs.
		Opening Cash & Bank Balances		
3,77,048	63,16,002	Indian Overseas Bank	2,97,443	2,39,72,089
—	58,08,162	United Bank of India	—	3,89,845
—	3,388	Cash in hand	—	10,983
		Grants-in-Aid		
	2,30,00,000	For Plan Expenditure	—	1,44,00,000
	32,00,000	For Non-Plan Expenditure	—	17,00,000
	1,78,000	For others		
		Misc. Grant-in-Aid		
4,44,663		For CSIR Fellows	3,20,619	
8,07,264		For Projects	6,61,663	
		Encasement of Fixed Deposits		
	14,45,000	Indian Overseas Bank		—
	—	United Bank of India		—
	34,819	Earnest Money from Contractors		5,500
	24,031	Security Deposit from Contractors		27,212
	15,30,376	Recovery of Advances from Suppliers		20,68,633
	34,27,604	Recovery of Advances from Contractors & WBSEB		
		Recovery of Other Advances		
	33,000	Festival Advance		7,080
	4,55,315	Advance to Staff		1,56,915
	—	LTC Advance		17,377
	13,181	Robin Banerjee		—
	—	Misc. Advance		1,19,796
		Deposits and Adjustable Rent Received		
		Deposit from K. Mondal		9935
	2,000	NSCH		
<u>16,28,975</u>	<u>4,54,70,878</u>	Carried Forward	<u>12,79,725</u>	<u>4,28,85,365</u>

FOR BASIC SCIENCES

Calcutta - 700 091

FOR THE YEAR ENDED 31ST MARCH, 1998

Figures for the previous
year

Project Account Rs.	General Account Rs.	P A Y M E N T S	Project Account Rs.	General Account Rs.
		Salaries, Allowances & Employees Benefits		
4,05,048	31,69,853	Salary & Allowances	3,56,226	53,44,706
	2,65,665	Wages		3,31,169
	1,01,230	Employer's Contribution-provident Fund		5,95,730
	96,366	Medical Expenses		1,14,089
	24,726	Leave Travel Concession		29,345
	50,005	Leave Salary		7,776
		Other Expenditure		
	7,24,736	Electricity Charges		11,75,128
	1,20,944	Hire Charges of Transport		1,61,108
	1,06,082	Office Contingency Expenses		1,14,626
	1,49,493	Printing and Stationery		2,28,576
4,370	51,446	Postage and Telegrams	30	69,186
	12,079	Insurance		1,510
	1,97,484	Telephone and Trunk Calls		2,29,545
	3,591	TA/DA to Non-Academic Staff		1,946
	15,616	TA/DA to Academic Staff (India)		18,762
	1,96,040	TA/DA to Academic Staff (Abroad)		1,62,812
	86,297	Meeting Expenses		2,61,741
2,141	3,135	Bank Charges	1808	8,195
	6,19,573	Seminar and other Academic Exps.		11,51,596
	2,75,364	Municipal Tax		2,75,364
	37,955	PAC Meeting		—
<u>4,11,559</u>	<u>63,07,680</u>	Carried Forward	<u>3,58,064</u>	<u>1,02,82,910</u>

SATYENDRA NATH BOSE NATIONAL CENTRE
Block JD, Sector III, Salt Lake

RECEIPTS AND PAYMENTS ACCOUNT

Figures for the previous year			
Project Account Rs.	General Account Rs.	R E C E I P T S	
Project Account Rs.	General Account Rs.	Project Account Rs.	General Account Rs.
16,28,975	4,54,70,878	Brought Forward	12,79,725 4,28,85,365
		Other Recoveries	
	20	Insurance Premium	
	13,977	Recoveries Provident Fund Acct. (Net)	
		Employees Contribution to	
	2,270	Provident Fund (Net)	
	227	Deduction of Taxes (Net)	1,440
	600	G S L I	
	25,000	Donation Received from J. Bose	25,000
		Miscellaneous Income	
	63,120	Income from Guest House	1,70,520
	39,900	Sale of Books (Refer Note No.)	3,800
	3,929	Other Receipts	984
	12,675	Hostel Charges	12,750
	4,67,545	Interest from Fixed Deposits	8,20,398
	38,104	Gratuity Fund - Investment Income	32,169
	4,07,316	Received from Project Account	3,275
2,40,410		Received from General Fund	
		Income from Registration fee	1,500
		Contribution for Seminar (Black Holes)	1,77,775
		Receipts from Participants (Black Holes)	25,760
		Prior Period (Int. on STD)	1,12,211
		Refundable Recoveries	2,962
<u>18,69,385</u>	<u>4,65,45,561</u>	Carried Forward	<u>12,79,725 4,42,75,909</u>

FOR BASIC SCIENCES

Calcutta - 700 091

FOR THE YEAR ENDED 31ST MARCH, 1998

Figures for the previous
year

Project Account Rs.	General Account Rs.	P A Y M E N T S	Project Account Rs.	General Account Rs.
4,11,559	63,07,680	Brought Forward	3,58,064	1,02,82,910
	3,29,577	Visiting Members Fellowship		2,94,755
	29,377	Director Research Expenses		32,771
	1,10,153	Academic Staff Research Expns.		1,55,355
	50,000	Publication of Seminar Proceedings		43,448
	531	Library Expenses		—
	6,24,467	T/DA to TPSC Speakers		7,00,710
	1,55,901	E-Mail		3,23,192
	8,214	Furnishing Accommodation for Visiting Scientists		1,31,831
	1,07,981	Legal Expenses		37,315
	37,847	Water Supply		13,772
	—	Movement Expenses		—
	3,14,000	Internet charges		5,64,423
	—	Other Expns. for Court Case		70,640
	30,154	Maintenance Expenses		
	—	Lift Maintenance		61,567
	17,078	AC Maintenance (G.H)		62,133
	26,071	Repair to Equipment		17,300
	41,787	Car Maintenance		32,352
13,500	52,200	Office Maintenance		67,458
	50,762	Computer Maintenance		3,81,207
	24,109	POL		60,052
	3,32,816	Building Maintenance		59,989
	34,571	Security Maintenance		3,68,311
	30,000	Maintenance of Iron Removal		64,196
	4,19,207	UPS Maintenance		58,000
	3,12,060	Electrical Maintenance		6,14,745
	—	A.C. Maintenance		4,61,658
	2,00,100	Fire-Alarm Maintenance		3,624
	11,42,814	Library Books		2,92,467
	26,774	Library Journals		14,33,038
	11,836	Equipment		
23,17,643	—	Small Equipment		9,305
	—	Office Equipment		—
	—	Computer Accessories		18,49,357
	—	Academic Staff Research Equipment		54,240
	48,493	Land and Building		
36,93,142	—	Campus Beautification		59,754
	—	Construction of Buildings		1,22,787
	3,97,462	Furniture and Fixture		
	15,220	Office Furniture		3,23,714
	68,516	Library Furniture		—
	—	Guest House Furniture		61,000
	—	A.C. (Computer) Maintenance		56,000
<u>4,25,059</u>	<u>1,73,68,543</u>	Carried Forward	<u>3,58,064</u>	<u>1,92,25,376</u>

SATYENDRA NATH BOSE NATIONAL CENTRE
Block JD, Sector III, Salt Lake

RECEIPTS AND PAYMENTS ACCOUNT

Figures for the previous year		R E C E I P T S			
Project Account Rs.	General Account Rs.		Project Account Rs.	General Account Rs.	
18,69,385	4,65,45,561	Brought Forward	12,79,725	4,42,75,909	

18,69,385 4,65,45,561

12,79,725 4,42,75,909

In the terms of our attached report of even date
for **MOOKHERJEE, BISWAS & PATHAK**
Chartered Accountants

Calcutta : 30th November 1998

Sd/- S. P. Mookherjee
Partner

FOR BASIC SCIENCES

Calcutta - 700 091

FOR THE YEAR ENDED 31ST MARCH, 1998

Figures for the previous
year

Project Account Rs.	General Account Rs.	P A Y M E N T S		Project Account Rs.	General Account Rs.
4,25,059	1,73,68,543	Brought Forward		3,58,064	1,92,25,376
		Advance to Contractors & Suppliers			
		Building Contractors			—
66,930	21,65,608	Other Suppliers			16,30,865
		Other Advance			
	33,000	Festival Advance			6,600
	2,649	Advance against LTC (Net)			6,439
	4,68,420	Staff Advance			60,885
	1,10,311	Misc. Advance			—
		Deposits			
	—	Deposit for Rent			7,135
	50,000	Refund of Security Deposits			29,151
	—	Refund of Earnest Money			27,750
		Other Payments			
	2,40,410	Project Accounts			—
		Employees Contribution to P.F. (Net)			1,855
1,000	2,54,509	Outstanding Liabilities - Revenue			4,71,362
	25,399	Outstanding Liabilities - Adhoc Bonus			28,620
	5,78,406	Outstanding Liabilities - Capital			22,307
	38,105	Gratuity Fund Investment			1,72,813
	75,505	Payment of Taxes			2,195
	5,40,077	Prior Period (Net)			—
3,34,898		Stipend to CSIR Fellows	2,89,584		—
1,00,757		Travel	62,746		—
5,970		RSIC Charges	—		—
		Payment to Provident Fund (Net)			29,517
	1,400	Adjustable Rent			5,800
	1,91,165	Short Term Deposit with UBI (Net)			1,42,61,948
	29,137	Payment from Gratuity Fund			—
1,79,840		Contingency and Raw Materials	1,22,989		—
1,700		Equipment	—		—
4,07,316		Payments to General Fund	3,275		—
48,472		Refund of Grant-in-Aid	5,900		—
		Short Term Deposit with IOB (Net)			52,63,062
		Closing Cash & Bank Balance			
2,97,443	2,39,72,089	Indian Overseas Bank	4,37,167		32,61,268
	3,89,845	United Bank of India	—		(-) 2,75,800
—	10,983	Cash in hand	—		36,261
<u>18,69,385</u>	<u>4,65,45,561</u>		<u>12,79,725</u>		<u>4,42,75,909</u>

Sd/- R. Banerjee
Administrative Officer (Acting)

S. N. Bose National Centre
for Basic Sciences

Sd/- C. K. Majumdar
Director

S. N. Bose National Centre
For Basic Sciences

ACTION IN COMPLIANCE WITH THE AUDITOR'S REPORT 1997-98

THE FOLLOWING CAN BE REPORTED.

1. (a) **Depreciation of fixed assets (Sch 16, notes 1(a) and (2))**

It should be entrusted as a special work to be auditors after the report of physical verification of stock is ready. It will be brought before the Finance Committee.

1. (b) **Capital work in progress (Sch 17 notes 1(b))**

The final bills for Phase I of construction of the campus have not been paid, because of a case before the Calcutta High Court.

1. (c) **Liquidated damage (Sch 16, note 1(i))**

The final bills have not been released by the Court and the consultant architects have not certified the bills or recommended liquidated damages.

1. (d) **Physical Verification (Sch 16, notes 5,6,7)**

The physical verification and marking of stock, furniture etc. is going on. In accordance with the instruction of the Governing Body (16th meeting), some instruments no longer necessary and found surplus in the Centre are given away to research centres which might utilize them (e.g. IACS, Saha Institute and VECC).

Some instruments and chemicals held up at the S.D. Chatterjee Research Foundation cannot yet be recovered as the foundation and the Asiatic Society are involved in a court case.

1. (e) **Old advances (Sch 16.13(a) and 9)**

Two old advances due from UGC (PATPAA, S. Manna) have not been recovered in spite of several reminders and will have to be written off after the concurrence of the Finance Committee. Other advances are being recovered.

1. (f) **“S. N. Bose : The Man and His Work” (Sch 16, note 20)**
Stock position is known.
1. (g) **License fee/Electricity charges (Sch 16, note 14)**
Calculations are in progress.
1. (h) **Confirmation about balance (Sch 16, note 15)**
Noted by Accounts Section.
1. (i) **5th Pay Commission (Sch 16, note 19)**
Noted by Accounts Section
2. **PF rules/Byelaws (Sch 16, note 10,11)**
Action has been taken and will be brought before the Governing Body.
3. **Electricity consumption (Sch 16, note 17)**
Consultant architect informed, but work slow in view of the pending court case.
Other suggestions are noted and being implemented

C. K. Majumdar
(Director)



