

ANNUAL

REPORT

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SATYENDRA NATH BOSE NATIONAL CENTRE
FOR BASIC SCIENCES

(Estd. 1986)

DB 17 : SECTOR 1, SALT LAKE CALCUTTA - 700 064

**SATYENDRA NATH BOSE NATIONAL CENTRE
FOR BASIC SCIENCES
CALCUTTA**

**ANNUAL REPORT
April 1, 1992 to March 31, 1993**

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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 in frontier areas, including challenging theoretical studies of future applications;

To provide a forum of personal contacts and intellectual interaction among scientists within the country and also between them and scientists abroad;

To train young scientists for research in basic sciences.

GOVERNING BODY

The present Governing Body of the Centre consists of the following members:

- | | | |
|----|--|---|
| 1. | Professor P. Rama Rao
Chairman | Secretary
Department of Science and Technology,
Government of India,
New Delhi. |
| 2. | Professor S. K. Joshi
Member | Director General
Council for Scientific and Industrial
Research, New Delhi. |
| 3. | Professor Mihir Chowdhury
Member | Indian Association for the
Cultivation of Science,
Calcutta. |
| 4. | Professor N. Mukunda
Member | Indian Institute of Science
Bangalore. |
| 5. | Shri S. B. Krishnan
Member | Joint Secretary and Financial Adviser,
Department of Science & Technology,
Government of India, New Delhi. |
| 6. | Shri N. Krishnamurthi
Member | Chief Secretary
Government of West Bengal,
Calcutta. |
| 7. | Professor C. K. Majumdar
Member | Director
S.N.Bose National Centre for Basic
Sciences, Calcutta. |
| 8. | Dr. J. Pal Chaudhuri
Dr. S. K. Sharma
Non-member secretary | Administrative Office (retired on 31.1.93)
Administrative Office (actg.)
S. N. Bose National Centre for Basic
Sciences, Calcutta |

The Centre now operates from a rented house at DB 17, Sector I, Salt Lake City, Calcutta 700 064. It has additional space at CD 85 - a short walk from the main offices. The Centre's own campus is being built in Block JD, Sector III, Salt Lake City, Calcutta. □

ACADEMIC PROGRAMMES

The Academic Programme Advisory Committee considers the yearly academic activities of the Centre. It has now been split into two smaller committees called Research Advisory Committee - I (for Physics and Mathematics) and Research Advisory Committee - II (for Chemistry and Life Sciences). The present composition of the RACs is as follows:-

Research Advisory Committee - I

- | | | |
|-----|-------------------------------------|---|
| 1. | Professor N. Mukunda
Chairman | Indian Institute of Science
Bangalore. |
| 2. | Professor P. K. Kaw
Member | Institute of Plasma
Research, Gandhinagar. |
| 3. | Professor A. Raychaudhury
Member | Formerly of Presidency
College, Calcutta. |
| 4. | Professor H. S. Mani
Member | Indian Institute of
Technology, Kanpur. |
| 5. | Professor S. S. Jha
Member | Tata Institute of
Fundamental Research, Bombay. |
| 6. | Professor K. B. Sinha
Member | Indian Statistical
Institute, New Delhi. |
| 7. | Professor J. V. Narlikar
Member | Inter-University Centre for
Astronomy and Astrophysics, Pune |
| 8. | Dr. V. P. Bhatkar
Member | Centre for Development of
Advanced Computing, Pune. |
| 9. | Professor N. Kumar
Member | Indian Institute of Science,
Bangalore. |
| 10. | Professor C. K. Majumdar
Member | S. N. Bose National Centre
for Basic Sciences, Calcutta. |

Research Advisory Committee - II

- | | | |
|----|---------------------------------------|---|
| 1. | Professor Mihir Chowdhury
Chairman | Indian Association for the
Cultivation of Science, Calcutta. |
| 2. | Professor H. Sharat Chandra
Member | Centre for Cellular and
Molecular Biology, Hyderabad. |
| 3. | Professor Jyotirmoy Das
Member | Indian Institute of Chemical Biology,
Calcutta |
| 4. | Professor V. Nanjundiah
Member | Indian Institute of
Science, Bangalore. |
| 5. | Professor G. Govil
Member | Tata Institute of
Fundamental Research, Bombay. |

- | | | |
|-----|---|---|
| 6. | Professor J. C. Parikh
Member | Physical Research
Laboratory, Ahmedabad. |
| 7. | Professor B. M. Deb
Member | Panjab University,
Chandigarh. |
| 8. | Professor R. Ramaswamy
Member | Jawaharlal Nehru
University, New Delhi. |
| 9. | Professor S. Ramasesha
Member | Indian Institute of Science,
Bangalore. |
| 10. | Professor N. Satyamurthy
Member | Indian Institute of
Technology, Kanpur. |
| 11. | Professor C. K. Majumdar
Member-Convener | S. N. Bose National
Centre for Basic Sciences, Calcutta. |

CONFERENCES / WORKSHOPS / SYMPOSIA

□ Theoretical Biology

A discussion meeting on problems in theoretical biology was organized at the Centre on the 31st July, 1992, with the following participants from institutions in and around Calcutta: R.Majumdar, S.Guha, P.K.Sengupta and D.Dasgupta (SINP); A. Thakur and C.Dasgupta (CU); A.B.Roy (JU); J.Das, C.Datta, A.Nandi (IICB); A. Dasgupta (Kalyani Univ); S.Mukhopadhyay (BI); D. Majumdar (IACS), and A.K.Bhattacharya (Lady Keane College, Shillong).

Talks were given on Theoretical Study of DNA Sequences (C. Datta); Computer Studies for Biological Systems (A. Nandi); Graph Theory and Drug Design (A.B.Ray); Structural Transformations of DNA (A.Thakur) and Conformation of Neurotransmitters (S.Guha). It was suggested that the group should meet periodically and that the S. N. Bose Centre could gain ideas from participation in the J.B.S. Haldane Centenary at the Indian Statistical Institute.

□ Current Trends in Optics

The Centre organized a seminar on Current Trends in Optics during September 29 to October 1, 1992, with 30 scientists from all over India. Dr. S. K. Sharma and Dr. N. Nayak were the conveners. Lecturers reviewed their respective fields and indicated frontier areas of research. Following areas were included: Quantum Optics (C.L.Mehta, IIT, Delhi; R.Ghosh, JNU, Delhi; D.S.Roy, IACS, Calcutta); Test of Quantum Mechanics Using Quantum Optics (P.Ghose, SNBNCBS, Calcutta); Non-linear Optics (K.C.Rustagi, CAT, Indore); Laser Physics (D.D. Bhawalkar, CAT, Indore; K.Rai Dastidar, IACS, Calcutta); Colour Physics (H.S.Shah, SVBRCE, Surat); Raman Spectroscopy (T.N.Misra, IACS, Calcutta; H.D.Bist, IIT, Kanpur) and Ocean Optics (K.Gopala Reddy, AU, Waltair).

□ Miniworkshop on Higher Order Processes in High Energy Physics

The Centre organized a Mini-Workshop on Higher Order Processes in High Energy Physics during October 20 - 25, 1992. Twenty-six scientists participated in the workshop. The speakers were: A.Datta, P.N.Pandita, B.Mukhopadhyay, A.Raychaudhuri, S. Raychaudhuri, G.Bhattacharyya and P.Roy. Topics covered were: QCD corrections to low energy electroweak processes; Radiative corrections to susy - Higgs masses and couplings; One loop two - and three - point diagram calculations; and numerical evaluation and precision electroweak variables.

□ Contours of Curriculum Development for Natural Disaster Reduction

The Centre organized in collaboration with the Applied Mathematics Department, University of Calcutta, a seminar on Contours of Curriculum Development for Natural Disaster Reduction during November 18 to 20, 1992. Sir James Lighthill, former Lucasian Professor of Mathematics at Cambridge University, England, delivered several lectures in this seminar.

□ Workshop in Foundations of Quantum Mechanics

The Centre, in collaboration with the VECC, Bose Institute and the British Council Division, Calcutta, organized a Workshop in Foundations of Quantum Mechanics during December 7 - 15, 1992. The Workshop was scheduled to begin on December 7, but was delayed slightly following the countrywide disturbances. Some interested persons could not come. Among the participants were H.R.Brown, University of Oxford; E.J.Squires, University of Durham; A.Mizobuchi, Hamamatsu Photonics, Japan; H. Yilmaz, USA; S.M.Roy, TIFR, Bombay; T. Pradhan, IOP, Bhubaneswar; R. K. Verma, PRL, Ahmedabad; G.Rajasekaran, IMSC, Madras; H. Banerjee, SINP, Calcutta; M.N.Sinha Roy, Calcutta; D. Home, BI, Calcutta and P. Ghose, SNBNCBS. The topics that were covered in the Workshop included the following: Lorentz invariance, locality and hidden variables, wave particle duality and the complementarity principle, measurement problems and quantum - classical transitions, interpretations, relativistic wave equations, and new experiments.

□ Conference on Mathematical Modelling

The Centre collaborated with the Department of Applied Mathematics, University of Calcutta, in holding the discussion meeting on Frontiers of Mathematical Sciences during December 12 - 15, 1992. A group of eminent mathematicians came from abroad and about 30 Indian scientists participated in the meeting. The foreign participants were :

1. P.K.Basu, Vanderbilt University, USA.
2. S.K.Dey, Eastern Illinois University, USA.
4. R.Guha, Central Florida University, USA.
5. K.Gustafson, University of Colorado, USA.
6. R.Hardy, International Institute of Sci & Tech, USA.
7. E.J.Kansa, Lawrence Livermore National Laboratory, USA.
8. S.Mitra, Emory University, USA.
9. B.Parlett, University of California, Berkeley, USA.
10. A.K.Roy, University of Ottawa, Canada.
11. S.M.Sharffuddin, Bangladesh.
12. M.Witten, Balcones Research Centre, USA.

This programme was also partly affected by the country-wide disturbances, but on the whole the lectures went on smoothly.

❑ Miniworkshop on Analysis

The Centre collaborated with Indian Statistical Institute, New Delhi, in organizing a miniworkshop on Analysis during December 14 to 19, 1992 at ISI, New Delhi. The Centre's scientists unfortunately could not travel to Delhi because of disturbances in the country at that time. But V.F.R.Jones (University of Berkeley, California, USA, Field medallist of 1990), H. Araki (University of Kyoto, Japan), L. Woronowics (University of Warsaw, Poland), H. Radjavi (Dalhousie University, Canada), Z. Ruan (University of Illinois, Urbana, USA), F. Phan (University of Nice, France), J. M. Lindsay (University of Nottingham, U.K.), K. R. Parthasarathy (ISI, Delhi Centre), V. S. Sundar (ISI, Bangalore Centre), M. Krishna (IMSC, Madras), S. Majid (Cambridge University, U. K.), Ajit Iqbal Singh (Delhi University) and a number of students participated. V.F.R.Jones gave three lectures on "Subfactors of von Neumann Algebras and Combinatorics."

❑ BCSPIN winter school in particle physics and cosmology at the interface

BCSPIN stands for Bangladesh, China, Srilanka, Pakistan, India and Nepal. The Centre, in collaboration with ICTP (BCSPIN), Trieste, and the Institute of Physics, Bhubaneswar, organized a Winter School in Particle Physics and Cosmology at the Interface during January 2 to 16, 1993. The School was held at Toshali Sands, Puri. Lectures were given by: J. C. Pati (Maryland, USA), J. Primack (Santacruz, USA), R.D. Peccei (UCLA, USA), B.J. Kayser (NSF, USA), R.N. Mohapatra (Maryland, USA), D.P. Roy (TIFR), Probir Roy (TIFR), J.V. Narlikar (IUCAA), J. Stone (Boston), G. Ross (Oxford), R. Raja (Fermilab, USA), E. Wright (UCLA, USA) and S. Banerjee (TIFR). There were 40 participants from India, 3 from Bangladesh, 7 from Nepal, 5 from China, 1 from Sri Lanka, 1 from Egypt, 1 from Morocco and 1 from USA. The School was funded by the National Science Foundation (USA); ICTP (BCSPIN), Trieste; S. N. Bose National Centre for Basic Sciences and the Institute of Physics, Bhubaneswar.

The participants were :

1. Mohammed Zahed	University of Dhaka, Bangladesh.
2. Md. Abul K. Azad	University of Chittagong, Bangladesh.
3. L.M. Nath	University of Dhaka, Bangladesh.
4. Prem Bahadur Basnet	Tribhuvan University, Katmandu, Nepal.
5. Sitaram Prasad Byahut	-do-
6. H.N. Paudel	-do-
7. Leela Pradhan	-do-
8. Neema Pradhan	-do-
9. S.P. Pradhan	-do-
10. Udayaraj Khanal	-do-
11. A.C.W.L. De Alwis	University of Colombo, Colombo, Sri Lanka.
12. E.L. Marrakchi	Univ. Mohammed Ben Abdulla, Fez, Morocco.
13. S.S. Khalid Ain Shams	Univ., Abbassia, Cairo, Egypt.
14. B. Ananthanarayan	PRL, Ahmedabad.



1. BCSPIN Winter School at Toshali Sands.



2. Prof. C H Llewellyn Smith: Fourth SN Bose Memorial Lecture.



3. Seminar on Current Trends in Optics.



4. Mini Workshop in Higher Order Processes in High Energy Physics.

15. Gautam Bhattacharya
16. Biplab Bhawal
17. Biswajoy Brahmachari
18. T.Chhabra
19. T.S.Ghosh
20. M.Guchait
21. Fawad Hussan
22. Prakash Matthew
23. P.K.Patra
24. S.Raychaudhuri
25. K.S.Sateesh
26. Shiv Kumar Sethi
27. H.Mishra
28. Amruta Mishra
29. Manoj K.Samal
30. G.Sidana
31. P.Bhattacharya
32. S.P.Misra
33. B.B.Deo
34. T.Pradhan
35. K.Maharana
36. L.Maharana
37. L.P.Singh
38. S.N.Nayak
39. B.P.Mohapatra
40. S.Mohanty
41. R. Kuchimanchi
42. A.Abbas
43. S.K.Paul
44. A.Raychaudhury
45. P.Ghose
46. J.Maharana
47. V.S.Ramamurthy
48. N.Panchapakesan
49. Bin Quang Hu
50. Yuang Fang Jiang
51. Hong Ying Jin
52. Jinghua Liu
53. Quing Wang
54. S.Mahajan
55. Amitava Datta
56. P.N.Pandita
57. S.Umasankar
58. A.Mukherjee
59. V.Soni

CU, Calcutta.
 IIT, Kanpur.
 PRL, Ahmedabad.
 M.B.Khalsa College.
 IUCAA, Pune.
 Jadavpur University, Calcutta.
 TIFR, Bombay.
 IMSC, Madras.
 NEHU, Shillong.
 CU, Calcutta
 Mehta Institute, Allahabad.
 University of Delhi.
 IOP, Bhubaneswar.
 Utkal University, Bhubaneswar.
 PRL, Ahmedabad.
 Panjab University, Chandigarh.
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 Sambalpur University.
 IOP, Bhubaneswar.
 University of Maryland, USA.
 IOP, Bhubaneswar.
 SNBNCBS, Calcutta.
 CU, Calcutta.
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 Chong quing Univ., Peop.Repbl.of China.
 East China Normal University,
 Shanghai,Peop.Repbl.of China.
 Academia Sinica, Beijing, Peop.Repbl.of China.
 Peking University, Peop.Repbl.of China.
 TsinghuaUniversity,Beijing, Peop.Repbl.of China.
 Delhi University.
 Jadavpur University, Calcutta.
 NEHU, Shillong.
 IMSC, Madras
 Delhi University.
 NPL, Delhi.

❑ Workshop on Geometry and its Applications in Physics

A pedagogical workshop on Geometry and its Applications in Physics was held during February 2 to 5, 1993 at the Centre. Participants were mostly fresh post-doctoral fellows, advanced Ph.D. students and research workers in colleges and universities. The lectures were on: Geometry and topology of gauge theories by G. Bhattacharya, SINP; Introduction to Non-linear Sigma Models (NLS) and self gravitating NLS by S. V. Chervon, Moscow State University, Ulyanovsk, Russia; Geometry of Chern - Simons theory by A.Chatterjee (SINP); Geometric phase in quantum mechanics by B.Datta Ray (SINP); Density inhomogeneity and the inflationary model by S. Mallik (SINP); Geometry of fermions by P.Mitra, SINP; and Vector bundles on Riemann surfaces - connections with physics by T.R.Ramdas, TIFR. While the emphasis was on applications of geometry in high energy physics and cosmology, other problems in ordinary quantum mechanics, many body problems in condensed matter physics and polymers (soft matter) were also discussed.

The participants were :

- | | | |
|-----|-------------------|--|
| 1. | N.Banerjee | SINP, Calcutta |
| 2. | Dr. R.Banerjee | SNBNCBS, |
| 3. | B.Basu Mallick | SINP, Calcutta |
| 4. | D.G.Bhattacharya | SINP, Calcutta |
| 5. | Dr.B.Chakrabarty | MRI, Allahabad |
| 6. | Dr.A.Chatterjee | SINP, Calcutta |
| 7. | D.Chatterjee | SINP, Calcutta |
| 8. | Dr.S.V.Chervon | Moscow State University, Ulyanovsk, Russia |
| 9. | Dr.B.Datta | Tripura University, Agartala |
| 10. | Dr.D.Gangopadhyay | SNBNCBS, |
| 11. | Dr.P.Ghose | SNBNCBS, |
| 12. | Dr.N.K.Jain | IIT, Delhi |
| 13. | S. Kar | IIT, Kanpur |
| 14. | T.K.Kar | IIT, Kharagpur |
| 15. | Dr.C.K.Majumdar | SNBNCBS, |
| 16. | Dr.S.Mallik | SINP, Calcutta |
| 17. | Dr.P.Mitra | SINP, Calcutta |
| 18. | Dr.M.Mukherjee | IACS, Calcutta |
| 19. | Dr.T.Mukherjee | IACS, Calcutta |
| 20. | Ms L.Mullick | ISI, Calcutta |
| 21. | Dr.S.K.Pal | SNBNCBS, |
| 22. | Dr.T.R.Ramdas | TIFR, Bombay |
| 23. | A.K.Roy | ISI, Calcutta |
| 24. | K.Samanta | Vidyasagar University, Midnapore |
| 25. | Dr.L.P.Singh | Utkal University, Bhubaneswar |
| 26. | Dr.A.Sinha | NERIST, Itanagar, Arunachal Pradesh |
| 27. | V. Sreedhar | SINP, Calcutta. |

❑ Aesthetics and Motivations in Science and Arts

This Discussion Meeting, originally slated to be held in November, 1992, was finally held at Santiniketan in collaboration with Visva Bharati and FAMTSIT, Jadavpur University, during February 18 - 20, 1993. Prof. P. Ghose of the Centre and Prof. K. C. Gupta of Visva Bharati looked

after the organization of the meeting. About 70 academics and scholars from different fields of Arts and Science attended the meeting. Among those who gave talks were Prof.C.K.Majumdar, Prof.S.Bhattacharya, Prof.K.G. Subramanyan, Prof.K.C.Gupta, Prof. Sukanta Chaudhuri, Prof.B.C.Sinha, Prof.S.Ray, Prof.Amlan Datta, Prof.N.Mukunda, Prof.M.Lath, Prof. Premata Sharma, Prof. P.M.Bhargava (his paper was read out), Dr.(Mrs.)Supriya Chaudhuri and Prof. P.K.Mukhopadhyay.

Two exhibitions were organized, one on Rabindranath Tagore's paintings at Rabindra Bhavan and one on a selection of paintings at Nandan (Kala Bhavan). A cultural programme based on Tagore songs and dance was held one evening. A book exhibition was also organized.

The EMRC Unit of St. Xavier's College, Calcutta has made two 20 minute programmes based on the theme of the meeting and these will be telecast under UGC's Countrywide Classroom Programme.

□ Discussion - Meeting on High Tc Superconductors

A Discussion Meeting on High Tc Superconductors was organized at the Variable Energy Cyclotron Centre (VECC), Salt Lake, during March 10 - 12, 1993, in collaboration with the Institute of Fundamental Research, North Eastern Hill University, and Indian Cryogenic Council, Calcutta. This meeting was a sequel to the one held at Shillong in March 1992, and was supported by the National Superconductivity Programme. Discussions were on both theory and experiment. Among the speakers were : K.P.Sinha (Shillong), P. Ganguly (NCL, Pune), D. Bhattacharya (IIT, Kharagpur), P.Mandal (SINP), S. Mishra (IIT, Kharagpur), K.L.Chopra (IIT, Kharagpur), R. Ranganathan (SINP), and I. Bose (BI, Calcutta). C.K.Majumdar (SNBNCBS), B.Ghosh (SINP) and Bholanath Ghosh (VECC) also participated in the discussion.

S. N. BOSE MEMORIAL LECTURE

The fourth S. N. Bose Memorial Lecture was delivered by Professor C. H. Llewellyn Smith, FRS, University of Oxford on September 8, 1992. The lecture was entitled **Particle Physics : Today and Tomorrow.**

SEMINARS ORGANIZED AT THE CENTRE

1. Das, M. P. ANU, Canberra, Australia: Hall anomaly : does it provide any clue to the High Tc mechanism? (10.04.92)
2. Sarkar, U., PRL, Ahmedabad: Current status of grand unified theories.(08.05.92)
3. Sen, S. K., IISC, Bangalore: An inequality sorting algorithm for a class of linear programming problems. (07.05.92)
4. Islam, J.N., Director, RCMPSC Univ., Chittagong, Bangladesh: An exact classical solution for a scalar field with quartic interaction.(02.06.92)
5. Gangopadhyay, D., SNBNCBS, Calcutta: Anti-self dual solutions and composition relations of classical Yang-Mills equation.(15.06.92)
6. Das, S.P., BARC, Bombay: The dynamical behaviour of fluids near the liquid-glass transitions.(29.06.92)
7. Chatterjee, Ramananda, University of Calgary, Canada: Fibre structure of space of molecular orbital within LCAO method/ quantum groups. (17.08.92)
8. Bhaduri, Rajat, McMaster Univ., Hamilton, Canada: Periodic orbits, quantum beats in the density of states and statistics.(20.08.92)
9. Sreedhar, V., SINP, Calcutta: Conformal Field Theory. (25.09.92)

Visitors at the Centre

1. Dr. Richard Stenvenson, APD Cryogenics, Allentown, Pennsylvania, USA : Discussion with Dr. C. K. Majumdar (SNBNBCS) on Cryogenics and High Tc Superconductivity (20.04.92).
2. Dr. Utpal Sarkar, PRL, Ahmedabad: Worked as a Visiting Scientist for three months (from 02.04.92).
3. Prof. Mirza S. Saiyadain, IIM, Ahmedabad: Discussion with Centre's scientists (20.05.92).
4. Dr. Sasanka Ghosh, IMSC, Madras: Worked as a Visiting Scientist for a month (July 1992).
5. Dr. Amritasu Sinha, NERIST, Itanagar, Arunachal Pradesh: Worked as a Visiting Scientist for six months (from 3.2.92).
6. Dr. Biswajoy Brahmachari, PRL, Ahmedabad: Worked as a Visiting Scientist for a month.
7. Dr. S.P.Das was a Visiting Scientist at the Centre from October 1992 for six months.
8. Prof. R. Bhaduri (McMaster University, Hamilton, Canada visited the Centre in August 1992.
9. Dr. Sunil K. Sinha, Exxon Res. & Engg. Co., Annandale, New Jersey, USA visited the Centre in October 1992.
10. Prof. S. K. Dey, USA; Prof. M. Witten, USA; Prof. R. Hardy, USA; Prof. L. Fishman, USA; Prof. B. Parlett, USA, and Prof. E. J. Kansa, USA, visited the Centre during their stay in Calcutta for attending the Conference on Mathematical Modelling at the Calcutta University. Prof. Dey was at the Centre for 3 months, and Prof. Fishman for 15 days as Visiting Professors.
11. Prof. M. R. Kundu, University of Maryland, USA spent some time at the Centre when he came to Calcutta as S.K. Mitra Professor of CSIR at Calcutta University.

RESEARCH ACTIVITIES AT THE CENTRE

☐ Physics

The areas of research activity in physics are: the foundations of quantum mechanics, quantum optics, particle physics, condensed matter physics.

Following the publication of a paper entitled "An experiment to throw more light on light" by Y. Mizobuchi and Y. Ohtake (Phys. Lett. A168 (1992) pp. 1-5), P. Ghose, D. Home and G. S. Agarwal have discussed the implications of the experiment (pub. no. A21). P. Ghose and D. Home have also contributed an invited paper entitled "Wave - particle duality of single photon states" to a special issue of Foundation of Physics published on the occasion of the birth centenary of Louis de Broglie (pub. no. A26). Work on clarifying issues related to action - at - a - distance in quantum mechanics is going on as a collaborative effort of P. Ghose, D. Home, H. Brown (Oxford) and E.J. Squires (Durham). Another collaborative work of P. Ghose, D. Home and M.N. Sinha Roy involves possible new predictions of the causal interpretation of quantum mechanics by Bohm. Work on relativistic quantum mechanics of bosons has continued.

The two photon process, involving simultaneous emission or absorption of two photons in the transition between two atomic levels via an intermediate level, is microscopically examined by N. Nayak for a proper representation of interactions involved. A theory of the Rydberg - atom one - photon micromaser is proposed to investigate the possibilities of generating a number state of the radiation field in the micromaser cavity now available at the Max Planck Institute in Munich. The work on a squeezed laser will be taken up for computation from the density matrix approach.

A detailed quantization scheme for dynamical systems with a Chern - Simons (CS) three - form has been developed by R. Banerjee following the Hamiltonian approach of Dirac. Here gauge fixing is not necessary. The analysis reveals the difference between the canonical and the symmetric form of the energy momentum tensor. The gauge independent quantization method has been applied to a modified Wilczek - Zee (WZ) model; this model is obtained by adding a CS three - form to the original WZ model (in 2+1 dim.) which has the $O(3)$ non - linear sigma model and a Hopf term. The theory now becomes a local gauge theory and the solitons acquire a 'fractional' spin. The analysis was exploited by R. Banerjee and B. Chakraborty (Mehta Research Institute, Allahabad) to quantize a system of non - relativistic point particle moving on a plane, with a CS interaction. The Galilean algebra can be demonstrated, but the 'fractional' spin exists.

In quantum mechanics canonical transformations (for example, Bogoliubov transformations) can be used to relate bosonic and fermionic operators. Similarly, in q - deformation algebra, canonical q - transformations can exist for harmonic oscillator realizations of q - oscillators. In this context two types of operators have been constructed with q - bosonic operators; these two types satisfy relations analogous to q - fermionic q - commutation relations. The "classical" limit (i.e. $q \rightarrow 1$) has been shown to correspond to the usual fermionic anticommutation relations. The fermionic number operator can be expressed in a new way in terms of the boson number operator.

The key point to understand the connection between non-linear integrable systems and two dimensional conformal field theories is the Drinfeld - Sokolov hamiltonian reduction of the phase space of $SL(n, R)$ centrally extended Kac - Moody currents. It has been shown that the fields of Kortweg de Vries (KdV) hierarchy can be expressed as definite polynomials in the currents and their derivatives on the reduced phase space, the Drinfeld - Sokolov moduli space. The KdV fields are the coordinates of the moduli space and its symplectic structure corresponds to Zamolodchikov - Fateev - Lykhanov W_n - algebra, reflecting the symmetry of an infinite set of conformally invariant solution of a two dimensional quantum field theory possessing a global Z_n - symmetry. It has been found by S. Paul and S. Ghosh that the hamiltonian reduction does admit a larger moduli space whose coordinates are again fields of $SL(n, R)$ KdV hierarchy expressed as definite non - polynomials in the currents and their derivatives. The corresponding symplectic structure is shown to correspond to W_n algebras.

D. Gangopadhyay, A. Sinha and S. Banerjee have found a new way through composition to get gauge - related vacuum solutions of classical Yang - Mills equation. Such solutions are not possible in the finite instanton - antiinstanton sectors. The low energy effective action of string theories related to the recently discovered $O(d) \times O(d)$ symmetry and black hole solutions, is being examined.

The Moessbauer spectroscopic studies of nearly twenty ilmenite samples (oxide mineral of iron and titanium) supplied by Dr. S. Babu of Kerala have been done; some low temperature data will be taken for complete analysis. Chromites and new iron silicate samples are under study.

As a direct consequence of the Workshop on Metals and Alloys held in Trieste during August 1992, work on random alloys and their phase diagrams was begun by Prof. A. Mookerjee and coworkers. The tight binding linearized muffin tin orbitals (TB-LMTO) package developed by the Stuttgart group of C. K. Anderson was installed in the HP 9000/300 and modified to incorporate the recursion technique, replacing the k - space module, to enable us to work on random systems. The modified version has been checked out on standard metallic systems having Cu, Ag and Au. The package is also modified to include augmented space averaging procedure to replace the mean field (CPA) type approximations. Local symmetries in augmented space can be used to reduce the computation time of the laborious CPA type calculations by almost a factor of ten, and to yield at the same time analyticity - preserving approximation including cluster effects. The Centre's scientists are collaborating with Dr. G. P. Das (Bhabha Atomic Research Centre, Bombay), Dr. Roger Haydock (University of Oregon, USA) and Dr. C. M. M. Nex (University of Cambridge, UK). The aim of this package development is to study alloy systems difficult to deal with existing available formalism, e. g. CuPd, NiPd, NiPt with large lattice distortions on alloying NiCr with large charge transfer effects and TiAl with large local strain on alloying. Another study will aim at vacancy and surface formation energies in MgO and CaO; in these, percolating heavy elements produce defect - saturated stratified systems.

Electron transport in a two - state polymer chain and scattering by shapes, in particular, the quantum diode and the star geometry related to quantum Hall measurements are being studied. Similarly, the dynamical randomness technique is being tried on disordered Hubbard model on a two dimensional lattice to simulate CuO planes in La - Cu - O compounds.

To explain the anomalies in the normal phase of the high temperature superconductors, R. Chaudhury (with J. P. Carbotte of McMaster University, Canada) has examined the Marginal Fermi Liquid (MFL) hypothesis of C. M. Verma and collaborators through a self - consistent Eliashberg formalism. When the bosonic spectrum consists of interacting bare particle - hole pairs and the renormalization is neglected, the MFL solution is stable for any magnitude of electron - boson coupling strength. However, when the bosonic spectrum consists of interacting fully - renormalized particle - hole pairs, the fully renormalized self - consistent equation shows instability. The free energy and specific heat of MFL in both normal and superconducting phase are calculated. The failure of Bardeen - Stephen formula can be understood. Newns et al. suggested that the Van Hove singularity in the electronic density of states in the two dimensional CuO plane raised T_c . R. Chaudhury, J. P. Carbotte and C. Jiang have found that with a Lorentzian deviation in the density of states the coherence peak familiar in BCS Superconductors for microwave conductivity does not exist. The dilute t - J model with random oxygen vacancies is being examined for the nuclear magnetic resonance relaxation rate and the acoustic attenuation rate (R. Chaudhury and J. W. Halley, University of Minnesota, USA). Experimentally observed anomalous temperature dependence of the relaxation rate is the motivation for the work.

On the experimental side, P. K. Mukhopadhyay has set up equipment for critical current measurements at zero magnetic field. A superconducting magnet operating at He - temperature will be necessary for further interesting work.

Advised by P. Sen (Schiumberger - Doll Research, USA), P. Mukhopadhyay has made some preliminary T_1 and T_2 measurements (T_1 and T_2 are usual longitudinal and transverse relaxation times in nuclear magnetic resonance) on crushed minerals saturated with deionized water. Such measurements can be done in India with relatively simple apparatus already available and can perhaps provide interesting information about oil inside the earth.

Based on this work going on, the following papers have been accepted for publication:

2. Chaudhury, R. : Stability of Marginal Fermi Liquid and its consequences (in Proc. XII Nat. Symp. on Cryogenics TNSC - 92 held at IACS, Calcutta. March 29 - 30, 1993).
3. Datta, A., Thakur, P. K., and Mookerjee, A. : Cluster coherent potential approximation within the TB - LMTO (in Phys. Rev.B).
4. Sain, A., and Mookerjee, A. : Scaling by resistance in the two dimensional Anderson tight binding model for disordered system: effect of a random environment (in Int. J. Mod. Phys.B., 1993).
5. Sharma, S. K. : A modified anomalous diffraction approximation for intermediate size soft particles (in Optics Commn).

Research Projects

1. Quantum Transmittance in Disordered Systems

This project with Professor A. Mookerjee sponsored by the Department of Science and Technology, New Delhi, is almost complete. The main results are:

(i) Stochastic resonances and their internal geometric structure, both in one and two dimensional geometries, have been elucidated.

(ii) In two dimensional random scatterers, it has been shown that there can be no extended states in either the Anderson or the Quantum Percolation model. A combination of the vector recursion technique and real space renormalization has been used to show that states in two dimensions, particularly near the band centres, are algebraically localized. Contrary to earlier predictions, there exists a crossover from exponentially localized states in systems with very large aspect ratios (large length to breadth ratios) to algebraically localized states in systems with aspect ratios near unity.

(iii) The imbedding method has been used to study scattering by one dimensional continuously random potentials. The earlier idea that phase is randomized in disordered potential is only true for very weak disorders. For strong disorders, there is the phenomenon of phase pinning. As the random phase approximation is suspect, the internal geometry of states in these potentials has to be examined by multifractal and multiaffine analyses.

(iv) A conjecture by N. Kumar (Indian Institute of Science, Bangalore) that the mobility edge is straddled by a dense set of stochastic resonances, which may mimic a minimum metallic conductivity and a discontinuous drop in the conductivity at the mobility edge, requires careful examination.

(v) The Vector Recursion package, based on which all this is done has been found to be stable, and can be added to a computer software library.

Apart from the students I. Dasgupta and T. Saha supported by the project, P.K.Thakur, S.K.Manna and C. Basu have worked part time in the project. Prof. B. K. Chakrabarti of Saha Institute and Dr. C. M. M. Nex, University of Cambridge, U.K., also participated.

Much of the above results are published (pub.nos. A7,8,14,15,16,24,25,26,27,28,32); some more accepted for publication are :

- i) Dasgupta, I. and Mookerjee, A.: An Augmented space approach to systems with both static and dynamic disorder: the disordered Hubbard Model (in Int. J. Mod. Phys. B).
- (ii) Manna, S. K., Basu, C., and Mookerjee, A. : Multiaffine scaling in one dimensional disordered systems (in J. Stat. Phys.).

2. Activities of VECC and SNBNCBS on High T_c Superconductivity and Extension to Low Temperature Superconductors

The project is sponsored by National Superconductivity Programme (NSP) as a collaborative effort of the S. N. Bose National Centre and the Variable Energy Cyclotron Centre. The increase in critical temperature of a 2212 Bi - Sr - Ca - Cu - O (T_c = 65K) under alpha particle bombardment with fluence about 10¹⁵ particle/cm² was established (pub.no.A1). Annealing studies of other samples after alpha irradiation have been started: 2223 Bi - Sr - Ca - Cu - O sample or 123 YBaCuO have only shown a decrease in T_c and recovery of original T_c by proper annealing is under study.

Several single crystals of 2212 Bi - Sr - Cu - O have been produced by the flux method. The apparatus for critical current measurement at zero magnetic field has been made operational (pub. B3). The measurements at finite field will have to be done elsewhere, perhaps at the National Physical Laboratory (NPL).

3. Electronic Structure of Random Alloys

The project sponsored by Department of Science and Technology, New Delhi, is run by Professor A. Mookerjee with collaborators of IIT Kanpur. The ab initio pair potential for FCC metals were published (pub.no. A29). A detailed account of the work will appear as :

Mookerjee, A. : The Augmented Space and Configuration Averaging in Random Alloys: Proc. of the Workshop of Metals and Alloys. (eds. C.K. Anderson, Vijay Kumar and A. Mookerjee, World Scientific, Singapore).

4. Nuclear Fission and Nuclear Structure Calculations

The project sanctioned by the Council of Scientific and Industrial Research (CSIR) is run by Professor M. K. Pal (National Scientist).

The soft - dipole mode which was indicated at the last saddle point before the two fission fragments separate, has also been observed in the two - neutron dissociation of ¹¹Li, and a structural theory has been worked out in detail. A paper has been accepted for publication:-

Pal, M. K.: 'ATDHF calculations on the fission of some actinide nuclei'. Nuclear Physics A.

❑ Collaborative Research with Warwick University, U. K./LINK Program

As a part of collaborative work with Dr. Ashok Bhattacharya, Catalysis and Solid State Research Laboratory, University of Warwick, Professor A. Mookerjee and A. Datta have been looking at the total binding energies of finite clusters of Na, K, Al and Cu as a function of their size and shape. They are using a TB - LMTO first principle approach, simulating clusters by embedding them in a lattice of empty spheres. The experimentally predicted magic numbers (special sizes with large negative binding energies, hence stable clusters) have been obtained. The binding energies of - O and - OH radicals on the clusters will be ascertained. A. Datta has visited Warwick in cooperation with using their VAX machines for the calculations.

This phase of the LINK program thus come to an end. The program will be reviewed by both sides and, if possible, new fields for collaboration will be explored.

❑ Mathematical Modelling

Light scattering patterns can be used as diagnostic tools for different scatterers. The anomalous diffraction approximation, widely used in analyzing such scattering patterns, has been modified and tested on two exactly solvable shapes - homogeneous spheres and infinitely long homogeneous

circular cylinders. Another approximation formula for backscattering of light by a homogeneous sphere has been proposed and found to be in good agreement with Mie results for intermediate size soft particles. (a particle is soft if its refractive index is close to that of the surrounding medium).

Simulation of tidal flows in the Hooghly estuary and a two dimensional sandpile model on the computer has been carried out. A 4 - transputer board bought from CDAC (Centre for Development of Advanced Computer) has been installed in a PC - AT and work on parallel computation with transputers has been tried. Hopefully, parallel computation will be tried on other programs too.

PUBLICATIONS

A. Scientific Journals

1. Bandyopadhyay, S. K., Barat, P., Kar, S., De, U., Poddar, A., Mandal, P., Ghosh, B. and Majumdar, C. K. : Increase in critical temperature of $\text{Bi}_2\text{Sr}_2\text{Ca Cu}_2\text{O}_x$ — super conductor due to Alpha Particle Irradiation — Solid State Commun. 1992, **82** (5), 397-399.
2. Banerjee, R. : Gauge - independent analysis of Chern - Simons theory with matter coupling — Phys. Rev. Lett., 1992, **69**, 17 - 20.
3. Banerjee, R. : Quantisation of matter coupled Chern Simons theory without gauge constraints and the anion operator — Nucl. Phys., 1993, **B390**, 681 - 690.
4. Banerjee, R., Chatterjee, A. and Sreedhar, V. V.: Canonical quantization and gauge invariant anion A- operators in Chern - Simons Scalar electrodynamics -- Ann. of Phys. 1993, **222** 54 - 290.
5. Banerjee, R. and Ghosh, S. : Algebraic approach to anomalous sigma models — Z. Phys. C. Particle and Fields. 1992, **54**, 577 - 579.
6. Barat, P., Bandyopadhyay, S. K., Chaudhury, R. : Theoretical model for internal relaxation effect in studies of specific heat — Ind. J. Pure & Appl. Phys. 1992, **30**, 715 - 718.
7. Basu, C., and Mookerjee, A. : Equivalence of geometric scaling of transport properties and wavefunctions — Int. J. Mod. Phys. B. 1993, **7**, 1309 - 1319.
8. Basu, C. and Mookerjee, A.: Multichannel scattering in a 1D disordered chain — Waves in Rand. Med. 1993, **3**, 1 - 8.
9. Bhattacharjee, A. K., Majumdar, D. and Guha, S.: Theoretical studies on the conformational properties and pharmacophoric pattern of several Bipyridine Cardiotonics — J. Chem. Soc. Perkin Trans. 1992, **2**, 805- 809.
10. Chaudhury, R. and Carbotte, J. P.: Stability of marginal Fermi Liquid — Solid State Commun. 1993, **85** (12), 1039 - 1042.
11. Das, D., Chakraborty, M. B., Choudhury, K., Nambissan, P. M. G., Babu, B. R. S., Sen, P., Sangeeta, and Majumdar, C. K.: Moessbauer, XRD and Positron annihilation studies on natural magnetite and hematite ore from Ari Dongri, Central India. Bull. Mat. Sc.(India). 1992, **15** (2), 161 - 170.
12. Das, D., Chakraborty, M. B. and Majumdar, C. K.: Moessbauer studies on rocks from transitional shale beds of a typical Banded Iron Formation — Ind. J. Pure & Appl. Phys. 1992, **30**, 263 - 266.
13. Das, R., Fay, D. Q. M. and Das. P. K. : Allocation of precedence - constrained tasks to parallel processors for optional execution — Microprocessing & Microprogramming. 1992, **35**, 237 - 244.

14. Dasgupta, I., Saha, T., Mookerjee, A. and Chakrabarty, B. K.: Is there a delocalisation transition in a two dimensional model for quantum percolation? — *Mod. Phys. Lett. B.* 1992, 6, 817 - 821.
15. Dasgupta, I., Saha, T. and Mookerjee, A. : Scaling of the resistance in the two - dimensional Anderson tight - binding model for disordered systems — *J. Phys. Cond. Matt.* 1992, 4, 7865 - 7876.
16. Dasgupta, I., Saha, T. and Mookerjee, A. : Analysis of stochastic resonances in two dimensional quantum percolation model — *Phys. Rev.B* 1993, 47, 3097-3102.
17. Datta, A. and Mookerjee, A. : Recursion method in augmented space — *Int. J.Mod.Phys.B.* 1992, 6, 3295 - 3308.
18. Filippov, A. T., Gangopadhyay, D. and Isaev, A. P.: Quantum discrete gauge models with bosonic and fermionic degrees of freedom — *Int. J. Mod. Phys.* 1992, A7, 2487 - 2507.
19. Filippov, A. T., Gangopadhyay, D. and Isaev, A. P.: Discrete strings and gauge model of those confined relativistic particles — *Int. J. Mod. Phys.* 1992, A7, 3639 - 3663.
20. Ghose, P. and Home, D.: Wave - particle duality of single photon states — *Found. of Phys.* 1992, 22, 1435 - 1447.
21. Ghose, P., Home, D. and Agarwal, G. S.: An experiment to throw more light on light: implications — *Phys. Lett.* 1992, A168, 95 - 99.
22. Guha, S., Majumdar, D. and Bhattacharjee, A. K. : A Molecular electrostatic potential : a tool for the prediction of pharmacophoric pattern of drug molecules — *J. Mol.Struc. (Theochem)* 1992, 256, 61.
23. Majumdar, C. K.: *Solid State Physics 1900 - 1980* — *Ind. J. Hist. Sc.* 1992, 27 (4), 421 — 434.
24. Manna, S. K., Basu, C. and Mookerjee, A. : Internal geometry of delocalised and localised states in a one dimensional, continuous quasi - periodic potential — *Physica A.* 1992, 189, 390 - 402.
25. Manna, S. K. and Mookerjee, A. : Numerical study of the distribution of phase as an electron moves in a one dimensional, continuously and randomly varying potential. — *Int. J. Mod. Phys. B.* 1992, 6, 1517 - 1527.
26. Manna, S. K. and Mookerjee, A. : Numerical studies of resistance and conductance fluctuations in chains with continuous disordered potentials. — *Mod. Phys. Lett. B.* 1992, 6, 391 - 398.
27. Mookerjee, A.: Transmittance through random media — *Ind. J. Phys.* 1992, 66A, 559 - 582.
28. Mookerjee, A., Chakrabarti, B. K., Dasgupta, I. and Saha, T.: Quantum percolation and A. 1992, 186, 258 - 269.
29. Mookerjee, A., Chen, Nan - Xian, Kumar, V. and Sattar, Md. A.: Ab Initio pair potentials for FCC metals: an application of the method of Mobius transformation. — *J. Phys. Cond. Matt.* 1992, 4, 2439 - 2448.
30. Nayak, N. : Squeezing in nondegenerate two - photon processes in a cavity quantum electrodynamics of a three level and a two - level Rydberg atom — *Phys. Rev. A.* 1993, 47, 2276 - 2280.
31. Sharma, S. K. : On the validity of the anomalous diffraction approximation — *J.Mod.Opt.* 1992, 39 (4), 2355 - 2361.
32. Thakur, P. K., Basu, C., Mookerjee, A. and Sen, A. K. : A Multifractal analysis for electronic transmittance in inhomogeneous potentials — *J. Phys. Cond. Matt.* 1992, 4, 6095 - 6107.

B. Proceedings of Conferences & Symposia

1. Bandyopadhyay, S.K., Barat, P., Sen, P., Kar, S.K., De, A., Ghose, B., Ghose, B. G., and Majumdar, C. K.: Irradiation effect on single crystal of $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+x}$ — DAE Sol. St. Phys. Symp., S.V. Univ., Tirupati (Dec 28, 1992 to Jan 1, 1993) vol 35C, 283.
2. Bandyopadhyay, S. K., Barat, P., Sen, P., Kar, S. K., De, A., Ghose, B., and Ghose, B. G.: Preparation of single crystals of $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_x$ — by Alkali Halide Flux method — DAE Sol. St. Phys. Symp., S. V. Univ., Tirupati (Dec 28, 1992 to Jan 1, 1993), vol 35C, 284.
3. Barat, P., Bandyopadhyay, S. K., Kar, S. K., Sen, P. and Majumdar, C. K.: Effect of irradiation on critical current density of polycrystalline Bi — 2223 — DAE Sol. St. Phys. Symp., S. V. Univ., Tirupati (Dec 28, 1992 to Jan 1, 1993) vol 35C, 282.
4. Bhattacharjee, A. K.: A Quantum chemical study of phenyl chienyl, and chienyl glycolic acids: the preferred conformation and their electrostatic similarities — Proc. Int. Cong. on Ultra Low Doses held at Bordeaux (France), Sept 20 - 22, 1990.
5. Das, D., Sudarshan, M., Krishna, I. B. M., Chintalpudi, S.N., and Majumdar, C. K.: Moessbauer studies in natural chromite spinels — DAE Sol. St. Phys. Symp., S.V.Univ., Tirupati (Dec 28, 1992 to Jan 1, 1993) vol 35C, 434.
6. Ghose, P. and Home, D.: The EPR problem in the light of the Tomonaga - Schwinger formalism - - Proc. Int. Conf. on Bell's Theorem and the Foundation of Modern Physics, Eds. A.van der Merwe, F.Selleri and G.Tarozzi (World Scientific, Singapore) 1992, pp. 244 - 249.

C. Miscellaneous

1. Gangopadhyay, D. : Book review: 'Renormalization and Asymptotic Expansions' by V.Smirnov (Progress in Physics, vol 14, Birkhauser, 1991) p. 380 in Ind. J. Phys, 1992, 66A, 710.
2. Majumdar, C. K.: 'Are we learning from Revolutions?' — Autumn Annual, Presidency College Alumni Association 1993, Vol XXI, 83 - 9.
3. Majumdar, C. K.: 'Condensed Matter in the Service of Man', Address of the President of the section 'Physics', 80th Indian Science Congress held at Goa (Jan 3 - 8, 1992).
4. Mookerjee, A.: 'Trends in the Scientific Research and Development in India', Autumn Annual, Presidency College Alumni Association 1993, Vol XXI, 162 - 7.

D. Ph. D. Theses

1. Dasgupta, S. : Phase transitions in Ising Antiferromagnets — Awarded Ph. D. degree form Jadavpur University. Supervisor: Dr. C. K. Majumdar.

Visits by Centre's Staff to attend Conferences, Seminars etc.

1. Banerjee, Srilekha: attended (i) the Workshop on Parallel User Library (PARUL) organized by CDAC, Bangalore (01.12.92);
(ii) the International Conference on Mathematical Modelling held at the University College of Science, Calcutta (December 14 - 16, 1992);
(iii) the International Symposium on Statistical Physics organized by Calcutta Mathematical Society (January 1 - 4, 1993);

2. Bhattacharya, N. C., VECC (represented Dr. C. K. Majumdar) at the 5th Asia Pacific Conference at Kuala Lumpur, Malaysia (10 to 15 August 1992).
3. Chaudhury, R : attended (i) the Discussion - Meeting on High To Superconductors held at VECC (March 10 - 12, 1993);
(ii) 12th National Symposium on Cryogenics (TNSC - 92) held at IACS, Calcutta during March 29-30, 1993 and gave an invited talk 'Stability of Marginal Fermi Liquid and its Consequences'.
(iii) the International Symposium on Statistical Physics organized by Calcutta Mathematical Society (January 1- 4, 1993).
4. Dasgupta, I. : attended Ordering Disorder, Hyderabad (December 28-January 5, 1993).
5. Ghose, P. : attended (i) an International Seminar on Colour organized by the National Centre for Performing Arts (NCPA) and Max Mueller Bhavan at NCPA, Bombay (April 22-25,1992) and presented a paper on 'The Science of Light and its History'.
(ii) the 5th Asia Pacific Conference at Kuala Lumpur, Malaysia (10 to 15 August,1992);
(iii) the BCSPIN Winter School in Puri;
(iv) the 2nd International Conference on Physics and Astrophysics of Quark - Gluon Plasma organized by VECC, Calcutta (Jan. 19 - 23, 1993);
(v) the National Laser Symposium at IIT, Madras and delivered an invited talk on Confronting the Complementarity Principle in a two - prism experiment (17.02.93);
(vi) a Workshop at the Nehru Memorial Museum and Library, New Delhi, on Scientific Traditions in India in connection with the Project of History of Indian Science, Philosophy and Culture (March 1 - 3, 1993);
(vii) National Seminar on "Differential Geometry, Relativity and Astrophysics" held at the St. Xavier's College, Calcutta, in memory of the late Father Goreaux organized by the Birla Planetarium, Indian Astronomical Society and World Laboratory (13.11.92).
6. Majumdar, C.K.: attended (i) the seminar on 'Recent Trend on Theoretical Physics held at Madras University (July 2- 3, 1992) on the occasion of Prof. P.M.Mathews's 60th birthday.
(ii) 80th Session of Indian Science Congress held at Goa (January 3 - 8, 1993).
(iii) the 37th Annual Meeting of the Indian Society of Theoretical and Applied Mechanics at Pantnagar (14 to 16 January, 1993).
7. Mookherjee, A., Basu, C. and Datta, A.: attended a Working Group in Random Alloys at ICTP, Trieste, Italy (August 24 to September 4, 1992).
8. Mookherjee, A.: attended the International Workshop on the Electronic Structure of Metals & Alloys organized at the Anna University, Madras (November 16 - 24, 1992).
9. Nayak, N. attended (i) a seminar 'Recent Trends in Theoretical Physics at Madras University (July 2- 3, 1992).
(ii) the "Birth Centennial Colloquium in Mathematical Contributions of S.N.Bose and M.N.Saha: in retrospect and prospect" held at Calcutta University (March 30- 31, 1993).
10. Paul, S.K.: attended the BCSPIN Winter School in Puri.

Seminars/Talks by the Centre's Staff

1. Chaudhury, R.: (i) 'Free energy formula for a strong coupling Marginal Fermi Liquid Superconductor' at Superconductivity Study Group Meeting in McMaster University, Hamilton, Canada (4.2.92);

- (ii) 'Marginal Fermi Liquid - Phenomenology and Stability', Theoretical Condensed Matter Meeting in Univ. of Minnesota, Minneapolis, USA (25.7.92)
- (iii) Stability of Marginal Fermi Liquid and its consequences - Invited talk at the 12th National Symposium on Cryogenics (TNSC 92) held at IACS, Calcutta (March 29 - 30, 1993)
- 2. Dasgupta, I. and Saha, T: 'Quantum transmittance in disordered media' at SNBNCBS (16.4.92).
- 3. Dasgupta, I. : 'Electrons in contact with Stochastic Baths' at International Workshop on Electronic Structure Calculations at Anna University, Madras (20.11.92)
- 4. Gangopadhyay, D.: (i) On Quantum oscillators, and (ii) Composition solutions of classical Yang - Mills equation, TPSC seminars given at IOP, Bhubaneswar, and IMSC, Madras, in November 1992.
- 5. Ghose, P.: (i) Relativistic Quantum Mechanics of Bosons at TIFR, Bombay (24.04.92).
(ii) Confronting the complementarity principle in a two prism experiment, — at 5th Asia Pacific Conference, Kuala Lumpur, Malaysia; also at IIT, Kanpur under TPSC (Feb 7 - 10, 1993).
(iii) The Science of Light and its History, — at NCPA, Bombay (25.4.92).
- 6. Majumdar, C. K. : (i) Moessbauer Spectra on Iron Minerals in East India, — At the Seminar on 'Current Trends on Condensed Matter Physics', BARC, Bombay (14.10.92 - 16.10.92); also at the seminar 'Recent Trends in Theoretical Physics Madras University (July 2 - 3, 1992)
(ii) Simulation of Fluid Flow on the Hooghly Estuary by Parallel Programming, — Pantnagar (14.01.93)
(iii) Understanding Culture, — at Dept. of Philosophy, Jadavpur University (13.02.93)
(iv) Theoretical aspects of Heavy Ion Irradiation Effects in High Tc Superconductors, — at the Nuclear Science Centre, New Delhi (23.3.93).
- 7. Mookerjee, A. : (i) Augmented Space and Disordered Alloys, at the Workshop on Electronic Structure, Trieste (August 17 -1 1992)
(ii) Dynamical Disorder (Plenary Seminar), at I.C.T.P., Trieste (24.08.92)
(iii) LMTO - Recursion on Augmented Space, at I.C.T.P., Trieste (August 24-25,1992)
(iv) Disordered Alloys, at the International Workshop on Electronic Structure Calculations at Anna University, Madras University (18.11.92)
(v) Some Outstanding Problems in Alloy Design, at the Annual Meeting the Indian Physics Association at SINP, Calcutta (15.03.92)
- 8. Mukhopadhyay, P.: Contrast of the dynamic elastic moduli between spin glasses from 1 K to 300 K at Groupe VIRGO, Orsay, France (September, 1992)
- 9. Paul, S.K.: (i) Non - polynomial realization of $SL(n, R)$ KdV Hierarchy through Kac - Moody currents and their derivatives, TPSC lectures at IMSC, Madras, and IOP, Bhubaneswar (December, 1992); also at Mehta Research Institute of Mathematics and Mathematical Physics, Allahabad (October,1992).
(ii) Krichever - Novikov operator formulation of NSR Superstring in curved backgrounds, at Mehta Research Institute, Allahabad (October,1992)
- 10. Saha, T.: The Quantum Percolation Model - at the International Workshop on Electronic Structure Calculations at Anna University, Madras (21. 11. 92).

Educational Activities

1. Working Party on Random alloys (August 24 - September 4, 1992, at ICTP, Trieste). Directors: A. Mookerjee (SNBNCBS), P. Butcher (Warwick).

The Working Party was held in tandem with a Workshop on Electronic Structure Calculations in metals and alloys. The Working Party programme involved a lecture followed by a technical session in the morning and working sessions in the afternoons. The participants formed groups and worked on specific problems under the guidance of an expert. The problems included electronic structure of alloys using KKR and LMTO versions of the CPA and its generalizations and alloy phase diagram determinations including pair potential approaches. Problems involving semiconductors and compounds like Si, MgO and CaO were also tackled. The expert panel included R. Haydock (Oregon), C.M.M. Nex (Cambridge), J. Staunton (Warwick), J. Kudrnovsky (Prague), A. Mookerjee (Calcutta) and R. Prasad (Kanpur). Vijay Kumar (Trieste) talked on Car - Parinello approaches and Chen (Peking) on pair potentials.

The participants were basically young scientists including young faculty members, post - doctoral fellows and research students. They came from several countries including Italy, Argentina, Chile, India, Bangladesh, China, Czechoslovakia, Bulgaria and Georgia.

2. The Centre's scientists have been asked to help other institutions by giving lectures. Prof A. Mookerjee lectured on Quantum Mechanics and Solid State Physics (Special paper) in Presidency College, Calcutta. Prof. C. K. Majumdar taught part of Solid State Physics (Special paper) in Calcutta University and Presidency College. He also gave several lectures on Advanced Quantum Mechanics at the Inter University Centre for Dept of Atomic Energy Facilities, Calcutta, and Academic Staff College in Physics at Calcutta University.

3. Prof. P. Ghose devoted considerable time to the production of a TV serial 'Kyon aur Kaise?' (Why and How?) by NCSTC, New Delhi.

Library

The S. N. Bose National Centre Library added 65 new books in 1992 - 93 to its collection. The technical processing of library books are now being carried out by using a 386 - MINICOMP Personal Computer supplied with an EPSON FX - 1000 printer, which have been purchased recently for the library. The DBaseIII computer software is being used for technical processing of books and other reading material. The library renewed subscription to the following journals for the year 1993:

☐ **A. Foreign Journals**

1. Computer Journal
2. Computers in Physics (AIP)
3. Economic Theory
4. Journal of Physics A: Mathematical and General
5. Nature
6. Physical Review Letters
7. Physics Letters (Section A)
8. Physics Letters (Section B)
9. Physics Reports

☐ **B. Indian Journals**

1. Bulletin of Material Science
2. Current Science

3. Indian Journal of Pure & Applied Physics
4. Journal of Astrophysics & Astronomy
5. Journal of Biosciences
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 Science) - Sadhana
11. Proc. Ind. Acad. of Sc.(Mathematical Sciences)

The library renewed subscription to SLAC preprints in Particles and Fields for 1992- 93. Preprints received in the library from more than 25 research institutes all over the world were displayed and preserved in the Preprint Library.

The library offers xerox facilities on a regular basis to its users during seminars, symposia and other academic activities. About ten thousand xerox copies from different research materials were distributed last year to the library users.

In view of the limited subscription to foreign journals in the library, we have sought help of the Indian National Scientific Documentation Centre (INSDOC) for providing us with xerox copies of papers from different foreign scientific periodicals.

COMPUTER CENTRE

The HP 9000 System with its dotmatrix printer and colour pen plotter has been functioning satisfactorily. The Quantum Workstation with its hard disk and Epson 1000 printer has provided full service; similarly the Quantum Double drive used for the Teachers' Training performed satisfactorily. Since the work - load has increased the Centre has procured another 80386PC - AT for the building CD 85 with a printer, besides the one it had earlier at DB 17. The Centre has also obtained a Laser printer system. However, the power requirement required upgrading the UPS system considerably and the system has been made operational after some effort. The library's computer has started functioning and the books are entered in a database. The machine has WORDPERFECT software, and this year's annual report was prepared in its final form through it.

The Centre procured a 4 - transputer card from C - DAC, and installed it in a PC- AT on December 7, 1992. Some amount of parallel processing is now possible. The mail facility has been running satisfactorily with the System Administrator Mrs R. Das in Charge.

The Teachers' Training programme was satisfactorily completed; the course material contained MSDOS, GWBASIC, and elements of WORDSTAR and FORTRAN. The programme is becoming popular and for the first time there were more applicants than the Centre could handle.

THEORETICAL PHYSICS SEMINAR CIRCUIT

The Centre continued to function as the coordinating Centre of the Theoretical Physics Seminar Circuit (TPSC). The following scientists visited Calcutta under the programme and gave seminars:

1. Dr. M. Rajasekaran, Department of Nuclear Physics, University of Madras,: Neutron emission from fast rotating nuclei (May 1992).
2. Dr. K. Sridhar, Physical Research Laboratory, Ahmedabad : Implication of LEP data for unified theories (May 1992).

3. Dr. V. Deshpande, School of Physical Science, JNU, Delhi,: Neural network models of associative memory and dynamical models for neural networks (June 1992).
4. Dr. Kumar S. Gupta, Dept. of Physics, Syracuse University, USA,: Edge currents in Chern - Simons theory (July 1992).
5. Prof. R. Sridhar, IMSC, Madras,: Fractional Statistics and Roton Excitations in Liquid Helium - 4 (August 1992).
6. Dr. M. K. Parida, Dept. of Physics, NEHU, Shillong,: New Developments in Grand Unified Theories (August 1992).
7. Dr. P. Chaddah, Centre for Advanced Technology, Indore,: Critical currents and magnetic irreversibilities in High Tc superconductors (November 1992).
8. Dr. P. N. Gade, Department of Physics, University of Poona, Pune,: Spatial period doubling in coupled map lattices (January 1993).
9. Dr. A. Das, Institute of Physics, Bhubaneswar,: Thermostatic properties of hot nuclear systems (March 1993).

CONSTRUCTION OF THE NEW CAMPUS

The Campus of the S. N. Bose National Centre for Basic Sciences is being built on a 15 acre plot of land in Block JD, Sector III, Salt Lake. At this stage construction is in progress of a section of the main building, a portion of the Guest House, and one block of Essential Staff Quarters and the necessary infrastructural facilities. The work is progressing satisfactorily.

MEETING OF THE VARIOUS COMMITTEES OF THE CENTRE

☐ **Governing Body**

The Governing Body of the Centre under the Chairmanship of Professor Rama Rao met twice during the period April 1992 to March 1993. The first meeting was held on May 2, 1992 at DST in Delhi, the second was held on August 29, 1992 at S. N. Bose Centre, Calcutta.

☐ **Academic Programme Advisory Committee**

The Research Advisory Committee I (Physics and Mathematics) held its meeting at the office of the Director of the Centre on August 21, 1992. The Research Advisory Committee (Chemistry and Life Sciences) could not meet in December because of the disturbances in the country.

☐ **Finance Committee**

The Finance Committee of the Centre met on July 20, 1992 at the Office of the Financial Adviser, Department of Science and Technology, Government of India, New Delhi. The members were the same as in the last year.

☐ **Construction Committee**

During the period under review, the Construction Committee met on July 3, 1992 and January 28, 1993. The members of the present Committee are:

- | | |
|----------------------------------|----------|
| 1. Prof. C. K. Majumdar | Chairman |
| Director, SNBNCBS | |
| 2. Prof. G. S. Sanyal | Member |
| (Retd.) Director, IIT Kharagpur | |
| 3. Prof. T. K. Chattopadhyay | Member |
| Professor of Architecture, J.U. | |
| 4. Chief Engineer or his Nominee | Member |
| CPWD (Est.Reg) represented by | |
| Mr. A. K. Saxena, Supt. Engr. | |

- | | | |
|----|--|--------------------|
| 5. | Prof. M. K. Dasgupta
Professor, Inst.of Radio Phys &
Elec, C.U. | Member |
| 6. | Dr. J. Pal Chaudhuri
Administrative Officer, SNBNCBS-
Dr. S. K. Sharma has been acting
for Administrative Officer, since
February 1, 1993. | Member - Secretary |

Centre's Staff as on March 31, 1993

- | | |
|--|---|
| <input type="checkbox"/> Academic
Dr. Chanchal Kumar Majumdar
Dr. Partha Ghose
Dr. Abhijit Mookerjee
Dr. Subodh Kumar Sharma
Dr. Nilkantha Nayak
Dr. Debashis Gangopadhyay
Dr. Rabin Banerjee
Dr. Samir Kumar Paul
Dr. Ranjan Chaudhury
Dr. Pratip Mukhopadhyay
Dr. Manu Mathur
Mrs Rina Das
Dr. Srilekha Banerjee | Director
Professor/Academic Programme Coordinator
Professor
Reader
Reader
Lecturer
Post Doctoral Fellow
Post Doctoral Fellow
Post Doctoral Fellow
Post Doctoral Fellow
Post Doctoral Fellow (on leave)
Scientific Officer
Scientific Officer |
| <input type="checkbox"/> Administrative, Technical and Auxiliary
Dr. J. Pal Chaudhuri
Dr. Santi Gopal Basu
Mr. Apurba Kanti Sarkar
Mr. Bhaskar Das Gupta
Mr. Sunish Kumar Deb
Mr. Tapan Kumar Sen
Mr. Sukanta Mukherjee
Mr. Jaydeep Kar
Mr. Prosenjit Talukdar
Mr. Gopal Chandra Ghosh
Mr. Pradip Kumar Bose
Mr. Partha Chakraborty | Administrative Officer (Retired on 31.1.1993)
Librarian
Administrative Assistant(Accts)
Office Superintendent(Resigned in Oct.1992)
Stenographer
Junior Assistant
Junior Assistant (UDC from February 1993)
Junior Assistant
Junior Assistant
Driver
Helper
Helper |
| <input type="checkbox"/> Personnel on Campus Construction
Mr. Nirmal Bhattacharya
Mr. Samar Sur
Mr. Aditya Paul Choudhury | Project Engineer
Sub - Assistant Engineer
Project Assistant |
| <input type="checkbox"/> Scientists on Projects
Prof. Manoj Kumar Pal
Prof. Manisha Bose
Dr. Sharmistha Ghosal
Ms. Chaitali Basu
Mr. Susil Kumar Manna
Mr. Abhijit Datta
Dr. Prabhat Kumar Thakur | Emeritus Scientist, CSIR
Coprincipal Investigator in DST project.
Research Associate, CSIR
Senior Research Fellow, CSIR
Teacher Fellow, UGC
Research Scholar
Pool Officer, CSIR (from March 1993) |

Mr. Indra Dasgupta
Ms. Tanusree Saha
Ms. Roshni Sen

Mr. Tapas Mitra
Mr. Sanjay Kar
Dr. P. Roychoudhury

Junior Research Fellow, DST
Junior Research Fellow, DST
Junior Research Fellow, CSIR
(Resigned in March 1993)
Junior Research Fellow, CSIR
Research Fellow, DST
Part Time Researcher.

Abbreviations

AU	=	Andhra University, Waltair
BARC	=	Bhabha Atomic Research Centre, Bombay
BI	=	Bose Institute, Calcutta
CAT	=	Centre for Advanced Technology, Indore
CDAC	=	Centre for Development of Advanced Computer
CSIR	=	Council of Scientific & Industrial Research
CU	=	Calcutta University
DAE	=	Dept of Atomic Energy
DST	=	Department of Science & Technology, New Delhi
FAMTSIT	=	Foundation and Methodology of Theoretical Sciences in the Indian Tradition, Jadavpur University
IACS	=	Indian Assoc. for the Cultivation of Sc., Calcutta
ICTP	=	Int. Centre for Theoretical Physics, Trieste
HCB	=	Indian Institute of Chemical Biology, Calcutta
IIM	=	Indian Institute of Management, Ahmedabad
IISC	=	Indian Institute of Science, Bangalore
IIT	=	Indian Institute of Technology
IMSC	=	Institute of Mathematical Sciences, Madras
IOP	=	Institute of Physics, Bhubaneswar
IPR	=	Institute of Plasma Research, Gandhinagar
IUCAA	=	Inter-Univ Centre for Astronomy & Astrophysics, Pune
JNU	=	Jawaharlal Nehru University, New Delhi
JU	=	Jadavpur University, Calcutta
MRI	=	Mehta Research Institute, Allahabad
NCL	=	National Chemical Laboratory
NEHU	=	North-Eastern Hill University, Shillong
NERIST	=	North-East Reg. Inst. of Sc. & Tech, Itanagar
PRL	=	Physical Research Laboratory, Ahmedabad
SINP	=	Saha Institute of Nuclear Physics, Calcutta
SLAC	=	Stanford Linear Accelerator Center, California, USA
SNBNCBS	=	S.N.Bose National Centre for Basic Sciences
SVCET	=	S.V.Regional College of Engg & Tech, Surat
TIFR	=	Tata Institute of Fundamental Research, Bombay
UCLA	=	University of California, Los Angeles, USA
UGC	=	University Grants Commission, New Delhi
VECC	=	Variable Energy Cyclotron Centre, Calcutta

Corrigendum

1. In the Annual Report 1991-92, page 3: The name of Professor N. Kumar, Indian Institute of Science, Bangalore should appear in the list of members of RACI.
2. In the same report, page 17 : (i) publication no. 3, should be 1992 (not 1991) and (ii) publication no. 5, should be "Metalinsulator....".

BUDGET SUMMARY for 1992 - 93

The funds come from the Department of Science and Technology. The following is the summary of the budget estimates of the year 1992-93 :

Amount in Lakhs of Rupees

	Actuals	Budget Estimate	Revised Estimate
	1991 - 92	1992 - 93	1992 - 93
Non Plan	22.9	26.7	29.4
Plan	111.4	332.8	325.1
Total	134.3	359.5	354.5

D. P. Sen & Co.
CHARTERED ACCOUNTANTS

8/2, KIRAN SHANKAR ROY ROAD
CALCUTTA - 700 001
PHONE : 28 - 1495 / 28 - 7785

AUDITORS' REPORT

To
The Director
Satyendra Nath Bose National Centre for Basic Sciences
DB 17 Salt Lake City
Calcutta - 700 064

We have audited the attached Balance Sheet as at 31st March, 1993 of Satyendra Nath Bose National Centre for Basic Sciences and the annexed Income & Expenditure Account for the year ended 31st March, 1993. We report as follows :-

1. a) Depreciation on Fixed Assets has neither been ascertained nor charged since inception (Schedule - N, Note - 1)
b) Consequent to accounting for unprovided expenses and incomes related to prior periods (Details as per - Schedule - M), a net credit balance of Rs. 85,412.22 has been taken into account for this year.
c) Capital Work-in-Progress has not been separately disclosed (Schedule-N, Note - 5).
d) The Bye-Laws of the Centre are pending final approval from the Department of Science & Technology, Government of India.
e) Indemnity bonds against advances made to a contractor have not been obtained in a number of cases, in contravention of the agreements with such contractor.
f) No confirmation of balances have been obtained from the parties as referred to in (Schedule - N, Note-8).
2. All necessary information, books and records required for audit were produced to us.
3. Subject to paragraphs 1(d) and 1(e) above, the transactions that came to our notice were within the delegated powers conferred by the Bye-Laws of the Centre.
4. Subject to paragraphs 1(a) to 1(c) and 1(f) above, and to the best of our information and explanations given to us, in our opinion, the said Balance Sheet and the Income and Expenditure Account read together with the schedules A to M and the Notes on Accounts attached thereto, reflect a true and fair view :
 - i) in case of the Balance Sheet as to the state of affairs of the Centre as on 31st March, 1993 and
 - ii) in case of the Income & Expenditure Account as to the excess of Income over Expenditure for the year ended 31st March, 1993.

The 29th day of June, 1993.

S/d Abhijit Bandyopadhyay
PARTNER

D. P. Sen & Co.,
CHARTERED ACCOUNTANTS

SATYENDRA NATH BOSE NATIONAL
DB 17, SECTOR I,
Balance Sheet as at

Figures for the previous Year Rs. P.	FUNDS & LIABILITIES	Schedule	Rs.	P.	Rs.	P.
	CAPITAL FUND :					
	<i>Balance as per Last A/c</i>		4,43,40,999.60			
	<i>Add : Grant-in-Aid received from Govt. of India for non-recurring expenses</i>		1,34,48,882.00			
4,43,40,999.60					5,77,89,881.60	
	GENERAL FUND :					
	<i>Balance as per Last A/c</i>		30,32,005.30			
	<i>Add : Net excess of Income over Expenditure for the year transferred from Income & Expenditure Account</i>		14,39,048.59			
30,32,005.30					44,71,053.89	
	OTHER FUNDS :					
	1) Computer Fund :					
	<i>Donation received from J. Bose upto Last A/c</i>		2,00,001.00			
	<i>Add : Received during the year</i>		75,000.00			
2,00,001.00					2,75,001.00	
	2) Project Fund :					
	<i>Balance as per last A/c</i>		10,73,491.34			
	<i>Less : Excess of Expenditure over Incomes for the year transferred from Income & Expenditure Account</i>		27,272.37			
10,73,491.34					10,46,218.97	
	3) T P S C Fund :					
	<i>Balance as per Last A/c</i>		4,512.30			
4,512.30						
4,47,438.06	4) Employees' Provident Fund		7,75,707.06			
83,722.00	5) Gratuity Fund		1,24,870.92			
					9,05,090.28	
4,91,82,169.69	Carried Forward				6,44,87,245.74	

CENTRE FOR BASIC SCIENCES

Salt Lake, Calcutta 700 064

31st March , 1993

Figures for the previous Year Rs. P.	PROPERTIES & ASSETS :	Schedule	Rs.	P.	Rs.	P.
2,90,01,597.94	FIXED ASSETS : At Cost / Capitalised Value	'D'			4,39,32,897.07	
	INVESTMENTS :					
1,67,22,502.19	1) In short Term Deposits with Scheduled Banks	'E'	1,03,69,388.49			
60,571.00	2) Gratuity Fund Invested : In short Term Deposits with scheduled Banks		83,722.00			
4,12,000.00	3) Provident Fund Invested : In short Term Deposits with Scheduled Banks		6,32,000.00		1,10,85,110.49	
	CURRENT ASSETS :					
299,529.79	1) Interest Accrued on Investments :					
-	a) General Fund		1,94,656.17			
-	b) Gratuity Fund		13,531.04			
-	c) Provident Fund		87,062.00			
11,313.80	2) Stock of Printing & Stationery		31,469.21			
	3) CASH & BANK BALANCES :					
335.07	a) Cash in hand		214.11			
7,10,838.06	b) With Schedule Banks	'F'	18,25,841.62		21,52,774.15	
	LOANS & ADVANCES :					
9,200.00	1) Advance to Employees from Provident Fund		13,638.00			
42,73,888.47	2) Advance to Suppliers & Contractors	'G'	74,73,740.08			
69,650.00	3) Deposit for Rent	'H'	1,34,750.00			
18,590.00	4) Security Deposits	'I'	18,590.00			
	5) Advance against Expenses receivable	'J'	37,574.75			
21,203.00	6) Other Advances	'K'	98,721.00			
67,021.00	7) Prepaid Expenses	'L'	2,48,492.15		80,25,505.98	
1,70,515.00						
5,18,48,755.32	Carried Forward				6,51,96,287.69	

SATYENDRA NATH BOSE NATIONAL
DB 17, SECTOR I,
Balance Sheet as at

Figures for the previous Year	FUND & LIABILITIES	Schedule	Rs.	P.	Rs.	P.
Rs.	P.					
4,91,82,169.60	<i>Brought Down</i>				6,44,87,245.74	
	CURRENT LIABILITIES & PROVISIONS :					
63,653.44	1) Ourstanding Liabilities for revenue expenditure	'A'	1,54,249.75			
20,29,042.37	2) Outstanding Liabilities for Capital Expenses	'A'	2,870.00			
3,17,658.31	3) Security Deposits from Contractors	'B'	5,28,514.20			
1,24,330.38	4) Sundry Creditors	'C'	24,250.00			
40,000.00	5) Earnest Money from Contractors		40,000.00			
9,771.00	6) Provisions for Bonus to Employees		12,332.00			
82,130.22	7) Provision for rent on Leasehold Land		-			
-	8) Contractors' Income Tax		984.00		7,63,199.95	
5,18,48,755.32					6,52,50,445.69	

* Note on Accounts are separately given in Schedule 'M'

* The Schedules referred above from an integral part of the Balance Sheet

AUDITORS' REPORT :

In term of our report of even date.

For D P SEN & CO.
Chartered Accountants

8/2, Kiran Sankar Roy Road
 Calcutta - 700 001
 The 29th day of June, 1993

(A. BANDYOPADHYAY)
Partner

31st March , 1993

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**SATYENDRA NATH BOSE NATIONAL
DB 17, SECTOR I,
INCOME AND EXPENDITURE ACCOUNT FOR**

Figures for the previous Year		EXPENDITURE	PROJECT ACCOUNT	GENERAL ACCOUNT
PROJECT ACCOUNT	GENERAL ACCOUNT		Rs. P.	Rs. P.
Rs. P.	Rs. P.			
75,866.67	10,91,611.26	Salary & Allowances	1,05,045.00	14,20,928.17
-	31,874.00	Wages (Casual)		54,684.75
	84,245.00	Employer's Contribution to P.F.		62,619.00
	50,473.74	Medical Claims		80,705.76
	10,750.00	Bonus to Employees		12,332.00
	10,779.28	Electricity charges		34,881.47
	72,023.80	Hire of Transport		73,757.22
	42,120.00	Hire of Generators		50,767.13
	1,84,500.00	Rent of Office Premises		2,62,800.00
	20,131.30	Office Contingency Expenses		24,022.27
	67,439.64	Printing & Stationery		94,159.59
	1,208.00	Repairs to Equipment		7,894.51
	30,606.00	Postage & Telegram		44,471.40
	14,310.00	Insurance premium		18,169.85
	45,942.60	Telephone & Trunk Calls		90,821.30
	560.20	TA/DA to Non-Academic Staff		947.20
	7,911.70	TA/DA to Academic Staff (India)		24,889.00
	39,012.00	TA/DA to Academic Staff (Abroad)		74,257.47
	90,005.35	Meeting Expenses		77,797.40
48.00	935.20	Bank Charges		3,870.50
	27,991.21	Car Maintenance		12,479.81
-	1,68,875.00	Computer Maintenance	14,175.00	1,96,425.00
	10,702.45	Office Maintenance		18,971.41
	2,44,074.80	Seminar & Other Academic Expenses		2,48,734.90
	30,000.00	Accommodation for visiting Scientists		30,000.00
	1,12,756.00	Visiting Member Fellowships		1,33,785.00
	9,464.39	Director's Research Expenses		6295.20
	10,044.40	Academic Staff Research Expenses		25,199.00
	48,885.08	Publication of Seminar Proceedings		38,185.00
75,914.67	25,59,232.40	Carried Forward	1,19,220.00	32,24,851.91

CENTRE FOR BASIC SCIENCES
Salt Lake, Calcutta 700 064
THE YEAR ENDED 31ST MARCH , 1993

Figures for the previous Year		INCOME	PROJECT ACCOUNT	GENERAL ACCOUNT
PROJECT ACCOUNT	GENERAL ACCOUNT		Rs. P.	Rs. P.
Rs. P.	Rs. P.			
	18,00,000.00	Grant-in-Aid Received :		
		Non - Plan		15,00,000.00
		Plan		25,51,118.00
		Misc. Grant-in-Aid Received :		
4,35,500.00		For Project	2,02,891.00	
71,350.00		For CSIR Fellows	1,45,027.00	
	85,000.00	For TPSC Speakers		-
	16,512.00	For UGC Fellows		-
	-	For WHEPP - II		25,829.00
	14,23,478.86	Interest on Short Term Deposits		17,34,763.68
		Misc. Income :		
	2,940.00	Income from Guest House		6,420.00
	170.00	Others		130.00
	-	Contribution against W H E PP - II		6,445.00
5,06,850.00	33,28,100.86	Carried Forward	Rs. 3,47,918.00	58,24,705.68

**SATYENDRA NATH BOSE NATIONAL
DB 17, SECTOR I,
INCOME AND EXPENDITURE ACCOUNT FOR**

Figures for the previous Year		EXPENDITURE	PROJECT ACCOUNT	GENERAL ACCOUNT
PROJECT ACCOUNT	GENERAL ACCOUNT		Rs. P.	Rs. P.
Rs. P.	Rs. P.			
75,914.67	25,59,232.40	Carried Down	1,19,220.00	32,24,851.91
		Stipend & Contingency to	1,44,417.25	
71,788.80		CSIR Fellows		
	4,800.00	Legal Expenses		-
	10,016.00	Library General Expenses		4,657.50
	23,151.00	Provision for Gratuity		27,617.88
	6,500.00	Audit Fee		6,500.00
5,662.00		Travel	45,262.00	
54,101.54		Contingency & Raw Materials	62,733.06	
	84,511.80	TA/DA to TPSC Speakers.		4,42,437.35
	47,824.00	E-Mail-etc. (57270.00+100250.00)		1,57,520.00
	16,499.80	Stipend & Cont. to UGC Fellows	-	
	16226.62	P O L		20,209.84
	-	Building Maintenance		24,950.00
	27,376.74	Lease Rent		9,226.00
3,952.20		Suppliers & Materials	3,558.06	-
	-	S. N. Bose Birth Centenary	-	7,973.00
	1,677.29	Furnishing Accommodation for visiting Scientists		2,295.85
		B C S P IN Account		5,42,829.98
2,95,430.79	5,30,285.21	Excess of Income over Expenditure for the year C/D	-	13,53,636.37
5,06,850.00	33,28,100.86		3,75,190.37	58,24,705.68

**SATYENDRA NATH BOSE NATIONAL
DB 17, SECTOR I,
INCOME AND EXPENDITURE ACCOUNT FOR**

Figures for the previous Year				EXPENDITURE	PROJECT ACCOUNT		GENERAL ACCOUNT	
PROJECT ACCOUNT		GENERAL ACCOUNT						
Rs.	P.	Rs.	P.		Rs.	P.	Rs.	P.
-		54,753.48		Adjustment relating to Prior Period			-	
				Excess of Expenditure over Income b/f	27,272.37			
2,95,430.79		4,75,531.73		Excess of Income over expenditure transferred to General Fund	-		14,39,048.59	
2,95,430.79		5,30,285.21			27,272.37		14,39,048.59	

8/2, Kiran Sankar Roy Road
Calcutta - 700 001
The 29th day of June, 1993

For D P SEN & CO.
Chartered Accountants

(A. BANDYOPADHYAY)
Partner

CENTRE FOR BASIC SCIENCES
Salt Lake, Calcutta 700 064
THE YEAR ENDED 31ST MARCH , 1993

Figures for the previous Year				INCOME	PROJECT ACCOUNT	GENERAL ACCOUNT
PROJECT ACCOUNT		GENERAL ACCOUNT				
Rs.	P.	Rs.	P.		Rs.	P.
2,95,430.79		5,30,285.21		Excess of Income over Expenditure for the year b/f		13,53,636.37
				Adjustement Relating to Prior Period (Sch. M)		85,412.22
				Excess of Expenditure over Income transferred to General Fund	27,272.37	
2,95,430.79		5,30,285.21			27,272.37	14,39,048.59

(S. K. SHARMA)

(C. K. MAJUMDAR)

Administrative Officer

Director

SATYENDRA NATH BOSE NATIONAL
DB 17, SECTOR I,
RECEIPTS AND PAYMENTS ACCOUNT

Figures for the previous Year				RECEIPTS	PROJECT ACCOUNT		GENERAL ACCOUNT	
PROJECT ACCOUNT		GENERAL ACCOUNT						
Rs.	P.	Rs.	P.		Rs.	P.	Rs.	P.
1,82,087.34		23,31,805.44		OPENING CASH & BANK BALANCES :				
				Indian Overseas Bank,	2,90,263.17		1,69,346.83	
				Salt Lake Branch				
			99,995.00	United Bank of India,			2,24,990.00	
				Mayukh Bhawan Branch				
			62.34	Cash in hand			335.07	
			-	Contribution for WHEPP - II			6,445.00	
				Recovery of Staff Advances :				
			4,920.00	Festival Advance			6,400.00	
			-	Staff Advance			28,000.00	
			85,00,000.00	Grant-in-Aid Received :			1,60,00,000.00	
			18,00,000.00	For Plan Expenditure			15,00,000.00	
				For Non - Plan Expenditure				
			-	For WHEPP - II			25,829.00	
				Misc. Grant-in-Aid Received :				
				For CSIR Fellows	1,45,027.00			
				For Projects	2,02,891.00			
	71,350.00			For TPSC Programme				-
4,35,500.00			For UGC Fellows				-	
		85,000.00	Encashment of Short Term Deposits			1,47,67,237.00		
		16,512.00						
		50,39,890.00	Earnest Money from Contractors				-	
		20,000.00	Security Deposit from Contractors			4,21,793.98		
		3,91,932.48	Interest on Short term Deposits			18,39,637.30		
		3,17,990.00	Recovery of Advance from Suppliers			2,27,084.02		
		3,09,049.83	Recovery of Advance from Contractors			1,24,14,853.80		
		13,40,473.00	Recovery of Deposits for Rent			78,900.00		
		48,450.00	Recovery of project Account			4,174.00		
		-	Recovery of Expenses for WHEEP-II			10,773.00		
		-						
		-	Contractors' Income Tax (Deduction)			1,394.00		
		-	Recovery of Insurance Premium			20.00		
		-						
6,88,937.34		2,03,06,080.09	Carried over	6,38,181.17		4,77,27,213.00		

CENTRE FOR BASIC SCIENCES
Salt Lake, Calcutta 700 064
FOR THE YEAR ENDED 31ST MARCH , 1993

Figures for the previous Year		PAYMENTS	PROJECT ACCOUNT		GENERAL ACCOUNT	
PROJECT ACCOUNT			Rs.	P.	Rs.	P.
Rs.	P.					
75,866.67	10,58,542.09	Salary Allowances	1,01,075.00		14,20,087.87	
	31,874.00	Wages (Casual)			54,684.75	
	84,245.00	Employers Constribution P.F.			85,841.00	
	4,800.00	Festival Advance			7,200.00	
	37,089.79	Medical Claims			56,004.47	
	11,039.00	Adhoc Bonus to Employees			10,317.00	
	10,779.28	Electricity charges			34,881.47	
	67,351.48	Hire of Transport			73,757.22	
	42,120.00	Hire of Generators			50,767.73	
	1,84,500.00	Hire of Office Premises			2,63,250.00	
	20,250.00	Deposit for Rent			1,44,000.00	
	20,013.30	Office Centingency Expenses			23,676.25	
	77,251.44	Printing & Stationery			1,14,315.00	
	1,208.00	Repair of Equipment			4,024.35	
	29,849.00	Postage & Telegram			43,477.40	
	14,465.00	Insurance Premium			18,552.00	
	45,291.60	Telephone & Trunk Calls			90,662.30	
	47824.00	E-Mail			57,270.00	
	7,911.70	TA/DA to Academic Staff (India)			24,889.00	
	39,012.00	TA/DA to Academic Staff (Abroad)			74,257.47	
	660.20	TA/DA to Non-Academic Staff			947.20	
	81,065.35	Meeting Expenses			77,797.40	
48.00	935.20	Bank Charges			3,870.50	
	60,655.00	Campus Beautification			39,528.50	
	69,90,253.04	Contruction of Buildings			1,56,19,662.70	
	12,20,280.00	Mobilization Advance to Conractors			-	
	22,54,435.20	Advance to Contractors			1,56,52,123.04	
		Adhoc Payment to Ghosh, Bose & Associates			-	
	3,00,000.00					
	24,991.21	Car Maintenance			12,479.81	
	16,226.62	P O L			20,209.84	
	10,702.45	Office Maintenance			17,221.41	
75,914.67	1,27,95,520.95	Carried Forward	101075.00		3,40,95,755.04	

**SATYENDRA NATH BOSE NATIONAL
DB 17, SECTOR I,
RECEIPTS AND PAYMENTS ACCOUNTS**

Figures for the previous Year				RECEIPTS	PROJECT ACCOUNT		GENERAL ACCOUNT	
PROJECT ACCOUNT		GENERAL ACCOUNT						
Rs.	P.	Rs.	P.		Rs.	P.	Rs.	P.
6,88,937.34		2,03,06,080.09		B/F		6,38,181.17		4,77,27,213.00
-				Donation Received :				
-		50,000.00		From J. Bose				75,000.00
-		5,000.00		P. Das (Refundable)				-
		1,250.00		Deposit from N. Nayak				-
1,348.42		-		Transfer from General Fund				-
		2,940.00		MISC. INCOMES :				
		170.00		Income from Guest House				6,420.00
				Others (Misc. Receipts)				130.00
6,90,285.76		2,03,65,440.09		Carried Over		6,38,181.17		4,78,08,763.00

CENTRE FOR BASIC SCIENCES
Salt Lake, Calcutta 700 064
FOR THE YEAR ENDED 31ST MARCH , 1993

Figures for the previous Year		PAYMENTS	PROJECT ACCOUNT	GENERAL ACCOUNT
PROJECT ACCOUNT	GENERAL ACCOUNT			
Rs. P.	Rs. P.		Rs. P.	Rs. P.
75,914.67	1,27,95,520.95	B/F	1,01,075.00	3,40,95,755.04
	1,89,500.00	Computer Maintenance	14,175.00	2,74,020.00
	10,016.00	Liberary General Expenses		4,657.50
	26,642.18	Library Furniture		84,969.86
	80,140.50	Library Books		1,04,817.68
	2,57,744.00	Library Journals		93,009.60
	20,36,690.00	Short Term Deposit with I O B, Salt Lake Branch		79,20,251.35
	25,00,000.00	Short Term Deposits with U B I, Mayukh Bhawan Branch		4,93,871.95
	3,87,798.93	Advance to Suppliers		7,79,239.66
	2,44,074.80	Seminar & Other Academic Expenses		2,48,134.90
	30,000.00	Accommodation for visiting Scientists		30,000.00
	1,677.29	Furnishings Accommodation for visiting Scientists		2,295.85
	64,190.00	Guest House Furniture		-
	1,05,201.48	Small Equipment		630.00
	1,12,756.00	Visiting Member Fellowship		1,33,785.00
	-	Office Equipment		3,750.00
	93,372.01	Office Furniture		99,450.89
	9,464.39	Director's Research Expenses		6,295.20
	1,03,116.00	Director's Research Equipment		23,347.47
	10,044.40	Academic Staff Research Expenses		24,709.00
	-	Academic staff Research Equipment		32,904.37
	48,885.08	Publication of Seminar Proceedings		38,185.00
	75,874.99	Installation of Computer		-
	3,02,796.00	Computer & Accessories		57,707.00
75914.67	1,94,85,505.00	Carried Over	1,15,250.00	4,45,51,787.32

**SATYENDRA NATH BOSE NATIONAL
DB 17, SECTOR I,
RECEIPTS AND PAYMENTS ACCOUNT**

Figures for the previous Year				RECEIPTS	PROJECT ACCOUNT		GENERAL ACCOUNT	
PROJECT ACCOUNT		GENERAL ACCOUNT						
Rs.	P.	Rs.	P.		Rs.	P.	Rs.	P.
6,90,285.76		2,03,65,440.09		B/F		6,38,181.17		4,78,08,763.00
6,90,285.76		2,03,65,440.09		Carried Over		6,38,181.17		4,78,08,763.00

CENTRE FOR BASIC SCIENCES
Salt Lake, Calcutta 700 064
FOR THE YEAR ENDED 31ST MARCH , 1993

Figures for the previous Year		PAYMENTS	PROJECT ACCOUNT	GENERAL ACCOUNT
PROJECT ACCOUNT	GENERAL ACCOUNT		Rs. P.	Rs. P.
Rs. P.	Rs. P.			
75,914.67	1,94,85,505.00	B/F	1,15,250.00	4,45,51,787.32
	4,800.00	Legal Charges		-
	50,335.89	Outstanding Liabilities		63,653.44
	50,915.21	U P S		95,590.00
	26,629.00	Gratuity Fund Investment		23,151.00
		Refund of Security Deposit		
	1,85,760.49	to Contractors		2,10,938.09
	84,511.80	TA/DA to TPSC Speakers etc		4,42,437.35
	4,200.00	Stipend & Contingency to		-
		Project Account		
	16,499.80	U G C Fellows		-
	41,181.00	Advances to Staff		600.00
	-	Advance to S. Manna		4,500.00
	410.00	Contractors' Income Tax (Deposit)		-
	20,000.00	Advance to the Registrar of Bombay		-
		University		
1,04,274.34	-	Advance for Equipment		
5,662.00		Travel	45,262.00	
20,432.00		Advance for Contingency & Raw	-	-
		Materials		
7,341.40		Equipment	2,12,611.20	
71,788.80		Stipend & Contingency to CSIR	1,44,417.25	
		Fellows		
98,377.70		Contingency & Raw Materials	62,707.06	
121.00		Transfer to General Fund	-	
16,110.68		Suppliers & Materials	3,558.06	
	20.00	Insurance Premium(Recoverable)	-	20.00
		S.N.Bose Birth Centenary		6,398.00
		Recoverable expenses for BCSPIN		8,602.00
4,00,022.59	1,99,70,768.19	Carried Over	5,83,805.57	4,54,07,677.20

**SATYENDRA NATH BOSE NATIONAL
DB 17, SECTOR I,
RECEIPTS AND PAYMENTS ACCOUNT**

Figures for the previous Year				RECEIPTS	PROJECT ACCOUNT		GENERAL ACCOUNT	
PROJECT ACCOUNT		GENERAL ACCOUNT						
Rs.	P.	Rs.	P.		Rs.	P.	Rs.	P.
6,90,285.76		2,03,65,440.09		B/F		6,38,181.17		4,78,08.763.00
6,90,285.76		2,03,65,440.09		Rs.		6,38,181.17		4,78,08,763.00

The 29th day of June, 1993.

CENTRE FOR BASIC SCIENCES

Salt Lake, Calcutta 700 064

FOR THE YEAR ENDED 31ST MARCH, 1993

Figures for the previous Year				PAYMENTS	PROJECT ACCOUNT		GENERAL ACCOUNT	
PROJECT ACCOUNT		GENERAL ACCOUNT			Rs.	P.	Rs.	P.
Rs.	P.	Rs.	P.					
4,00,022.59		1,99,70,768.19		B/F.....	5,83,805.57		4,54,07,677.20	
				Adjustable Rent			2,000.00	
				Lease Rent			27,680.00	
				BCSPIN Account			5,61,782.73	
				Advance to Santimoy Chatterjee			56,000.00	
				Building Maintenance			24,950.00	
				CLOSING CASH & BANK BALANCE				
				Cash			214.11	
2,90,263.17		335.07		Indian Overseas Bank	54,375.60		14,91,961.91	
		1,69,346.83		Salt Lake Branch			11,512.05	
				United Bank of India			2,24,985.00	
		2,24,990.00		Mayukh Bhavan Branch				
6,90,285.76		2,0365,440.09			6,38,181.17		4,78,08,763.00	

(S. K. SHARMA)

Administrative Officer

(C. K. MAJUMDAR)

Director

Satyendra Nath Bose National Centre For Basic Sciences

SCHEDULE - 'A'

a) Outstanding Liabilities (Revenue)	
1) Medical Claim	24,701.29
2) E-Mail	1,00,250.00
3) S. N. Bose Birth Centenary Expenses	1,575.00
4) Seminar & Other Academic Expenses	600.00
5) Salary & Allowances	840.30
6) Repair to Equipment	3,870.16
7) Postage & Telegram	994.00
8) Misc. Contingency Expenses	346.00
9) Academic Staff Research Expenses	490.00
10) Telephone & Trunk Calls	159.00
11) Office Maintenance	1,750.00
12) Audit Fee	6,500.00
13) Employer's Contribution to P.F.	8,204.00
b) Outstanding Liabilities (Capital) :	Rs. 1,50,279.75
Construction of Building	2,870.00
c) Outstanding Liabilities for Project :	Rs. 2,870.00
Allowance to Scientists	3,970.00
	Rs. 3,970.00
Total (a + b + c +) :Rs.	Rs. 1,57,119.75

SCHEDULE - 'B'

Security Deposit from Contractors :

1. Gannon Dunkerley & Co. Ltd.	1,76,700.83
2. Nabin Designers & Constructors (P) Ltd.	2,50,487.37
3. Ghosh, Bose & Associates	1,01,326.00
4. B.B.Construction	-
5. RoyChowdhury Construction	-
	Rs. 5,28,514.20

SCHEDULE - 'C'

Sundry Creditors :

1. Deposit from A. Mookherjee	18,000.00
2. Deposit from N. Nayak	1,250.00
3. Refundable Donation from P.Das	5,000.00
	Rs. 24,250.00

**Satyendra Nath Bose National Centre
For Basic Sciences**

SCHEDULE - 'D'

Fixed Assets	Opening Balance as on 01.04.92	Addition during the year.	Adjustment during the year.	Closing Balance as on 31.3.93.
A. Office Equipment :				
Xerox Machine	97,040.00	-	-	97,040.00
Type Writers	66,868.72	48,750.00	-	1,15,618.72
Fixograph	6,401.05	-	-	6,401.05
Calculators	933.00	-	-	933.00
Weighing Machine	1,258.15	-	-	1,258.15
Binding Machine	9,854.00	-	-	9,854.00
	Rs. 1,82,354.92	48,750.00	-	2,31,104.92
B. Guest House Furniture :				
Refrigerator	6,600.00	-	-	6,600.00
Water Heaters	4,300.00	-	-	4,300.00
Fans	1,710.00	-	-	1,710.00
Emergency Lights	1,240.00	-	-	1,240.00
Clock	135.00	-	-	135.00
Television Set	12,600.00	-	-	12,600.00
Air-Conditioning Machine	51,590.00	-	-	51,590.00
Other Furniture (Cots, Dining Table, Chairs etc.)	40,707.36	-	-	40,707.36
	Rs. 1,18,882.36	-	-	1,18,882.36
C. Small Equipment :				
Duplicating Machine	19,148.60	-	-	19,148.60
Projectors	22,164.08	-	-	22,164.08
Voltage Stabiliser	9,131.00	-	-	9,131.00
Glass Boards	7,354.00	-	-	7,354.00
Vacuum Cleaners	3,650.00	-	-	3,650.00
Franking Machines	9,289.26	-	-	9,289.26
Fax Machine	74,400.00	-	-	74,400.00
Electronic Weighing Machine	14,945.00	-	-	14,945.00
Acquaguards - SE-1000	5,000.00	-	-	5,000.00
Plastic Screen	1,212.12	-	-	1,212.12
Others	4,448.73	630.00	-	5,078.73
Punching & Binding Machine	-	10,500.00	-	10,500.00
	Rs. 1,70,742.79	11,130.00	-	1,81,872.79

**Satyendra Nath Bose National Centre
For Basic Sciences**

Fixed Assets	Opening Balance as on 01.04.92	Addition during the year.	Adjustment during the year.	Closing Balance as on 31.3.93.
D. (1) Books & Journals	8,96,036.89	4,06,707.28	-	13,02,744.17
(2) Directors Research Equipment	1,44,514.48	43,025.07	-	1,87,539.55
(3) Boundary Wall	10,38,937.20	-	-	10,38,937.20
(4) Construction of Buildings	1,01,66,206.98	1,56,22,451.68	-	2,57,88,658.66
(5) Computer (Quantum + HP 9000/5350)	13,08,680.44	-	-	13,08,680.44
(6) Computer & Accessories	3,19,087.10	1,06,412.00	-	4,25,499.10
(7) Campus Land	1,09,50,694.00	-	-	1,09,50,694.00
(8) Air-Condition Machines	1,09,474.99	-	-	1,09,474.99
(9) Campus Beautification	1,41,053.11	39,528.50	-	1,80,581.61
(10) Office Car (WNW 8486)	1,04,794.00	-	-	1,04,794.00
(11) UPS	1,22,095.21	95,590.00	-	2,17,685.21
(12) Academic Staff Research Equipment	-	49,163.77	-	49,163.77
Rs.	2,53,01,574.40	1,63,62,878.30	-	4,16,64,452.70
E. Furniture & Fixture :				
Office Furniture	3,86,849.52	1,14,077.80	-	5,00,927.32
Fans & Clocks etc.	37,153.34	10,950.00	-	48,103.34
Library Furniture	1,03,144.41	88,569.86	-	1,91,714.27
Rs.	5,27,147.27	2,13,597.66	-	7,40,744.93
F. Project Assets :				
Equipment	6,64,773.75	3,23,985.54	-	9,88,759.29
Books & Periodicals.	7,080.08	-	-	7,080.08
Rs.	6,71,853.83	3,23,985.54	-	9,95,839.37
TOTAL (A+B+C+D+E+F)	Rs 2,69,72,555.57	1,69,60,341.50	-	4,39,32,897.07

Satyendra Nath Bose National Centre For Basic Sciences

SCHEDULE - 'E'

Short Term Deposits (including Accrued & reinvested interest)

a) Indian Overseas Bank - Salt Lake Branch :

STD (91 days)	34,23,115.00	
STD (93 days)	3,39,413.00	
STD (One year)	<u>22,37,567.50</u>	60,00,095.50

b) United Bank of India - Mayukh Bhavan Branch :

STD (6 months)	31,306.00	
STD (91 days)	43,08,767.00	
STD (8 months)	29,219.99	43,69,292.99

TOTAL (a+b) Rs. 1,03,69,388.49

SCHEDULE - 'F'

Bank Balance :

a) With Indian Overseas Bank, Salt Lake Branch :

General Fund Account	14,91,961.91	
TPSC Fund Account	11,512.05	
Project Fund Account	54,375.60	
Provident Fund Account	<u>43,007.06</u>	16,00,856.62

b) With United Bank of India, Mayukh Bhavan Branch :

General Fund Account		2,24,985.00
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TOTAL (a+b) Rs. 18,25,841.62

SCHEDULE - 'G'

Advance to Suppliers and Contractors :

1. Nabin Designers & Contractors (P)Ltd.	69,11,984.44
2. Advance to CDAC	1,76,166.94
3. Godrej & Boyce Mfg. Co. Ltd.	7,548.47
4. IVP Ltd	-
5. Allied Publishers (P) Ltd.	3,06,300.00
6. H C L	18,513.00
7. Wiley Eastern Ltd.	11,000.00
8. Pertec Computer Ltd.	42,227.23
	Rs. 74,73,740.08

SCHEDULE - 'H'

Deposit for Rent :

1. N. Dasgupta	18,000.00
2. Rama De	1,250.00
3. K. Pal Chowdhury	5,000.00
4 T. B. Dey	91,500.00
5 J. B. Bhowmick	19,000.00
	Rs. 1,34,750.00

Satyendra Nath Bose National Centre For Basic Sciences

SCHEDULE - 'I'

Security Deposits :

1. West Bengal State Electricity Board	16,990.00
2. Department of Telecommunication	1,600.00
	Rs. 18,590.00

SCHEDULE - 'J'

Advance against expenses recoverable :

1. Recoverable Expenses on Seminar (PATPPA)	10,000.00
	20.00
2. Recoverable Insurance Premium	27,554.75
3. Recoverable Expenses on BCS PIN	Rs. 37,574.75

SCHEDULE - 'K'

Other Advances

1. Registrar of Bombay University	20,000.00
2. Rabin Banerjee	13,181.00
3. Festival Advance	2,440.00
4. A Mookherjee (Adjustable Rent)	2,000.00
5. Misc. Staff Advance	600.00
6. Santimoy Chatterjee	56,000.00
7. S. Manna	4,500.00
	98,721.00

SCHEDULE - 'L'

Prepaid Expenses :

1. Insurance Premium	12,772.15
2. Computer Maintenance	2,35,720.00
	2,48,492.15

SCHEDULE - 'M'

Prior Period Adjustment :

	Debits	Credits
	Rs. P.	Rs. P.
Adhoc Bonus to employees (91-92)	546.00	
Lease Rent		63,676.22
Hire of Office premises	450.00	
Employer's contribution to Provident Fund.		22,732.00
Balance transferred to Income & Expenditure Account.	85,412.22	
	86,408.22	86,408.22

Satyendra Nath Bose National Centre For Basic Sciences

SCHEDULE - 'N'

Notes on Accounts :

1. The Fixed Assets have been disclosed at historical cost without any provision for depreciation, on a consistent basis.
2. Fixed Assets of Rs. 4,39,32,897.07 as disclosed in the Balance Sheet includes Library Books and Journals valued at Rs. 13,02,744.17
3. The grants received from the Department of Science & Technology, Government of India have been accounted for on Cash basis.
4. Surplus of Grants received from Government of India for non-plan expenditure for the year has been transferred to General Fund.
5. As per consistent practice, all capital work-in-progress including Buildings under construction, plant & Machinery and Equipment pending installation have been directly debited to the asset heads instead of segregating the total amount between work completed and capital work-in-progress.
6. The Centre possesses 15,0401 acres of leasehold land out of which 10 acres had been allotted by the Government of West Bengal free of cost; a consideration of Rs. 36.30 lakhs was paid by the Department of Science & Technology directly to the Salt Lake Reclamation & Development Circle, Government of West Bengal for 5 acres, not reflected in the accounts of the Centre previously; an amount of Rs. 60,694.00 was paid by the Centre for the balance 0.0401 acres. During the last year, the 10 acres of land received free of cost; has been brought into the books at the valuation arrived at by applying the rate at which the 5 acre plot has been purchased and paid for by the Department of Science & Technology. The 5 acres plot has also been capitalized in last year. This has resulted in further capitalization of Rs. 1,08,89,999.60 during the last year; being the value of land received free of cost by the Centre in prior periods. A corresponding credit of the same amount has been taken in the Capital Fund.
7.
 - i) The Employees' Provident Fund and Gratuity Fund have not been registered/ recognized. The Schemes framed in this respect are pending approval by the Competent Authority.
 - ii) Out of the accumulated balances in the Employees' Provident Fund and the Gratuity Fund, Rs. 6,32,00.00 and Rs. 83,772.00 have been invested in separate, earmarked short term deposits with a bank. Amount of Rs. 43,007.06 and Rs. 27,617.88 are lying in Provident Fund Account and General Account with the I.O.B., Salt Lake Branch respectively.
8. No Certificates confirming the balances outstanding as at the end of the year have been obtained from the parties.
9. Certain comparative figures for the previous year in the accounts have been reclassified to conform to the current year's presentation.

