HOMI BHABHA NATIONAL INSTITUTE

ANNUAL REPORT 2008-2009

Reg. Off. : Knowledge Management Group
Bhabha Atomic Research Centre
Central Complex, Mumbai - 400 085.

HOMI BHABHA NATIONAL INSTITUTE

ANNUAL REPORT 2008-2009

Knowledge Management Group,
Bhabha Atomic Research Centre,
Central Complex, Mumbai-400 085.

1. Constituent Institutions (CIs) of the Institute

1. BHABHA ATOMIC RESEARCH CENTRE (BARC), MUMBAI
2. INDIRA GANDHI CENTRE FOR ATOMIC RESEARCH (IGCAR) , KALPAKKAM
3. RAJA RAMANNA CENTRE FOR ADVANCED TECHNOLOGY (RRCAT), INDORE
4. VARIABLE ENERGY CYCLOTRON CENTRE (VECC), KOLKATA
5. SAHA INSTITUTE OF NUCLEAR PHYSICS (SINP), KOLKATA
6. INSTITUTE FOR PLASMA RESEARCH (IPR), GANDHINAGAR
7. INSTITUTE OF PHYSICS (IOP), BHUBANESWAR
8. HARISH-CHANDRA RESEARCH INSTITUTE (HRI) , ALLAHABAD
9. TATA MEMORIAL CENTRE (TMC), MUMBAI
10. INSTITUTE OF MATHEMATICAL SCIENCES (IMSC.), CHENNAI

2. From the Director

I am happy to write for the fourth annual report of the Institute and during this year, the Institute made further progress. More students have completed their academic programmes and this includes fourteen students completing their Ph.Ds. Number of students admitted this year crossed 700. It is encouraging to note that more and more engineering graduates are enrolling for Ph.D. Number of doctorates in engineering needed in India is many times of what is being produced. While looking towards increasing enrolments, the Institute is very conscious of quality of research output and overall knowledge base of research students. Every student has to complete a Comprehensive General Examination as a part of requirements towards a Ph.D. from the Institute. This examination is meant for gauging the student's mastery of the discipline of research and also related disciplines. It is also serves as a diagnostic tool to identify weaknesses in the student's preparation for research with a view to assist the student in addressing the weaknesses.

The Government has announced setting up of eight new IITs and 30 new Central Universities. Central Government has also announced setting up of five Indian Institute of Science Education and Research and one National Institute of Science Education and Research. All the new institutes and universities will need faculty and the existing universities have to make all out efforts to increase their output of doctorates. Constituent Institutions of our Institute are well placed to do their bit as they are well endowed with research infrastructure as well as faculty. Towards this end Bhabha Atomic Research Centre (BARC) has taken one good step. To increase student enrolments, it is necessary to provide good hostel facilities. The Government has sanctioned construction of a hostel to house 500 students in Anushakti Nagar, Mumbai and it will help to increase annual intake of students to Ph.D. programme in BARC to above 100. Indira Gandhi Centre for Atomic Research has also taken steps to increase infrastructure for accommodation for research students.

M.Tech. programme is also proceeding very well and first 4 students have completed their thesis.

DAE Graduate Fellowship Scheme (DGFS) fo Ph.D. was instituted in 2005 and this year a beginning has been made for admissions to students under the scheme. Objective of the scheme is to encourage research at the interface of basic research and technology development and therefore, under this scheme, a student pursues research under the supervision of two guides, one having strength in basic research and the other in technology development. Four students have been admitted. We expect to expand enrollments under the scheme in the years to come, as research at the interface is the key to accelerate pace of technology development.

(R B Grover)

3. Annual Report 2007-2008

Composition of various bodies

Institute functioned as per the decisions taken by various bodies of the Institute. Composition of various bodies is given in the Annexure-1. It also lists officers of the Institute.

Academic Activities

The academic programmes at the CIs of HBNI were conducted as per schedule. The Annexure-2 lists the Standing Committees whereas the status of admissions during the year in various programmes in each CI is placed at Annexure-3. The list of faculty is placed at Annexure-4.

The abstracts of the theses fulfilling all the formalities for the award of the Degree of the Doctor of Philosophy are placed at Annexure-5.

The titles of M.Tech theses fulfilling all the formalities for the award of the Degree of the Masters of Technology are placed at Annexure-6.

Summarized next are the decisions taken in the meetings of Council of Management and the Academic Council during the period of the report.

A. Following meetings of the Advisory Committee (CAC) were held during the period:
   1. Second meeting on January 7, 2009, BARC, Mumbai.

B. Following meetings of Council of Management (CoM) were held during the period:
   1. Fifth meeting on July 14, 2008, BARC, Mumbai.

C. Following meetings of Academic Council (AC) were held during the period:
   1. Eighth meeting on June 28, 2008.
   2. Ninth meeting on February 18, 2009.

Important decisions taken in these meetings are summarized below.

A. Important decisions taken in the meetings of the Advisory Committee

1. It advised that the gap areas in our knowledge base be identified and the research students be deployed to work on these areas. it opined that, to that end, a panel be created under the chairmanship of Dr. Baldev Raj to work out a mechanism by which the problem of identifying gap areas could be undertaken. This would involve reaching out inter alia to specialist groups for plan projects and professional societies embedded in our units.

2. The Committee advised that the Deans-Academic be made permanent invitees to the Academic Council.

3. It advised that the convocation may be held when there is a significant number of students for the award of degrees. Till that time degrees may be awarded by post.

B. Important decisions taken in the meetings of the CoM

Fifth meeting: July 14, 2008

1. The proposal forwarded by the Academic Council to include National Institute for Science Education and Research (NISER) as eleventh Constituent Institution of HBNI was accepted. It was noted that the academic programme at NISER aims to link the Science education with Engineering and that this approach is in accordance with the objective of HBNI to link Science with Technology. It also opined that any future undergraduate programme in Engineering should likewise be linked with Science. With a view to promote further the linkages between Science and Engineering education, it opined that it would be advisable to have a common Board of Studies for undergraduate education in Science and Engineering.

2. The procedures for declaring results of various programmes were approved.

3. The authorities for signing mark sheets

4. The authorities for signing mark sheets and certificates for various programmes were identified.

5. Formats of various Degree and Diploma Certificates were approved.

6. Amendments of Ordinances recommended by the Academic Council in its 7th meeting held on November 17, 2007 were approved.

7. It was decided to seek the opinion of the Advisory Committee regarding the desirability and practicality of holding Convocation.

8. It was decided that Internal Finance Advisor, BARC shall be ex-officio Finance Officer of HBNI.

9. The Joint Secretary (R&D) and the Finance Officer, HBNI were requested to draft in consultation with Director/Dean, and present to the Chairman, CoM at the earliest, the Financial Rules including the desirability of having separate head of account for HBNI (debited presently to BRNS).

C. Important decisions taken in the meetings of the Academic Council

Eighth meeting: June 28, 2008

1. It was decided to recommend to the Council of Management (CoM) to include National Institute for Science Education and Research (NISER) as 11th Constituent Institution of HBNI.

2. It was decided to recommend to CoM to approve constituting the Board of Undergraduate Studies in Science. The number of members and other terms and conditions of the proposed board to be the same as that of the existing Board of Studies.

3. Director, NISER was requested to draft ordinances to govern the academic programmes at NISER. It was decided that, till the time the ordinances are drafted and approved, NISER may conduct academic programmes as per best practices for similar courses in the country.

4. It was decided that the candidates possessing the degree of M.Sc. by research will be eligible for registration in the Ph.D. programme. Such candidates generally will have to undertake one year course work in the Training School even if they are employees in a CI. The guidelines for exemption from part of the course work were outlined.

5. Minimum pass percentages for various courses were decided.

6. It was decided that the M.Sc. part of the integrated M.Sc.-Ph.D. programme be restricted to two years.

7. It was decided to seek the CoM's advice on the question of desirability and practicality of holding Convocation

Ninth meeting: February 18, 2009

1. Rules were formulated with respect to carrying part of Ph.D. study and research away from the University.

2. Guidelines were formulated for holding Homi Bhabha Chair and Raja Ramanna Fellowship at HBNI.

3. Memorandum of Understanding with University of Virginia was approved.

4. Video conferencing as a mode of conducting the viva-voce examination of Ph.D. candidates was approved.

5. It was decided to include the Deans-Academic at the CIs as permanent invitees to the AC.

4. Receipts & Payments for the financial year ending on 31.3.2009 are given in *Annexure* 7.

Annexure - 1

Composition of the Bodies of the Institute

Council of Management (CoM)

Dr. Anil Kakodkar Chairman, AEC	Chairman	
Shri R.C.Joshi Member Finance, AEC	Member	
Shri R. P. Agrawal Secretary Higher Education, MHRDD	Member	
Prof. Arun Nigavekar Raja Ramanna Fellow & Trustee & Senior Advisor, Science & Technology Park, University of Pune	Member	
Prof. Vinod K. Gaur India Institute of Astrophysics Bangalore	Member	
Dr. Baldev Raj Director, IGCAR	Member	
Dr. S. Banerjee Director, BARC	Member	
Dr. K.A. Dinshaw Director, TMC	Member	Till Nov. 30, 2008
Dr. R.B. Grover Director HBNI	Member	
Dr. Bikash Sinha Director, SINP	Member	
Dr. R.R. Puri Dean HBNI	Member-Secretary	

Academic Council

Prof. R.B. Grover	Chairman
Prof. S.K. Apte	Convener Board of Studies in Life Sciences

Dr. R. Badwe	Director, TMC (Since Dec. 1, 2008)
Prof. D. Balasubramanian	Director, Eye Research Foundation, Hyderabad
Prof. R. Balasubramanian	Director, IMSc
Prof. Baldev Raj	Director, IGCAR
Prof. S. Banerjee	Director, BARC
Prof. K. A. Dinshaw	Director, TMC (Till Nov. 30, 2008)
Prof. B. K. Dutta	Convener Board of Studies in Engineering Sciences
Prof. Dipan Ghosh	IIT-Bombay
Prof. P. K. Kaw	Director, IPR
Prof. E. D. Jemmis	IISc, Bangalore
Prof. P. Mohandas	Convener, Board of Health Sciences
Prof. V. Venugopal	Convener Board of Studies in Chemical Sciences
Prof. Gangan Prathap	CSIR Centre for Mathematical Modeling and Computer Simulation, Bangalore.
Dr. K. L. Ramakumar	Convener Board of Strategic Studies
Prof. A. Raychaudhuri	Director, HRI
Prof. V.C. Sahni	Director, RRCAT
Prof. Abhijit Sen	Convener Board of Studies in Physical Sciences
Prof. Bikash Sinha	Director, SINP and Director, VECC
Prof. V. S. Sunder	Convener Board of Studies in Mathematical Sciences
Prof. Y. P. Viyogi	Director, IoP
Prof. R. R. Puri	Member Secretary

Advisory Committee

Dr. Anil Kakodkar Chairman, AEC	Chairman
Dr. R. A. Badwe Director, TMC	Member (Since Dec. 1, 2008)
Prof. R. Balasubramanian Director, IMSc	Member
Prof. Baldev Raj Director, IGCAR	Member
Prof. S. Banerjee Director, BARC	Member
Prof. M. Barman Director, TIFR	Member
Prof. T. K. Chandrashekar Director, NISER	Member
Prof. K.A. Dinshaw Director, TMC	Member (Till Nov. 30, 2008)
Prof. R. B. Grover Director, HBNI	Member
Prof. P. K. Kaw Director, IPR	Member
Prof. A. Raychaudhury Director, HRI	Member
Prof. V.C. Sahni Director, RRCAT	Member
Prof. Bikash Sinha Director, VECC and Director, SINP	Member
Prof. Y. P. Viyogi (from April 06) Director, IoP	Member
Prof. R. R. Puri Dean, HBNI	Member-Secretary
Dr. P. Mukherjee JS (R&D)	Invitee

Board of Studies of HBNI

Physical Sciences

1. Prof. Abhijit Sen (IPR) Convener
2. Prof. V.M. Datar (BARC)
3. Prof. C.S. Sunder (IGCAR)
4. Prof. Dinesh Srivastava (VECC)
5. Prof. Avinash Khare (IOP)
6. Prof. P.D. Gupta (RRCAT)
7. Prof. A. Raychaudhari (HRI)
8. Prof. Kamles Kar (SINP)
9. Prof. Gautam Menon (IMSc)
10. Prof. Srinivas Ramakrishnan (TIFR) Since January, 2008

Chemical Sciences

1. Dr. V. Venugopal (BARC) Convener
2. Dr. J.V. Yakhmi (BARC)
3. Dr. V.K. Manchanda (BARC)
4. Prof.. Swapan Ghosh (BARC)
5. Dr. K.S. Viswanathan (IGCAR)
6. Dr. T. Gnanasekaran (IGCAR)
7. Dr. V.K Jain (BARC)
8. Prof. P.N.Bajaj (BARC) Since January, 2008.

Life Sciences

1. Prof. S.K. Apte (BARC)
   Convener
2. Dr. (Mrs.) S.M. Zingde (TMC)
3. Dr. S.F. D'Souza (BARC)
4. Prof. J.K. Dattagupta (SINP)
5. Prof. Rita Mulherkar (TMC))
6. Prof. M.Seshadri (BARC))
7. Prof. A.K.Sharma (BARC)) From Jan, 2008
8. Prof. B.J.Rao (TIFR))

Engineering Sciences

1. Prof. B.K. Dutta(BARC) Convener
2. Dr. S.B. Koganti (IGCAR)
3. Dr. P.K. Vijayan (BARC) From Jan, 2008
4. Dr. D. Sathiyamoorthy (BARC)
5. Prof. A.P. Tiwari (BARC)
6. Dr. A. K. Suri (BARC)
7. Dr. Kamachi Mudali (IGCAR)
8. Dr. M.S. Bhatia (BARC)
9. Dr. P.V. Varde (BARC)
10. Dr. Debranjan Sarkar (VECC)

Mathematical Sciences

1. Prof. V.S. Sunder (IMSc)
   Convener
2. Prof. S. Kesavan (IMSc)
3. Prof. S.D. Adhikari (HRI)
4. Dr. R.R. Puri (BARC)
5. Prof. R. Ramanujam (IMSc)
6. Dr. N. Raghwendra (HRI)
7. Prof. R.C.Cowsik (MU))
8. Prof. Murali Srinivasan (IIT-B)) From Jan, 2008
9. Prof. Madhav Mukund (CMI))

Strategic Studies

1. Dr. K.L. Ramakumar (BARC) Convener
2. Dr. A.K. Kohli (BRIT)
3. Dr. Subhash Chandra (DAE)
4. Dr. B.B. Singh (ex-BARC and Scientific Advisor, High Court Mumbai)
5. Prof. Rangan Banerjee (IIT-Bombay)

Board of Health Sciences (Constituted in January, 2008)

1. Prof. K.Mohandas (TMC)
2. Prof. K.B.Sainis (BARC)
3. Dr. Rajiv Sarin (TMC)
4. Dr. S.K.Srivastava (TMC)
5. Dr. R.A.Badwe (TMC)
6. Dr. P.M.Parikh (TMC)
7. Dr. N. Jambekar (TMC)
8. Prof. Shobha Bhatia (KEM)
9. Prof. Avinash Supe (KEM)
10. Dr. M.G.R.Rajan (BARC)

Officers of the Institute

Academic

Prof. R.B. Grover	Director
Prof. R.R. Puri	Dean
Dr. R.P. Patel	Associate Dean (w.e.f. 4.6.2008)

Administrative and Accounts

Shri A. Ramaiah	Finance Officer
Shri D. Ramesh	Administrative officer (Till 10.8.2008)
Shri K. Padmanabhan	Administrative Officer (Since 11.8.2008)
Shri Mahabir Singh	Accounts Officer

Deans-Academic at the CIs

BARC

Prof. S.K. Apte - Life Sciences
Prof. B.K. Dutta - Engineering Sciences
Prof. V.M. Datar - Physical Science
Prof. Swapan Ghosh - Chemical Sciences

IGCAR
Prof. K.S. Viswanathan

RRCAT
Dr. S.C. Mehendale

VECC
Dr. P. Barat

SINP
Prof. Parthasarathi Majumdar

IPR
Prof. Abhijit Sen

IoP
Prof. Avinash Khare

TMC
Dr. K.M. Mohandas

IMSc
Prof. S. Kesavan - Mathematical Sciences
Prof. R. Jagannthan - Physical Sciences

HRI
Prof. Biswarup Mukhopadhyaya

Annexure - 2

Standing Committees

BARC Standing Committees

Physical Sciences and Mathematical Sciences

1.	Dr. J.V. Yakhmi	Chairman
2.	Dr. S. Kailas	Member
3.	Dr. R.K. Choudhury	Member
4.	Dr. S.L. Chaplot	Member
5.	Dr. B.N. Jagtap	Member
6.	Dr. S.M. Sharma	Member
7.	Dr. (Smt.) L.J. Dhareshwar	Member
8.	Dr. K.C. Mittal	Member
9.	Dr. S.C. Sabharwal	Member
10.	Dr. R. Srivenkatesan	Member
11.	Dr. D.N. Sharma	Member
12.	Dr. D.P. Chakravarthy	Member
13.	Dr S.V.G. Menon	Member
14.	Dr. V.M. Datar	Convener

Chemical Sciences

1.	Dr. V. Venugopal	Chairman
2.	Dr. T. Mukherjee	Member
3.	Dr. S.K. Kulshreshtha	Member
4.	Dr. B. Venkatramani	Member
5.	Dr. S.K. Sarkar	Member
6.	Dr. S.V. Narsimhan	Member
7.	Dr. J. Arunachalam	Member
8.	Dr. (Smt.) Meera Venkatesh	Member
9.	Dr. V.K. Manchanda	Member
10.	Dr. K.L. Ramkumar	Member
11.	Dr. S.K. Aggarwal	Member
12.	Dr. S. Sabharwal	Member
13.	Dr. S.K. Ghosh	Convener

Life Sciences

1.	Dr. K.B. Sainis	Chairman
2.	Dr. S.F. D'Souza	Member
3.	Dr. M. Seshadri	Member
4.	Dr. A.K. Sharma	Member
5.	Dr. M.G.R. Rajan	Member
6.	Dr. M.V. Hosur	Member
7.	Dr. S.K. Apte	Convener

Engineering Sciences & Strategic Studies

1.	Dr. A.K. Suri	Chairman
2.	Dr. L.M. Gantayet	Member
3.	Dr. R.K. Singh	Member
4.	Dr. P.K. Vijayan	Member
5.	Dr. A.P. Tiwari	Member
6.	Dr. M.S. Bhatia	Member
7.	Dr. P. Varde	Member
8.	Dr. D. Sathiyamoorthy	Member
9.	Dr. V.K. Suri	Member
10.	Dr. B.K. Dutta	Convener

RRCAT Standing Committee

1.	Dr. P.D. Gupta	Chairman
2.	Shri S. Kotaiah	Member
3.	Dr. P.K. Gupta	Member
4.	Dr. A.K. Nath	Member
5.	Dr. L.M. Kukreja	Member
6.	Shri C.P. Navathe	Member
7.	Dr. G.S. Lodha	Member
8.	Dr. S.B. Roy	Member
9.	Dr. S.C. Mehendale	Convener

IGCAR Standing Committees

Physical Sciences

1.	Dr. C.S. Sundar	Chairman
2.	Dr. R. Indira	Member
3.	Dr. P. Mohanakrishnan	Member
4.	Dr. A.K. Arora	Member
5.	Dr. K.G.M. Nair	Member
6.	Dr. A.K. Tyagi	Member
7.	Dr. P.V. Sivaprasad	Member
8.	Dr. N. Subramanian	Member
9.	Dr. H.K. Saha	Member
10.	Dr. M. Sai Baba	Member
11.	Dr. K.S. Viswanathan	Member
12.	Dr. G. Amarendra	Convener

Chemical Sciences

1.	Dr. T. Gnanasekaran	Chairman
2.	Dr. T.G. Srinivasan	Member
3.	Dr. S.B. Koganti	Member
4.	Dr. V. Ganesan	Member
5.	Dr. K. Nagarajan	Member
6.	Dr. U. Kamachi Mudali	Member
7.	Dr. S. Anthonysamy	Member
8.	Dr. K.V.G. Kutty	Member

9.	Dr. A. Bharathi	Member
10.	Dr. M. Sai Baba	Member
11.	Dr. K.S. Viswanathan	Convener

Engineering Sciences

1.	Dr. T. Jayakumar	Chairman
2.	Dr. P. Chellapandi	Member
3.	Dr. S.B. Koganti	Member
4.	Dr. A.K. Bhaduri	Member
5.	Dr. P.V. Sivaprasad	Member
6.	Dr. U. Kamachi Mudali	Member
7.	Dr. C. Anand Babu	Member
8.	Dr. K. Velusami	Member
9.	Dr. B.P.C. Rao	Member
10.	Dr. B.K. Panigrahi	Member
11.	Dr. K.S. Viswanathan	Member
12.	Dr. M. Sai Baba	Convener

VECC Standing Committee

1.	Dr. R.K. Bhandari (Director, VECC)	Chairman
2.	Dr. D.K. Srivastava	
3.	Dr. S. Pal	
4.	Shri Subimal Saha	
5.	Shri Jayanta Chaudhuri	
6.	Dr. D Sarkar (Convener, Engineering Sciences)	
7.	Dr. Alok Chakraborty	
8.	Dr. S. Bhattacharya	
9.	Dr. S. R. Banerjee	
10.	Dr. P. Barat (Convener, Physical Sciences)	
11.	Dr. V.S. Pandit	
12.	Dr. Jane Alam	
13.	Dr. (Smt.) Paramita Mukherjee	

Annexure - 3

Admission Statistics

HOMI BHABHA NATIONAL INSTITUTE
Admissions: 2008-09

S. No.	Programme	BARC	IGCAR	RRCAT	VECC	SINP	IPR	IOP	HRI	TMC	IMSc	TOTAL
1	PGD*	233	43	17	0	0	0	0	0	0	0	293
2	PGDRM	9	0	0	0	0	0	0	0	0	0	9
3	PGDMRIT	6	0	0	0	0	0	0	0	0	0	6
4	DipRP	28	0	0	0	0	0	0	0	0	0	28
5	M. Sc. (Engg.)	7	9	0	0	0	0	0	0	0	0	16
6	M. Tech.	65	27	12	6	0	0	0	0	0	0	110
7	M. Phil.	6	0	1	0	0	0	0	0	0	0	7
8	Ph. D. (Engg.)	20	31	0	1	0	0	0	0	0	0	52
9	Ph. D. (Phys.)	32	14	10	4	5	2	8	5	0	5	85
10	Ph. D. (Chem.)	29	14	0	0	0	0	0	0	0	0	43
11	Ph. D. (Life)	13	0	0	0	2	0	0	0	14	0	29
12	Ph. D. (Math.)	0	0	0	0	0	0	0	0	0	6	6
13	Ph. D. (Hlth.)	0	0	0	0	0	0	0	0	0	0	0
14	Ph. D. (Stra.)	0	0	0	0	0	0	0	0	0	0	0
15	I. PhD (Phys.)	0	0	0	0	0	0	0	3	0	0	3
16	I. PhD (Math.)	0	0	0	0	0	0	0	0	0	3	3
17	M. Ch.	0	0	0	0	0	0	0	0	2	0	2
18	M. D.	0	0	0	0	0	0	0	0	16	0	16
19	D. M.	0	0	0	0	0	0	0	0	2	0	2
20	D. A.	0	0	0	0	0	0	0	0	4	0	4
Total		448	138	40	11	7	2	8	8	38	14	714

Total-PhD No.: 221
Actual Admission No.: 714-(MTech+MPhil) No.= 597
PGD: Post Graduate Diploma in Nuclear Science and Engineering
DRM: Diploma in Radiation Medicine
DMRIT: Diploma in Medical Radio Isotope Techniques
Dip. R. P.: Diploma in Radiological Physics
M. Tech: Master of Technology
M. Phil: Master of Philosophy
M. Sc. (Engg.) : Master of Science (Engineering)
Ph. D.: Engineering, Physics, Chemistry, Life, Mathematics, Health and Strategic Studies
IPhD: Integrated Ph. D.
M. Ch.: Surgical Oncology
MD: Pathology, Radiotherapy, Anaesthesia
DM: Medical Oncology
DA: Diploma in Anaesthesia
*** No. under BARC includes Students fro BARC Training Schools at Hyderabad, Tarapur, Rawatbhata, Kaiga, Kalpakkam and Kudankulam**
 # Refers to Students who have upgraded enrolment from PGD to M. Tech./ M. Phil. subsequent successfully completing course work for PGD

Annexure - 4

Faculty List 2007 (Up to March 2009)

BARC

Chemical Sciences

1. Acharya R.
2. Achutan P.V.
3. Adhikari S.
4. Agarwal S.K.
5. Arunachalam J.
6. Bajaj P.N.
7. Banerjee Aparna
8. Banerjee (Smt.) S.
9. Bharadwaj (Smt.) S.R.
10. Chattopadhyay A.
11. Chattopadhyay S.
12. Chaurasia S.C.
13. Das D.
14. Dash S.
15. Deo M.N.
16. Ganguly R.
17. Ghosh S.K.
18. Ghosh Swapan
19. Goswami A.
20. Jaikumar Sunil
21. Jain V.K.
22. Jha S.K.
23. Kalsi P.C.
24. Kapoor Sudhir
25. Kayasth S.R.
26. Krishnamurthy N.
27. Kshirsagar R.J.
28. Kulshreshtha S.K.
29. Majumder C.
30. Manchanda V.K.
31. Meera Venkatesh (Smt.)
32. Mohapatra P.K.
33. Mukherjee S.K.
34. Mukherjee T.
35. Naik D.B.
36. Naik P.D.
37. Narasimhan S.V.
38. Natrajan V.
39. Nayak S.K.
40. Padmanabhan P.V.A.
41. Pal H.D.
42. Palit D.K.
43. Pathak P.N.
44. Pandey A.K.
45. Pandit Gouri G.
46. Parathasarthy V.
47. Pillai C.G.S.
48. Priyadarshini (Smt.) K.I.
49. Pujari P.K.
50. Ramakumar K.L.
51. Rangarajan S.
52. Reddy A.V.R.
53. Sabharwal Sunil
54. Samanta S.K.
55. Sarkar S.K.
56. Sinha P.K.
57. Shashikala K.
58. Shivanna K.
59. Sudarshan V.
60. Tomar B.S.
61. Tripathi R.M.
62. Tyagi A.K.
63. Varshney Lalit
64. Vatsa R.K.
65. Velmurugan S.
66. Venkataramani B.
67. Venkateswaran G.
68. Venugopal V.
69. Yakhmi J.V.

Engineering Sciences

1. Auluck S.K.H.
2. Awasthi A.
3. Badodkar D.N.
4. Balasubramaniam R.
5. Banerjee S.
6. Bhatia M.S.
7. Bidaye A.C.
8. Chakraborty S.P.
9. Chattopadhyay J.
10. Chkaravarthy J.K.
11. Das R.
12. Dey G.K.
13. Dutta B.K.
14. Gantayet L.M.
15. Ghosh A.K.
16. Ghorui Srikumar
17. Gopika Vinod
18. Grover R.B.
19. Hubli R.C.
20. Kain V.
21. Kale G.B.
22. Kapoor Rajiv

23. Kar D.C.
24. Khan K.B.
25. Krishnan J.
26. Kulkarni U.D.
27. Kutty T.R.G.
28. Madan V.K.
29. Maheswari N.K.
30. Nagesh K.V.
31. Nayak A.K.
32. Pande D.P.
33. Patankar V.H.
34. Prasad G.J.
35. Ramanathan S.
36. Rami Reddy G.
37. Ravindranath S.V.G.
38. Roy S.B.
39. Saravana Kumar U.
40. Sathiyamoorthy D.
41. Sengupta A.K.
42. Singh J.B.
43. Singh R.K.
44. Singh R.N.
45. Srivastava D.
46. Suri A.K.
47. Suri V.K.
48. Taliyan S.S.
49. Tewari P.K.
50. Tewari R.
51. Tiwari A.P.
52. Topkar Amita V.
53. Vaidya P.P.
54. Varde P.V.
55. Vijayan P.K.
56. Vinod Kumar A.

Life Sciences

1. Apte S.K.
2. Balakrishnan Sreedevi
3. Bandekar J.R.
4. Bhagwat S.G.
5. Chaubey R.C.
6. Chaudhari Pradip
7. D'Souza S.F.
8. Das Birajlakshmi
9. Devasagayam T.P.A.
10. Dongre T.K.
11. Fulzele D.P.
12. Ganapathi T.R.
13. Gopalakrishna T.
14. Grace Samuel
15. Hosur M.V.
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18. Jawali Narendra
19. Kale S.P.
20. Kamat J.P.
21. Lebana J. Joseph (Smt.)
22. Malini (Smt.) Krishna
23. Melo J.S.
24. Meera Venkatesh
25. Minal Mhatre (Smt.)
26. Misra Hari S.
27. Mukherjee P.K.
28. Narkar Archana
29. Poduval T.B.
30. Rao T.S.
31. Rajan M.G.R.
32. Roja Gopalakrishnan (Smt.)
33. Sainis (Smt.) J.K.
34. Sainis K.B.
35. Satpathy K.
36. Seshadri M.
37. Sharma A.K.
38. Susan (Smt.) Eapen
39. Suprasanna P.
40. Venugopalan V.P.
41. Vinay Kumar
42. Warrier Prasad

Physical Sciences

1. Amitabh Das
2. Aswal D.K.
3. Aswal V.K.
4. Auluck S.K.H.
5. Basu S.
6. Bhanumurthy K.
7. Bhattacharyya D.
8. Biswas D.
9. Biswas D.C.
10. Biswas D.J.
11. Chaplot S.L.
12. Choudhury N.
13. Choudhury R.K.
14. Chougaonkar M.P.
15. Das A.K.

16. Dasgupta K
17. Deb S.K.
18. Debnath A.K.
19. Deo M.N.
20. Degweker S.B.
21. Dhareshwar L.
22. Gadkari S.C.
23. Gaitonde D.M.
24. Ganesan S.
25. Ghorui Srikumar
26. Godbole S.V.
27. Godwal B.K.
28. Goswami B.K.
29. Gupta S.C.
30. Gupta S.K.
31. Gupta N.K.
32. Jagtap B.N.
33. Jain S.R.
34. John B.V.
35. Kailas S
36. Kaushik T.C.
37. Kher R.K.
38. Kothiyal G.P.
39. Kshirsagar R.J.
40. Kulkarni U.D.
41. Manohar K.G.
42. Mayya Y.S.
43. Mazumdar S.
44. Mehboob S.A.H.
45. Menon S.V.G.
46. Mishra A.P.
47. Mohanty A.K.
48. Mukherjee G.D.
49. Mukhopadhyay R.
50. Nakhate S.G.
51. Panakkal J.P.
52. Pant L.M.
53. Puri R.R.
54. Raju V.S.
55. Rannot R.C.
56. Rao Mala N.
57. Rao P.M.
58. Rao T.V.C.
59. Ravikumar G.
60. Ray A.K.
61. Sahoo N.K.
62. Sakuntala T
63. Sangeeta
64. Sapra B.K.
65. Sarkar P.K.
66. Sastry U
67. Satyaranjan Santra
68. Saxena Alok
69. Sharma S.M.
70. Shrivastava Aradhana
71. Shukla P
72. Sinha Amar
73. Sinha S (Smt.)
74. Srivastava G.K.
75. Sundararaman M.
76. Suresh Kumar D.
77. Singh Pitamber
78. Tickoo A.K
79. Thakur K.B.
80. Vijaikumar V
81. Vinay Kumar
82. Wagh A.G.
83. Yusuf S.M.

Strategic Studies

1. Grover R.B.
2. Ramakumar K.L.
3. Vijai Kumar

HRI

Physical Sciences

1. Bagla J.S.
2. Choubey (Smt.) Sandhya
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5. David Justin R.
6. Gandhi Raj
7. Ghoshal Debashis
8. Gopakumar Rajesh
9. Gopalakrishnan Manoj
10. Goswami S.
11. Jatkar Dileep P.
12. Majumdar Pinaki
13. Mukhopadhyaya B.
14. Naik S.
15. Panda Sudhakar
16. Pareek T.P.
17. Rao (Smt.) Sumathi
18. Ravindran V.

19. Raychaudhuri Amitava
20. Sen Ashoke
21. Sen Prasenjit
22. Sriramkumar L.

Mathematical Sciences

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2. Batra Punita
3. Chakraborty Kalyan
4. Dalawat Chandan Singh
5. Dey Rukmini
6. Raghavendra N.
7. Ramakrishnan B.
8. Ratnakumar P.K.
9. Surya Ramana D.
10. Thangadurai R.

IGCAR

Chemical Sciences

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3. Kamachi Mudali (Smt.) U.
4. Mallika(Smt.) C.
5. Nagrajan K.
6. Panigrahi B.S.
7. Ponraju D.
8. Sai Baba M.
9. Satpathy K.K.
10. Srinivasan T.G.
11. Vasudeo Rao P.R.
12. Viswanathan K.S.
13. Viswanathan R.

Engineering Sciences

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2. Baldev Raj
3. Bhaduri A.K.
4. Chellapandi P.
5. Dasgupta Arup
6. Dayal R.K.
7. Jayakumar T.
8. Kamachi Mudali
9. Mathew M.D.
10. Purna Chandra Rao B.
11. Ramachandran D.
12. Sivaprasad P.V.
13. Valsan M.
14. Velusamy K.
15. Venugopal S.

Physical Sciences

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3. Baskaran R.
4. Bharathi A.
5. Chandra Shekar N.V.
6. Dasgupta Arup
7. Dash S.
8. Indira (Smt.) R.
9. John Philip
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11. Kuppusami P
12. Mathi Jaya S.
13. Mohanakrishnan P.
14. Mohankumar N.
15. Murthy K.P.N.
16. Nair Muraleedharan K.G.
17. Panigrahi B.K.
18. Raghavan G.
19. Ramachandran Divakar
20. Ravindran T.R.
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22. Sahu Ch. P.
23. Sahu H.K.
24. Sankar P.
25. Subramanian N.
26. Sunder C.S.
27. Tata B.V.R.
28. Tyagi Ashok Kumar
29. Venkatesan R.
30. Vijayalakshmi M.

IMSc

Engineering Sciences

1. Mahajan Meena B.
2. Subramanian C.R.
3. Venkatesh Raman

Mathematical Sciences

1. Arvind V.
2. Balasubramanian R.

3. Chakraborty Partha Sarathi
4. Chatterjee Pralay
5. Iyer (Smt.) Jaya N.
6. Kesavan S.
7. Kodiyalam Vijay
8. Krishna M.
9. Lodaya Kamal
10. Mahajan Meena
11. Mohari Anilesh
12. Mukhopadhyay Anirban
13. Nagaraj D.S.
14. Paranjape Kapil
15. Prasad Amritanshu
16. Raghavan K.N.
17. Ramanujam R.
18. Sankaran Parameswaran
19. Srivinvas K.
20. Subramanian C.R.
21. Sunder V.S.
22. Venkatesh Raman

Physical Sciences

1. Adhikari Ronojoy
2. Anishetty R
3. Baskaran G
4. Basu R
5. Date G.D.
6. Digpal S
7. Ghosh Sibasish
8. Govindarajan T.R.
9. Indumathi D
10. Jagannathan R
11. Kalyana Rama S
12. Kaul R.K.
13. Mishra A.K.
14. Murthi M.V.N.
15. Rajesh R
16. Ray P
17. Saratchandra H.S.
18. Sathiapalan B
19. Shankar R
20. Siddharthan R
21. Simon R
22. Sinha N
23. Sinha R
24. Sitabhra Sinha
25. Sudeshna Sinha
26. Vemparala Satyavani

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1. Chaturvedi Shashank
2. Pathak Surya Kumar

Physical Sciences

1. Anurag Shyam
2. Bora Dhiraj
3. Chattopadhyay Prabal
4. Chaturvedi Shashank
5. Das (Smt.) Amita
6. Ghosh Joydeep
7. Kaw P.K.
8. Mukherjee Subroto
9. Rajaraman Ganesh
10. Raole P.M.
11. Reddy Chenna D.
12. Sen Abhijit
13. Sengupta Sudip
14. Srinivasan R.
15. Vinay Kumar

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2. Alok Kumar
3. Bhattacharjee Somendra M.
4. Dev Bhupendra Nath
5. Jayannavar A.M.
6. Khare Avinash
7. Kundu Kalyan
8. Mahapatra Durga Prasad
9. Mishra Suresh G.
10. Mukherji Sudipta
11. Patra Suresh Kumar
12. Ravi Prasad G.V.
13. Sahu P.K.
14. Sahu S.N.
15. Satyam Parlapalli V.
16. Sekhar Biju R.
17. Som Tapobrata
18. Srivastava Ajit M.

19. Tripathy Gautam
20. Varma Shikha
21. Viyogi Y.P.

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Chemical Sciences

1. Das K.

Life Sciences

1. Dube Alok
2. Sharma (Smt.) Mrinalini

Physical Sciences

1. Banerjee Arup
2. Bartwal Kunwal Singh
3. Chakrabarti (Smt.) Aparna
4. Chattopadhyay M.K.
5. Ganesamoorthy S.
6. Ghosh Harnath
7. Gupta P.K.
8. Gupta, P.D.
9. Gupta S.M.
10. Ingale Alka
11. Joshi Mukesh
12. Krishnagopal S.
13. Kukreja L.M.
14. Lodha G.S.
15. Majmumdar Shovan
16. Mehandale S.C.
17. Naik P.A.
18. Nath Ashish K.
19. Oak S.M.
20. Rai V.N.
21. Rawat H.S.
22. Roy S.B.
23. Sahni V.C.
24. Senecha V.K.
25. Shailendra Kumar
26. Tiwari V.S.

Engineering Sciences

1. Chatterjee Sanjil
2. Nath A.K.

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Chemical Sciences

1. Basu Samita
2. Bhattacharya Dhananjay
3. Chakraborti Abhijit
4. Ganguly Bichitra
5. Lahiri Sushanta
6. Nayak (Smt.) Dalia

Engineering Sciences

1. Mukhopadhyay Supratik

Life Sciences

1. Chakrabarti Abhijit
2. Chandana Chakrabarti
3. Bhattacharya Dhananjay
4. Mukhopadhyay Debashis
5. Sampa Biswas
6. Udayaditya Sen

Physical Sciences

1. Agrawal Bijay Kumar
2. Bandyopadhyay Debades
3. Banerjee Sangam
4. Basu Chinmay
5. Bhattacharjee Pijushpani
6. Bhattacharyya Gautam
7. Chakrabarti Nikhil
8. Chattopadhyay Sukalyan
9. De Asit K.
10. Ganguly Bichitra
11. Ghosh Amit
12. Gupta Sankar Kumar
13. Ghoshal Ambar
14. Harindranath A.
15. Iyengar Sekar A.N.
16. Kar Kamles
17. Kundu Anjan
18. Majumdar Debasish
19. Majumdar Harashit
20. Majumdar Nayana
21. Majumdar Parthasarathi
22. Mathews Prakash
23. Menon K.S.R.
24. Mitra Parthasarathi

25. Mustafa M.G.
26. Nambissan P.M.G.
27. Nandy Maitreyee
28. Ranganathan R.
29. Ray Nihar Ranjan
30. Roy Shibaji
31. Samanta Chhanda
32. Sanyal Milan Kumar
33. Sengupta Krishnendu
34. Singh Harvendra
35. Sinha Bikash

TMC

Chemical Sciences

1. Pakhale S.S.

Life Sciences

1. Bose Kakoli
2. Chandan Kumar
3. Chiplunkar (Smt.) S.V.
4. Dalal S.N.
5. Desai (Smt.) Sangeeta B.
6. Deshpande DD
7. Dinshaw K.A.
8. Gude Rajiv
9. Gupta Sanjay
10. Jambhekar N.A.
11. Joshi Narendra N.
12. Kadam (Smt.) P.S. Amare
13. Kalraiya Rajiv D.
14. Kelkar Rohini
15. Mahimkar Manoj B.
16. Maru Girish B.
17. Mohandas K. Mallah
18. Mulherkar (Smt.) Rita
19. Mukhopadhyaya Rabindranath
20. Muralikrishna C.
21. Naik(Smt.) Nishigandha R.
22. Prasanna Venkatraman
23. Rai (Smt.) Rekha
24. Sarin Rajiv
25. Shirsat (Smt.) Neelam V.
26. Teni Tanuja R.
27. Vaidya Milind M.
28. Verma Ashok K.
29. Zingde (Smt.) S.M.

VECC

Chemical Sciences

1. Das Satyen K.
2. Sen Pintu

Engineering Sciences

1. Mukherjee Paramita
2. Sarkar Debranjan

Physical Sciences

1. Bandyopadhyay S.K.
2. Banerjee S.R.
3. Banerjee G.N.
4. Barat P.
5. Basu D.N.
6. Bhandari R.K.
7. Bhattacharaya (Smt.) Chandana
8. Bhattacharya Sailajananda
9. Chakrabarti Alok
10. Chattopadhyay Subhasis
11. Chaudhuri A.K.
12. De Udayan
13. Jan-e-Alam
14. Md.Haroon Rashid
15. Mohanty Bedangdas
16. Mukhopadhyay Tapan
17. Pal Santanu
18. Pandit V.S.
19. Rashid M.H.
20. Ray Amlan
21. Sarkar Sourav
22. Sarma P.R.
23. Srivastava Dinesh Kumar

Annexure - 5

Abstracts of Ph.D. Theses

HOMI BHABHA NATIONAL INSTITUTE

1. Rajeev Kapri

Enrolment No.	: PHYS07200604001
Constituent Unit	: Institute of Physics, Bhubaneswar
Date of award of Provisional Degree	: 21.4.2008
Title of Thesis	: Unzipping Transition of Adsorbed Polymer and DNA

Abstract

We study the unzipping of a double stranded DNA (dsDNA) and an adsorbed polymer under the inuence of a pulling force. We consider pulling at a fraction s ($0 \leq s \leq 1$) on the dsDNA from one end, and obtain the complete phase diagrams in both the fixed distance and the fixed force ensembles by using exact analytical and numerical techniques. We find that for $s < 1$ case, the phase diagrams show strong ensemble dependence even in the thermodynamic limit. We study various thermodynamic quantities like the extensibility, the length of the unzipped segment of a Y-fork, the specific heat etc., and suggest a procedure, which uses the finite size scaling of these quantities, to obtain the thermodynamic phase boundaries from finite chain lengths. We also study the effect of single stranded binding proteins on DNA unzipping by modelling it by randomly oriented force of zero mean. We find that the ground state develops bubbles of various lengths that grow as the random force fluctuation is increased resulting the unzipping of dsDNA. In contrast to the pure case, this unzipping is a continuous phase transition. We also study the unzipping of a homogeneous polymer adsorbed on the soft- and the hard-wall in the pure as well as in the random medium. We obtain the phase diagrams and the probability distributions for various quantities, for the random medium case, such as the unzipped length, first bubble length, spacer length etc. The unzipping of a dsDNA by pulling only a single strand is also studied. We find that, above some temperature, the dsDNA can be unzipped even by pulling a single strand if the force exceeds a critical value. The phase diagram, in the presence of an attractive surface (can be a membrane that plays an important role in DNA replication) near the dsDNA, gets modified drastically with four different phases and a critical end point.

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2. Ved Prakash Gupta

Enrolment No.	: MATH10200604003
Constituent Unit	: Institute of Mathematical Sciences, Chennai
Date of award of Provisional Degree	: 12.8.2008 (28.11.2009)
Title of Thesis	: Planar Algebra of the Subgroup-Subfactor

Abstract

Introduction: For the so called extremalinclusions of II1-factors $N \subset M$ with finiteJones'index, in order to have a better understanding of its standard invariant, Jones,in[Jon],introduced the combinatorial structure of a planar algebra on its tower of relative commutants $C = N \cap N \subset N \cap M \subset \cdots \subset N \cap Mk \subset \cdots$. This planar algebra structure is unique with respect to certain conditions to be satisfied by a set of tangle maps (corresponding to a 'generating' set of tangles) and is usually denoted by $P^{N}C^{M.}$

Subgroup-Subfactor: We consider an outer action α of a finite group G on the hyperfinite II1-factor R, which, by the crossed product construction, yields a II1 - factor $R \rtimes \alpha$ G. If H is any subgroup of G, we obtain a pair of II1-factors $R \rtimes \alpha_{|H}$ H $\subset$ R $\rtimes$ α G usually called a subgroup - subfactor.

In addition to subgroup-subfactor, such a group action also yields the fixed subfactor $R^G \subset R^H$, which is also the 'dual' of the subgroup-subfactor $R \rtimes H \subset R \rtimes G$.

To every finite bipartite graph with as pinfunction, Jones,in[Jon00],associated a planar algebra and called it the planar algebra of that graph. Planar Algebra of the Subgroup-Subfactor. We begin with an exhibition of a model for the tower of basic constructions, and thereafter for the standard invariant, of the subgroup-subfactor in terms of matrix algebras of operators. We then introduce the notion of group action on a ?nite bipartite graph with a spin function and analyse its implications on the (Jones') planar algebra associated to it.

Once all the requisites are formalized, we obtain an identification between the planar algebra of the subgroup-subfactor $R \rtimes H \subset R \rtimes G$ and the G-invariant planar subalgebra of the planar algebra of the bipartite graph $\star$ n (the bipartite graph with n even vertices all connected by single edges to one odd vertex) and an appropriate spin function.

In addition to this theorem and some immediate corollaries to it, a similar identification for the planar algebra of the fixed subfactor $R^G \subset R^H$ was also established.

The thesis concluded with some questions that arise naturally from the work accomplished therein. Appendix. Apart from the above work, an attempt was also made to understand the rotation map, that appears in [Jon], in terms of Ocneanu's paragroup [Ocn88, Ocn91], which has been discussed in the appendix. The motivation behind this work was to obtain a bridge between the Jones' planar algebras and Ocneanu's paragroups.

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Publication(s)

1. Planar Algebra of the Subgroup-Subfactor. Proc. IndianAcad. Sci. (Math. Sci.);Vol118(4), 2008, pp. 583-612.

3. Aaloka Kanhere

Enrolment No.	: MATH10200604001
Constituent Unit	: Institute of Mathematical Sciences, Chennai
Date of award of Provisional Degree	: 12.8.2008
Title of Thesis	: Some Explicit Minimal Graded Free Resolutions

Abstract

Let P^n be n⁻ dimensional projective space over a field K. Let $\sigma : P^2 \rightarrow P^5$ be the embedding given by the complete linear system of quadrics. Let S be the homogenous coordinate ring of P^5 . It is known that given a finitely generated graded S module M one can construct a minimal free resolution of M. But in general, it is quite hard to construct the minimal free resolutions and there are not many explicit examples.

For a subscheme T of P^2 , the homogenous ideal of all homogenous polynomials in S vanishing on σ (T) is denoted by $I\sigma$ (T).

In this thesis the explicit resolutions of were obtained for the following cases:
1) $S/I\sigma(C)$, where C is a curve in P^2.
2) $S/I\sigma(E)$, where E is a zero-dimensional subscheme of P^2 obtained by complete intersection of two curves in P^2.

It was found that when the the zero-dimensional scheme E of P^2 is obtained by complete intersection of two curves of different parity the resilution P (E), of $S/I_\sigma(E)$ is symmetric and of length four.

It is known that when the resolution is symmetric and of length four the corresponding acyclic complex admits a differential graded structure. In this thesis the the explicit differential graded structue is given for the acyclic complex corresponding to symmetric length four resolution P (E)., of $S/I\sigma(E)$, where E is a complete intersection of two curves of different parity in P^2.

Publications

"Resolutions of Veronese Embeddings of Plane Curves", Aaloka Kan-here, Submitted to Indian Journal of Pure And Applied Mathematics

4. Suvankar Dutta

Enrolment No.	: PHYS08200604001
Constituent Unit	: Harish-Chandra Research Institute
Date of award of Provisional Degree	: 12.9.2008
Title of Thesis	: Aspects of The Thermal AdS/CFT Correspondence

Abstract

In this thesis we have mainly studied different aspects of the AdS/CFT conjecture. Most of the work in this thesis has been on the finite temperature version of this conjecture. The finite temperature case, in particular is interesting because one can analyse the mysterious thermodynamical nature of black holes using the dual field theory at finite temperature and vice versa. In fact there exists an amazing equivalences between confinement-deconfinement transition in gauge theory, and gravitational phase transition to black hole geometry (Hawking-Page transition).

In this thesis we have studied the finite temperature theory from both sides of the AdS/CFT correspondence, i.e. from the (super) gravity side as well as from the gauge theory side. The main aim of this work has been to make the connection between the two sides of the correspondence.

String Theory/Gravity

We have studied the thermodynamics on the gravity/string theory side. The topics we have discussed include:

a) Relation between Wald entropy and Euclidean entropy calculations [1]

b) Hawking-Page phase transition for Ricci-flat black holes [2].

c) Hydrodynamics [4].

a) **Wald entropy vs. Euclidean entropy:** There are two apparently different looking methods to calculate the entropy of asymptotically AdS black holes.

- **Noetherian (or Wald) Approach:** Entropy is given in terms of local quantities evaluated on the horizon.

- **Euclidean Approach:** Entropy is evaluated by computing the Euclidean gravity action.

From the point of view of holography these two approaches are somewhat complementary in spirit. The former is evaluated on the horizon while the latter is a boundary contribution at infinity and it is not obvious why they should give the same answer in the presence of arbitrary higher derivative gravity corrections. In fact there were some claims of disagreement in the literature. For the case of the AdS Schwarzschild black hole, we explicitly studied the leading correction to the Bekenstein-Hawking entropy in the presence of a variety of higher derivative corrections studied in the literature, including the Type IIB R^4 term. We found a non-trivial agreement between the two approaches in every case. Finally, we gave a way of understanding the equivalence of these two approaches in general [1].

b) **Phase transition for Ricci-flat black holes:** We have also been interested in studying the thermal phase transition between black holes and other asymptotically AdS space-times. In the case when the horizon topology is $S^1 \times S^1 \times \Gamma 2$, where $\Gamma 2$ is some Ricci flat space, there exists a phase transition between the black hole and global AdS solution spacetime of Horowitz and Myers. The phase diagram becomes more interesting when one introduces charges (or chemical potentials) in the picture. We have considered different R-charged black holes in five dimensions and studied their thermodynamics and phase structure in the presence of chemical potentials. We have also done the stability analysis of these R-charged black holes and given an interpretation from the point of view of the boundary gauge theory [2].

c) **Hydrodynamics:** The holographic description of boundary hydrodynamics is also an interesting subject of current research. For blackholes with a translation invariant horizon, on can also discuss the hydrodynamic which is basically the low energy fluctuations about thermodynamic equilibrium. There are different approaches to describe hydrodynamic fluctuations of boundary guage theory plasma using AdS/CFT correspondence.

Recently in *ar Xiv : 0712.2456 [hep-th]* the authors have developed an elegant systematic framework to construct the nonlinear fluid dynamics, order by oder in boundary derivative expansion. They considered locally boosted black brane geometry in 5 dimensional space-time. These are not solutions of Einstein equations of motion. So one has to add fluctuations to the boosted geometry and then find fluctuations to this metric by solving the Einstein equations order by order in derivative expansion. We have generalized the construction of finding local boosted black brane geometry in higher derivative gravities. We considered Gauss-Bonnet term as an example and found the α' corrected local black D3 brane geometry [4].

Gauge Theory

On the gauge theory side we have discussed the phase diagram of the theory at weak coupling and make connection with the geometric description of the dual supergravity theory.

Recently in [3] we have studied the thermal gauge theory partition function. At weak coupling the gauge theory partition function can be written in terms of a unitary matrix model. We have obtained an exact expression for the partition function as a sum over representations of the unitary group. This is an *exact result* expression for any finite *N*. Our analysis can also be generalized for the partition function of gauge theory in presence of R charges.

In the large limit, the exact answer is dominated by a saddle point. The dominant saddle points are basically different dominant representations of the unitary group. At large N we found that the answer shows non-analytic behaviour, as one varies the temperature, which is characteristic of a phase transition. In other words, in the large N limit, there is a dominant saddle point in the sum over representations and the nature of this saddle point exhibits non-analytic jumps as one varies the temperature.

The solution in the large N limit shows three different saddle points. According to the AdS/CFT conjecture these three saddle points in the weakly coupled gauge theory correspond to thermal AdS, small black hole and large black hole in the dual gravity description. For example, at low enough temperature the saddle point corresponding to global AdS dominates the partition function (confined phase of gauge theory) whereas the high temperature phase is dominated by the "big black hole" saddle point (deconfined phase in the gauge theory). In fact we reproduced the complete Hawking-Page phase diagram of the dual gravity descriptions (strong coupling side), which was found earlier by usual eigenvalue analysis of the unitary matrix model.

An interesting feature of our analysis is that the different saddle points of these matrix model can all be described in terms of **free fermions.** The representations of *U (N)* have an interpretation in terms of free fermions where the number of boxes in the Young tableaux behave like the momentum. In our analysis we find the momentum distribution function for free fermions for different saddle points. On the other hand, in the usual eigenvalue analysis of matrix model, the eigen value distribution gives the position distribution function for different saddle points since the eigenvalues are like positions of the fermions. Therefore a uniform phase space distribution for fermions gives rise to these individual distribution functions. Different saddle points corresponds to different filled regions in phase space. This free fermionic phase space description of the different bulk saddle points geometries may be useful in trying to reconstruct the local bulk geometry from the gauge theory.

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5. Dipak Paramanik

Enrolment No.	:	PHYS07200604011-
Constituent Unit	:	Institute of Physics, Bhubaneswar
Date of award of Provisional Degree	:	25.09.2008
Title of Thesis	:	Nano-structures formation on InP(111) semiconductor surfaces by ion beam irradiation

With the fast growing interest in nanotechnology, fabrication of regular arrays of semiconductor nanostructures with controlled size and height is of great importance. These nanoscale pattern hold promise in applications as varied as optical devices, templates for liquid crystal orientation, and strain-free patterned substrates for hetero-epitaxial growth of quantum dots or wires. Fabrication of nano-dots through self-organization, induced by ion irradiation processes, has attracted special interest due to the possibility of production of regular arrays of dots on large areas in a single technological step. The pattern formation occurs due to the competition between curvature dependant ion sputtering that roughens the surface and it's smoothening by different relaxation mechanisms.

During this patterning, however, along with nano dot fabrication the surface also undergoes structural modifications due to ion irradiation. Although these surface modifications have not received much attention, they are important for understanding the parameters influencing the formation of nano-dots as well as their evolution. Ion irradiation can, however, also lead to modifications in the nature of the surface as well as its stochiometry which can affect the self assembly crucially.

In this thesis, I present the results of investigations on the formation of nano-structures on InP(111) surfaces after low energy (3 keV) Ar ion irradiation and high energy (1.5 MeV) Sb ion irradiation. The thesis discusses the formation of nano-dots, their evolution as a function of fluence, their size and height distributions, related surface modifications as well as the surface exponents. I have primarily utilized the techniques of Scanning Probe Microscopy (SPM), Raman scattering, X-ray Photo-electron Spectroscopy (XPS) and ion beam accelerator for these studies.

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1. Morphological evolution of InP nano-dots and surface modi¯cations after keV irradiation, D. Paramanik, S.N. Sahu and S. Varma, *J. Phys. D: Appl. Phys.(in press)*
2. Scaling Studies of Nano-dots on InP(111) Surfaces after MeV Implantation, D. Paramanik, and S. Varma, *J. Nanosci. and Nanotech.(in press)*
3. High temperature grown transition metal oxide thin ¯lms: tuning physical properties by MeV N+ ionbombardment, R. Sivakumar, C. Sanjeeviraja, M. Jayachandran, R. Gopalakrishnan, S.N. Sarangi,D. Paramanik, and T. Som, *J. Phys. D: Appl. Phys.(in press)*
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16. Surface Roughening and Radial Separation Distribution Studies on InP(111) Surfaces after MeV Sb2+Implantation, Dipak Paramanik and Shikha Varma, *Nucl. Instr. Meth. B. 244, 81 (2006).*
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5. Temperature dependence of interface properties and conduction mechanism of ultrathin high-k ZrO2 gate dielectrics deposited on strained Si/Si-Ge hetero layers, M.K. Bera, S. Chakraborty, S. Saha,D. Paramanik, S.Varma, S. Bhattacharya and C.K. Maiti, *International onference on Electronic and Photonic Materials, Devices and Systems, January 4-6, 2006, University of Calcutta, Kolkata, India.*
6. Evolution of Surface Structures and Surface Roughness after of InP(111) after MeV implantation, D.Paramanik and S. Varma, *DAE Solid State Physics Symposium, December 26-31, 2004, Guru Nanak Dev University, Amritsar, India.*
7. Nanoscale Structure formation on InP(111) surfaces after MeV Implantation, Dipak Paramanik and Shikha Varma, *International Symposium on Advanced Material and Processing, December 6-8, 2004, Indian Institute of Technology, Kharagpur, India.*
8. Surface studies on InP(111) after MeV implantation, Dipak Paramanik and Shikha Varma, *Indo-US Workshop on Nano-Scale Materials: From Science To Technology, April 5-8, 2004, Puri, India, NOVA publications, pp-232, NY, USA.*

6. Rahul Muthu

Enrolment No.	:	MATH10200604014
Constituent Unit	:	Institute of Mathematical Sciences, Chennai
Date of award of Provisional Degree	:	30.9.2008
Title of Thesis	:	Acyclic Edge Colouring Bounds and Algorithms

Abstract

In this thesis we study the problem of acyclic edge colouring of graphs-a variant of the standard graph colouring problem. An acyclic edge colouring of a graph is an assignment of colours to its edges such that incident edges get distinct colours and the set of edges of each cycle receive at least three colours. The acyclic chromatic index of a graph G, denoted a'(G), is the least number of colours required to colour the edges of G acyclically. We obtain the following results related to acyclic edge colouring and acyclic chromatic index.

Theorem 1: Let G be any graph with girth, $g(G) = 220$. Then, $a'(G) = 4.52\,\Delta(G)$.
Theorem 2: Let G be any graph with girth $g(G) = 9$. Then, $a'(G) = 5.91\,\Delta(G)$.

Theorem 3: There are absolute constants c1 , c2 > 0 such that, for any graph G with g = c1 log Δ we have,

$$a'(G) = \Delta + 1 + \left\lceil c2 \left(\frac{\Delta \log \Delta}{g} \right) \right\rceil$$

Theorem 4: Let G be a grid-like graph, of dimension d. Then,

- $a'(G) = \Delta(G) + 1 = d + 1$ if G is a hypercube with $d \geq 2$.
- $a'(G) = \Delta(G) = 2d$ if G is a mesh.
- $a'(G) = \Delta(G) + 1 = 2d + 1$ if G is a torus.
- $a'(G) \in \{\Delta, \Delta + 1\}$ when G is any other graph in this class. Both values occur.

Theorem 5: Let G be a simple graph with $a'(G) = \eta$. Then,

1. $a'(G \square P2) = \eta + 1$, if $\eta \geq 2$.
2. $a'(G \square Pl) = \eta + 2$, if $\eta \geq 2$ and $l \geq 3$.
3. $a'(G \square Cl) = \eta + 2$, if $\eta > 2$ and $l = 3$.

Theorem 6: Let G =(VG,EG) and H =(VH ,EH) be two connected non-trivial graphs such that $\max\{a'(G), a'(H)\} > 1$. Then,

$a'(G \square H) = a'(G) + a'(H)$.

Theorem 7: If G is a 2-tree or a partial 2-tree, then $a'(G) = \Delta + 1$

Publications

Conferences:

- Rahul Muthu, N. Narayanan and C.R. Subramanian Improved bounds on Acyclic Edge Colouring. Proceedings of GRACO-2005,Electronic Notes in Discrete Mathematics, Volume 19, 1 June 2005, Pages 171-177.

- Rahul Muthu, N. Narayanan and C.R. Subramanian Optimal acyclic edge colouring of grid like graphs. Proceedings of COCOON-2006, Lecture Notes in Computer Science, Springer 2006, volume 4112, pages 360-367

Journals:

- Rahul Muthu, N. Narayanan and C.R. Subramanian Improved bounds on acyclic edge coloring. Discrete Mathematics, 307:23, 2007, 3063-3069

- Rahul Muthu, N. Narayanan and C.R. Subramanian Optimal acyclic edge colouring of grid like graphs. To appear in Discrete Mathematics.

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Preprints

- R. Muthu, N. Narayanan and C. R. Subramanian, Acyclic edge colouring of partial 2-trees , Preprint.

7. Saket Saurabh

Enrolment No.	:	MATH10200604023
Constituent Unit	:	IMSC
Date of Viva Voce	:	8.12.2008
Date of award of Provisional Degree	:	23.12.2008 (28.11.2009)
Title of Thesis	:	Exact Algorithms for Optimization and Parameterized versions of some graph theoretic problems

Abstract

We look at various problems from the exact algorithm paradigm for both pa-rameterized and optimization versions of the problems. We begin with FPT algorithms for Feedback Vertex Set in undirected graphs, Feedback Set problems in Tournaments and duals of Feedback Set problems in directed graphs. Further, we show that several problems like Dominating Set, In-dependent Set that are hard for various "parameterized complexity classes" on general graphs, become ûxed parameter tractable on graphs with no small cycles. Finally we give an FPT algorithm for Directed Maximum Leaf Out-Tree which is the problem of ûnding a directed out-tree with at least k leaves in directed graphs.

In the second part, we introduce three techniques to design non trivial exact algorithms and illustrate these techniques with several examples. Our ûrst tech-nique obtains a non trivial exact algorithm for optimization version of various problems using parameterized algorithm for the same problem. Our second tech-nique illustrates the idea of designing exact algorithms by enumerating maximal independent sets (MIS) in a graph. We exemplify this technique by designing polynomial space exact algorithms for Odd Cycle Transversal, Minimum Maximal Matching, Minimum Edge Dominating Set and Matrix Dom-inating Set. Our last technique is based on diûerent combinations of branch and reduce and dynamic programming on graphs of bounded treewidth. Finally, we give exact algorithms for the optimization versions of Maximum r-Regular Induced Subgraph problems. We give $O(c^n)$ time algorithms for these prob-lems for any ûxed constant r, where c is a positive constant strictly less than 2 depending on r alone.

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8. T. C. Vijayaraghavan

Enrolment No.	:	MATH10200604015
Constituent Unit	:	Institute of Mathematical Sciences, Chennai
Date of award of Provisional Degree	:	11.12.2008
Title of Thesis	:	Classifying certain Algebraic Problems using Logspace Counting Classes

Abstract

The complexity class NC consists of computational problems that have eûcient poly-logarithmic time parallel algorithms. A prominent subclass NC^2 is inhabited by natural computational problems and has been the focus of intensive research. Furthermore, NC^2 itself contains a rich landscape of complexity classes deûned through logarithmic space-bounded computations. Many natural computational problems get tightly classiûed into these logarithmic space-bounded complexity classes. For example, computing the integer determinant, solving linear equations over rationals or ûnite ûelds, and counting the number of source to sink paths in a graphs are problems that are captured precisely using logspace counting classes.

The focus of this thesis is on logspace counting classes. The complexity of various natural algebraic computational problems is studied and classiûed using logspace counting classes. These algorithmic problems include abelian permutation group problems, linear algebraic problems like solving linear equations over ûnite rings, matroid intersection and group prob-lems where the input groups are presented by their Cayley tables. The results shown in this thesis yield new complexity upper bounds as well as fairly tight complexity-theoretic hardness results for these problems using logspace counting classes. Some of the upper bound results obtained involve randomized and nonuniform versions of these logspace counting complexity classes.

Publications

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3. V. Arvind and T.C. Vijayaraghavan. The complexity of solving linear equations over a ûnite ring. In STACS '05: Proceedings of the 22nd Annual Symposium on Theoretical Aspects of Computer Science, volume LNCS 3404, pages 472–484, 2005.

9. Alok Kumar

Enrolment No.	:	PHYS10200605001
Constituent Unit	:	Institute of Mathematical Sciences, Chennai
Date of award of Provisional Degree	:	31.12.2008
Title of Thesis	:	Studies In Su(2) Savvidy Model Of QCD

SU(2) Yang-Mills theory in the Savvidy background (constant chromomagnetic background) is studied both at zero and finite temperature. The Savvidy vacuum in the Gaussian approximation is known to be plagued by the unstable modes at zero and finite temperature. They lead to an imaginary part in the effective energy density and therefore it was concluded that the Savvidy vacuum was unstable and hence could not represent the QCD vacuum. This long standing problem is solved in here by going beyond the Gaussian approximation. The stable and the unstable modes of the fluctuations are separated. The stable modes are treated keeping terms up to quadratic in the fluctuations. For the unstable modes, we consider the full action including the cubic and the quartic terms in the fluctuations. Then the effective energy density is found to be real and hence its minimum serves as a model for the QCD vacuum. Thus, we show that the earlier instability is an artifact of Gaussian approximation. The real one-loop effective energy density is used to calculate the bag constant and found it to be $B^{(1/4)}=188$ MeV for $N_f=6$ and with the gluon condensate 0.012 GeV^2 which compares well with the MIT value 145 MeV. The β-function for the theory is also calculated.

The above procedure is extended to finite temperature. We have introduced a chemical potential for the gluons originating from the conservation of the color charges. The exact treatment of the unstable modes leads to real effective energy density, dependent on the temperature and the chemical potential. At high temperatures the behavior is that of a non-interacting relativistic gas. We find a deconfining transition at non-zero chemical potential at medium temperatures.

The issue of chiral symmetry breaking has been studied using Gribov's approach. The Schwinger-Dyson integral equation for the quark propagator is converted to a differential equation in Feynman gauge. This equation is further modified to include the pion back-reaction correction. A relation between the dynamical mass function of the quarks without and with the pion correction is found. For low momentum, the variation of the mass function with momentum is numerically studied. It is found that the pion back-reaction has a small effect on the dynamical mass of the quarks.

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1. Savvidy Vacuum in SU(2) Yang-Mills Theory, Modern Physics Letters A 20, No.22 (2005), 1655-1662, Daniel Kay, A. kumar and R. Parthasarathy.

2. SU(2) Yang-Mills Theory in the Savvidy Background at Finite temperature and Chemical Potential, Physical Review D75, 085007 (2007), R. Parthasarathy and A. Kumar.

3. Chiral Symmetry Breaking in Gribov's Approach to QCD at Low Momentum, Alok Kumar, arXiv:0711.3970v1 [hep " th], Submitted to "European Physical Journal C".

10. Prabir Pal

Enrolment No.	:	PHYS07200604010
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Date of award of Provisional Degree	:	20.1.2009
Title of Thesis	:	Electron spectroscopic studies of some colossal Magnetoresistive manganites

Transition-metal oxides exhibit a number of fascinating physical properties like the high temperature superconductivity and the colossal magnetoresistance (CMR). An exceptionally appealing material in this context is Pr1"xSrxMnO3, where the Mn valency is shifted from Mn^{3+} to Mn^{4+} with increasing divalent cation doping, x. At the forefront of the present condensed matter research lies the study of the correlated dynamics of electrons spin and charge near the metal-insulator transitions in these oxides.

Photoemission spectroscopy is a very powerful experimental tool for probing the occupied electronic structure, bonding and chemical nature of a material. The introduction of high energy resolution to this technique enables us to probe directly the most crucial low-energy excitations near the Fermi level (EF). In this thesis we have studied polycrystalline three dimensional manganese oxides Pr1"xSrxMnO3 and Sm1"xCaxMnO3 using photoemission spectroscopy. The near Fermi-level electronic spectra across the phase diagram have been investigated by varying the doping level and the temperature. In these manganites the spectral weight near the Fermi-level is strongly suppressed and this is called a pseudogap. We have also studied the resonance photoemission and x-ray absorption spectroscopy for probing the partial density of sates (PDOS) below and above the Fermi-level and their hybridization and gap behavior in different phases. We have done the band structure calculations using LSDA + U method for identifying the different subband emissions in the valence band region of Pr1"xSrxMnO3 system.

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11. Sanjoy Pal

Enrolment No.	:	PHY05200604001
Constituent Unit	:	Saha Institute of Nuclear Physics
Date of Award of Provisional Degree	:	23.01.09
Title of the thesis	:	Characterizations of cathode pad chamber as tracking detector for MUON Spectrometer of ALICE

Ultra relativistic heavy ion collisions offer the unique opportunity to probe highly excited dense matter under controlled laboratory conditions. One of the main driving forces for these studies is the expectation that an entirely new form of matter may be created in such reactions. This form of matter is called the Quark Gluon Plasma (QGP), which is the quantum chromodynamics (QCD) analogue of the plasma phase of ordinary atomic matter. The QGP state formed in nuclear collisions is a transient rearrangement of the correlations among quarks and gluons contained in the incident baryons to a larger but globally still colour neutral system with remarkable theoretical properties, such as restored chiral symmetry. The task of ultra-relativistic heavy ion reaction is to provide experimental information on this fundamental predication of the standard model. The formation of QGP is expected at about an energy density of 1 GeV/fm^3. The nucleon-nucleon center of mass energy for collision of the heaviest ion (Pb-Pb) at the Large Hadron Collider (LHC) will be 5.5 TeV/nucleon and the energy density will far exceed the critical energy density ($\varepsilon_c \cong 1$ GeV /fm^3) and temperature ($\sim$170MeV). The formation of QGP has been the object of experimental search for last two decades. Several signals of the experimental observables of the QGP in laboratory experiments have been proposed. One of the most promising signals is the suppression of the yield of heavy quarkonium bound state in dense medium, as proposed by Matsui and Satz in 1986. It was proposed that if QGP is formed, the interaction potential of color charges are screened beyond a certain distance λ_D (Debye length) due to the high density of quarks and gluons in plasma and the production of cc or bb bound states will be hindered. ALICE (A Large Ion Collider Experiment) is the detector dedicated to the study of nucleon-nucleon collision at Large Hadron Collider (LHC), CERN. It will investigate the physics of strongly interacting matter at extreme energy density, where the formation of the new phase of the matter, the QGP is expected. The Muon Spectrometer of ALICE will measure the production cross-sections for heavy quark vector mesons, i.e. $J/\psi, \psi'$, γ, γ' and γ'', through their dimuon decay channel. The Muon Spectrometer has been designed to reach a mass resolution better than 100 MeV so that J/ψ, ψ' and γ, γ' and γ'' resonances can be resolved. The mass resolution is determined by the precision achieved in measurement of the angle between the two muons and their momenta. The Muon Spectrometer consists of: a front absorber; 5 tracking stations each consisting of two detection planes; a large area dipole magnet; a muon filter and two trigger stations. The angular acceptance of the spectrometer is 2° to 9°. To achieve the mass resolution of 100 MeV, a spatial resolution better than 100μm in bending plane (Y direction) and $\sim$2 mm in non-bending plane (X direction) is required. This has been realized by using Cathode Pad Chamber (CPC) as the tracking detector, which has an intrinsic resolution $\sim$50 μm and can be made nearly transparent to minimum ionizing particles. The size of the muon tracking stations vary from 1.8 to 5.22 meter in diameter. There were two major hardware responsibilities of Saha Institute of Nuclear physics (SINP) in the Dimuon Collaboration:

1. Design, fabrication and installation of the Second Muon Tracking Station.

2. Design, fabrication and testing of the front end readout chip (MANAS) for Muon

Spectrometer of ALICE. The thesis contains:

- The R&D efforts to design and fabricate the detector prototypes.
- The validation tests of the Muon chambers by in-house tests with radioactive sources and in-beam tests with relativistic proton and pion beams.
- Fabrication of the chambers of Second Tracking Station according to the final design.
- Installation and commissioning of second tracking station at CERN.
- Characterization and validation tests of the Front End Readout chip MANAS, for Dimuon Spectrometer and PMD collaborations of ALICE.

Publications

In Refereed Journal

1. *In-Beam Test of Manas 1.2-1 Chip with 7 GeV/c Proton Beam at CERN :Part I*
P. Bhattacharya, S. Bose, S. Chattopadhyay, D. Das, P. Datta, T. Ghosh, N. Majumdar, S. Mukhopadhyay, S. Pal, L. Paul, P. Roy, A. Sanyal, S. Sarkar, M. Sharan, P. Sen, S. K. Sen, T. Sinha and B.C. Sinha.
ALICE-INT-200*1-40*.
2. *Mechanical Prototype for Stations 1 and 2 in FMS of ALICE: Part I*
P. Bhattacharya, S. Chattopadhyay, D. Das, P. Datta, T. Ghosh, C. LaGaillard, N. Majumdar, S. Pal, L. Paul, J. Peyre, J. Pouthas and E. Rindel.
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3. *Resolution Studies with MANAS 1.2-1 Chip*
P. Bhattacharya, S. Bose, S. Chattopadhyay, D. Das, P. Datta, T. Ghosh, N. Majumdar, S. Mukhopadhyay, S. Pal, L. Paul, P. Roy, A. Sanyal, S. Sarkar, M. Sharan, P. Sen, S. K. Sen, T. Sinha and B.C. Sinha.
ALICE-INT-2003-032-v1.
4. *Mechanical Prototype for Station 2 in FMS of ALICE: Part II*
P. Bhattacharya, S. Chattopadhyay, D. Das, P. Datta, T. Ghosh, C. LaGaillard, N. Majumdar, S. Mukhopadhyay, S. Pal, L. Paul, P. Roy, A. Sanyal, S. Sarkar, M. Sharan, P. Sen and S. K. Sen.
ALICE-INT-2003-046.
5. *Raw data format for the MUON*
Ch. Finck, L. Aphecetche, A. Baldisseri,V. Barret-Ramillien, J.-L. Beney, R. Berny, V. Chambert, I. Das , I. Hrivnacova, B.Y. Ky, Y. Le Bornec, F. Lefèvre , S. Pal , Ch. Renard, S. Rousseau, A. Szostak and N. Willis.
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6. *Test of the tracking readout electronics of the Dimuon Forward Spectrometer.*
A. Charpy, M.P. Comets, P. Courtat, B. Espagnon, I. Hrivnacova, R. Kunne, Y. Le Bornec, J. M. Martin, S. Rousseau, C. Suire and N. Willis, Z. Conesa Del Valle, J.P. Cussonneau, C. Finck, M. Germain, L. Luquin and G.Martinez, A. Baldisseri, H. Borel, M. Combet, S. Herlant, F. Orsini, M. Arba, I. Atanassov, S. Basciu, C. Cicalo, D. Marras, E. Siddi and M. Tuveri, P. Bhattacharya, S. Chattopadhyay, D. Das, S. Pal, L. Paul., V. Nikulin, E. Rostchin, V. Polyakov and V. Ivanov ALICE-INT-2006-016. *7. ALICE: Physics Performance Report, Volume II*

ALICE Collaboration
B Alessandro, F Antinori, J A Belikov, C Blume, A Dainese, P Foka, P Giubellino, B Hippolyte, C Kuhn, G Martínez,M Monteno, A Morsch, T K Nayak, J Nystrand, M López Noriega, G Pai´c, J Pluta, L Ramello, J-P Revo, K Safarík, J Schukraft, Y Schutz, E Scomparin, R Snellings, O Villalobos Baillie andE Vercellin (editors)
J. Phys. G: Nucl. Part. Phys. 32 (2006) 1295–2040

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1. *Installation of Eight Cathode Pad Chambers for 2nd Muon Tracking Station of ALICE.* DAE Symposium on Nuclear Physics, Vol 52, p. 587, 2007.
   M. Danish Azmi, S. Bose, S. Chattopadhyay, S. Das, D. Das, M. Irfan, I.A. Khan, S. Pal, L. Das, T. Sinha and B.C. Sinha
2. *Validation of Sixteen Electronics Read Out Plane 2nd Muon Tracking Station of ALICE on CROCUS in* DAE Symposium on Nuclear Physics, Vol 52, p. 611, 2007
   M. Danish Azmi, S. Bose, S. Chattopadhyay, S. Das, D. Das, M. Irfan, I.A. Khan, S. Pal, L. Das, T. Sinha and B.C. Sinha
3. *Production of Cathode Pad Chambers for 2nd Muon Tracking Station of ALICE.* In DAE Symposium on Nuclear Physics, Vol 50, p. 437, 2005.
   M. Danish Azmi, S. Bose, S. Chattopadhyay, D. Das, I. Das, P. Datta, A.K. Dutt-Mazumder, M. Irfan, S. Jana, I.A. Khan, S. Pal, L. Paul, P. Roy, T. Sinha and B.C. Sinha.
4. *Study of Characteristics of Production Batch MANAS chips.*
   DAE Symposium on Nuclear Physics, Vol 50, p. 449, 2005
   M. Danish Azmi, S. Chattopadhyay, I. Das, S. Pal, P. Roy, S. Sarkar, S. Sen, T. Sinha and B.C. Sinha.
5. *Study of the Characteristics of Cathod Pad Chamber (CPC) with the generation of MANAS 1.2-3.1*
   Proc. of DAE Symposium on Nuclear Physics, 45B(2002)484
   P. Bhattacharya, S.Bose, S. Chattopadhyay, D. Das, P. Datta, T. Ghosh, N. Majumdar, S. Mukhopadhyay, S. Pal, L. Paul, P. Roy, A. Sanyal, S. Sarkar, P. Sen, S. K. Sen, M. Sharan and B. Sinha.
6. *Numerical Simulation of Gas Detectors*
   Proc. of DAE Symposium on Nuclear Physics, 45B(2002) 456
   S. Pal, P. Datta, T. Ghosh, S. Mukhopadhyay.
7. *Simulation studies on spatial resolution and reconstruction efficiency of Cathode Pad Chambers with MANAS Read-out chip.*
   Proc. of DAE Symposium on Nuclear Physics, Vol 44B(2001) 308
   P. Bhattacharya, S.Bose, S. Chattopadhyay, D. Das, P. Datta, T. Ghosh, N. Majumdar, S. Mukhopadhyay, S. Pal, L. Paul, P. Roy, A. Sanyal, S. Sarkar, P. Sen, S. K. Sen, M. Sharan and B. Sinha.
8. *Mechanical Prototype of Tracking Chamber In Dimuon Spectrometer of ALICE*
   International Conference on Physics and Astrophysics of Quark Gluon Plasma, 2001, E-31
   P. Bhattacharya, S.Bose, S. Chattopadhyay, D. Das, P. Datta, T. Ghosh, N. Majumdar, S. Mukhopadhyay, S. Pal, L. Paul, P. Roy, A. Sanyal, S. Sarkar, P. Sen, S. K. Sen, M. Sharan and B. Sinha.
9. *MANAS: A Low Noise CMOS Analog Signal Processor for Dimuon Spectrometer of ALICE in LHC* International Conference on Physics and Astrophysics of Quark Gluon Plasma, 2001, E-31 P. Bhattacharya, S.Bose, S. Chattopadhyay, D. Das, P. Datta, T. Ghosh, N. Majumdar, S. Mukhopadhyay, S. Pal, L. Paul, P. Roy, A. Sanyal, S. Sarkar, P. Sen, S. K. Sen, M. Sharan and B. Sinha.

12. Joy Ghatak

Enrolment No.	:	PHYS07200604008
Constituent Unit	:	Institute of Physics, Bhubaneswar
Date of award of Provisional Degree	:	27.01.2009
Title of Thesis	:	Flux Dependent MeV Ion Beam Induced Modifications of Nanostructured Thin Films on Si

The thesis work centers on the study of surface and interface modifications of nanostructured thin films on silicon substrate due to ion beam bombardment. Thin films of various thicknesses of gold and silver have been deposited using thermal deposition method. The focus in the present thesis work is on the investigation of the various aspects of ion beam interaction with nanostructured films as a function of incident beam flux (number of ions per unit area per unit time) and fluence (number of ions per unit area).

Different thicknesses of Au (2.0, 5.3, 10.9 and 27.5 nm) and Ag (1.5 nm) films have been deposited on Si (111) surface using thermal evaporation method. The ion beam flux and fluence during irradiations on Au samples have been varied from 3.2×10^{10} to 6.3×10^{12} ions cm^{-2} s^{-1} and 6×10^{13} to 1×10^{15} ions cm^{-2}, respectively. For Ag samples, the fluence values were varied from 5×10^{13} to 1×10^{15} ions cm^{-2} at a flux value of 6.3×10^{12} ions cm^{-2} s^{-1}. Irradiations were carried out with 1.5 MeV Au^{2+} ions at room temperature. Samples were then characterized by Transmission electron microscopy and Rutherford backscattering spectroscopy.

At the fluence and the flux of 6×10^{13} ions cm^{-2} and 6.3×10^{12} ions cm^{-2} s^{-1}, respectively, dramatic mass transport from the Au nanostructures (for 2.0 nm thick Au film on Si) has been observed to extend into the substrate up to a distance of about 60 nm which is much beyond their size. The maximum depth of mass transport inside Si has been observed to reduce at higher fluence and segregation of Au atoms towards the surface has been observed at fluence 5×10^{14} ions cm^{-2} and beyond. This unusual mass transport has been found to be very sensitive to the ion flux. At the same fluence, the mass transport and the maximum transport depth are found to be more for higher film thickness (5.3, 10.9 and 27.5 nm) of Au. In each case, the mass transport is associated with the Au-Si alloy formation which was absent in low flux irradiation experiments. The results are explained in light of recoil implantation and radiation enhanced diffusion due to substrate heating by high flux irradiation.

The sputtering yield, the sputtered particle size distribution and the exponent values under high flux conditions have been studied in detail. The sputtering yield is found to increase with the increase of beam flux and a bimodal distribution was observed for the sputtered particle sizes at the highest flux. With an ion flux of 6.3×10^{12} ions cm^{-2} s^{-1}, the present result showed the sputtering yield of Au from a nanostructured target due to 1.5 MeV Au ions is to be as high as 312 atoms/ion. Decay exponent of sputtered particles found in catcher grid is also found to be varied from 1.5 to 2.5 when the flux were varied from 3.2×10^{10} to 6.3×10^{12} ions cm^{-2} s^{-1} which suggests that the mechanisms operative at different flux, are different. The increase of sputtering yield with the increase of beam flux was attributed to the increase of temperature of the wafer (hence decrease of binding energy). The embedding of the Ag nanoparticles was observed at lower fluence compared to that of low flux irradiation. The embedded Ag particles inside Simatrix have been found to be of uniform in size.

Publications:

1. Ion induced segregation in gold nanostructured thin films on silicon.
   J. Ghatak and P. V. Satyam *Nucl. Instrum. Meth. Phys. Res. B 266 4849 (2008)*. *arXiv: 0805.3965[cond-mat.mtrl-sci]*

2. Ion beam induced enhanced diffusion from gold thin films in Silicon.
   J. Ghatak, B. Sundaravel, K. G. M. Nair, P. V. Satyam, *J. Phys. C: Cond. Mat.* 20 485008 (2008); *arXiv: 0805.3965 [cond-mat.mtrl-sci]*

3. MeV Gold Ion Induced Sputtered Nanoparticles from Gold Nanoislands: Dependence of Incident Flux and Temperature.
   J. Ghatak, B. Sundaravel, K. G. M. Nair, and P. V. Satyam, *J. Nanosci. Nanotechnol.* 8, 4318 (2008).

4. Flux dependent 1.5 MeV self-ion beam induced sputtering from Gold nanostructured thin films.
   J. Ghatak, B Sundaravel, K.G.M Nair and P.V. Satyam, *J. Phys. D: Appl. Phys.* 41 165302 (2008); *arXiv: 0806.3162 [cond-mat.mtrl-sci]*.

5. Flux dependent MeV self-ion- induced effects on Au nanostructures: Dramatic mass transport and nano-silicide formation.
   J. Ghatak, Umananda M. Bhatta, B. Sundaravel, K. G. M. Nair, Sz-Chian Liou, Cheng-Hsuan Chen, Yuh-Lin Wang, P. V. Satyam, *Nanotechnology* 19 325602 (2008); *arXiv: 0803.3495v2. [cond-mat.mtrl-sci]*.

6. Flux dependent MeV ion induced modifcation of nano-Ag/Si system.
   J. Ghatak and B. Sundaravel, K. G. M. Nair and P. V. Satyam, *Nucl. Instrum. Meth. Phys. Res. B* 266 1282 (2008).

7. Mass transport in Ion - Nanostructure interactions.
   J. Ghatak, B. Sundaravel, K G M Nair, S. C. Liou, C-H Chen and P V Satyam.
   Nucl. Instrum. Meth. Phys. Res. B 266, 1671 (2008).

8. MeV ion-induced strain at nanoisland-semiconductor surface and interfaces.
   J. Ghatak, B. Satpati, M. Umananda, P.V. Satyam, K. Akimoto, K. Ito and T. Emoto,
   Nucl. Instrum. Meth. Phys. Res. B 244, 64 (2006); *arXiv:cond-mat/0503091*.

13. Bindusar Sahoo

Enrolment No.	:	PHYS08200604006
Constituent Unit	:	Harish-Chandra Research Institute
Date of award of Provisional Degree	:	17.2.2009
Title of Thesis	:	Black Hole Entropy and Higher Derivative Correction

The subject of black hole entropy has been an interesting area of study both from the point of view 'of gravity as well as string theory. It serves as a tool to test the ideas of quantum gravity. The fact that black hole has temperature as well as entropy was discovered as a mere analogy, to start with, between the laws of thermodynamics and the laws of black hole mechanics according to which surface gravity (which is a geometrical quantity defined on the horizon) played the role of temperature and area of the event horizon played the role of entropy[1]. But later it was discovered by Stephen Hawking that black holes radiate and has temperature consistent with the analogy discovered earlier and thus the interpretation of the area of the evel;1t horizon as entropy became concrete. It was later discovered by Waid that if the theory of gravity has some higher derivative terms constructed out of several powers of Riemann tensor and its covariant derivatives then one has to appropriately modify the entropy formula.

With the knowledge that black hole has entropy, the question that imme-diately arises is that whether there exist a microscopic description of these black holes such that the statistical entropy, which is defined in terms of the degeneracy of the states of the underlying microscopic theory, agrees with the standard result for the thermodynamic entropy of these black holes. The leading candidate for giving such a description for black holes is string theory.

In string theory for a wide class of extremal black holes the statistical entropy matches with the Bekenstein-Hawking entropy for large size of the horizon i.e.

$$S_{BH}(Q) = S_{stat}(Q) \tag{1}$$

where $S_{BH}(Q)$ is the Bekenstein-Hawking entropy and $S_{stat}(Q)$ is the statis-tical entropy for a black hole carrying charge Q. $S_{stat}(Q)$ is given by:

$$S_{stat}(Q) = 1n\, d\, (Q) \tag{2}$$

where $d(Q)$ is the degeneracy of the microstates describing the extremal black hole carrying charge Q. For large horizon size which arises in the large charge limit the statistical entropy is given by Cardy formula.

Given the successful matching in this limit one would like to ask if such a matching exists if one deviates from the large charge limit. In the scenario where one deviates from the large charge limit, one has to take into account the effect of higher derivative terms while computing the black hole entropy. On the statistical side there is deviation from the Cardy formula which are supressed by inverse power of charges.

The collaborative research projects that I had taken up analyzed the black hole side of the story. There are a couple of techniques known in the literature to incorporate the effect of higher derivative terms in computing the black hole entropy. They are the Wald's formalism and Euclidean action formalism. For extremal black holes one can manipulate the Walds formula in deriving a much simpler formalism known as the entropy function formalism. In this formalism one needs to extremize a function with respect to the near horizon field configuration of the moduli fields. This leads to a set of algebraic equations for determining the near horizon field configuration in terms of the charges carried by the black hole. The value of the function at the extremum gives the entropy.

We use the entropy function formalism to resolve issues related to the entropy of black holes in the presence of higher derivative terms.

There is a particular class of higher derivative terms known as the Chern-Simons terms, that one could add to the action known as the Chern-Simons term. These terms are not manifestly covariant and were thus not treated using Wald's formalism (since Wald's formula requires manifestly covariant action). They were historically treated using the Euclidean action formalism. We showed how one can handle these terms using the Walds formalism by dimensional reduction of the action. This gives a covariant Lagrangian from the non-covariant Chern-Simons term after throwing away some total deriva-tive pieces. We then apply Wald's formalism on the dimensionally reduced action.

In the next piece of work we use off-shell version of curvature curvature squared $N = 2$ supergravity action in four dimensions formulated by B. dewitt et al and compute the entropy of supersymmetric as well as non-supersymmetric extremal black holes. Our results for supersymmetric case matched with ear-lier prediction based on the assumption that the underlying five dimensional theory has AdS_3 as a factor in the near horizon geometry. But the results did not match for non-supersymmetric case. We attributed the mismatch to some missing terms in the four dimensional action that might arise as a result of the dimensional reduction of the underlying five dimensional theory. Later a off-shell formulation of five dimensional supergravity action was devised by K. Hanaki et al and was used by A. castro et al to compute the entropy. The results matched with the earlier predictions confirming that the mismatch in the four dimensional analysis was due to some missing terms in the action. It still remains a puzzle as to why these missing terms did not affect the entropy of the supersymmetric extremal black holes.

There were certain non-renormalization theorems by Krauss and Larsen which said that if the near horizon geometry has AdS_3 as a factor and the underlying 2-dimensional conformal field theory on the boundary has ap-propriate supersymmetry then the entropy of the supersymmetric as well as non-supersymetric extremal black holes are not normalized beyond certain order. We wished to directly check these results using tree level effective ac-tion arising out of heterotic string theory and included linear *(XI* corrections. At this order the standard definition of the 3-form field strength is modified by the addition of the gravitational Chern-Simons 3-form. Thus in the action we get a coupling of the 3-form field strength with the gravitational Chern-Simons 3-form. We devise a strategy to deal with these terms and calculate. the entropy of supersymmetric as well as non-supersymmetric extremal black holes. The results matched with Krauss and Larsen's prediction.

The non-renormalization theorem mentioned above was originally derived usi.ng AdS-CFT correspondence. We wanted to look at the origin of this non-renormalization theorem directly in supergravity. We attributed it to the fact that AdS_3 supergravity prevents the addition of higher derivative terms apart from those which could be removed by field redefinition. Apriori this allows for a renormalization of the cosmological constant. However if the underlying conformal field theory in the boundary has appropriate supersymmetry then the cosmological constant gets related to the coefficient of a Chern-Simons term and hence is not renormalized.

From this we argued that the entropy is completely fixed by the coefficient of the gauge as well as gravitational Chern--Simons terms as per Krauss and Larsen's non-renormalization theorem. It doesn't receive any further higher derivative corrections.

Publications

1. Giant magnons in the DI-D5 system, Justin R. David, Bindusar Sahoo, arXiv:0804.3267.

2. AdS_3, Black Holes and Higher Derivative Corrections, Justin R. David, Bindusar Saboo, Ashoke Sen, Ref: arXiv:0705.0735, JHEP 0707 (2007) 058.

3. á Corrections to Extremal Dyonic Black Holes in Heterotic String The-ory, Bindusar Sahoo, Ashoke Sen,
Ref: hep-thj0608182, JHEP 0701 (2007) 010

4. Higher Derivative Corrections to Non-supersymmetric Extremal Black Holes in N=2 Supergravity, Bindusar Sahoo, Ashoke Sen, Ref: hep-th/0603l49, JHEP 0609 (2006) 029.

5. BTZ Black Hole with Chern-Simons and Higher Derivative Terms, Bindusar Sahoo, Ashoke Sen, hep-th/0601228, JHEP 0607 (2006) 008.

14. Jayalal Sarma M.N.

Enrolment No.	:	MATH10200604016
Constituent Unit	:	Institute of Mathematical Sciences, Chennai
Date of Award of Provisional Degree	:	31.3.2009
Title of the thesis	:	Complexity Theoretic Aspects of Rank, Rigidity and Circuit Evaluation

Abstract

This thesis studies some combinatorial, topological and linear algebraic parameters associated with Boolean and Arithmetic circuits. It is mainly divided into two parts.

The first part describes a study of combinations of graph-theoretic or circuit-theoretic restrictions that we can impose on Boolean circuits to obtain complexity-theoretic characterizations for the circuit value problem (CVP). We first address the question of evaluating monotone planar circuits (MPCVP). Using recent insights developed in the context of topological constraints in small-width circuits, we -in this thesis-review the developments leading up to and beyond the "MPCVP is in NC" result, and make some improvements on the known bounds for general MPCVP as well as some special cases. Our main improvements are obtained while considering circuits with cylindrical embeddings. Another contribution is that we are able to extend the NC upper bound on MPCVP totoroidal (genusone) monotone circuits.

Exploring how topological restrictions interfere with those in circuit theoretic parameters, we show that unless P=NC in the non-uniform setting, there are P-computable functions requiring super-polylogarithmic number of negation gates in any poly-sized planar circuit computing them. In order to achieve this we prove that any circuit C with poly-logarithmic number of negation gates can be evaluated in NC. In a similar spirit, we prove an NC upper bound for evaluating a circuit which has poly-logarithmic crossing height when presented along with an embedding which achieves this crossing height. Combining these results, we show that any circuit C which has at most polylog crossing number and use polylog number of negations can be evaluated in NC when presented with along with an embedding which achieves this crossing height.

Motivated by applications in circuit complexity bounds, in the second part of the thesis we study the complexity of some linear algebraic parameters associated with the circuits. We ûrst explore the circuit and computational complexity of matrix rank. This problem, in general is known to characterise a complexity class inside P. We study several restricted cases of the problem to obtain algebraic characterisations of the complexity classes. For instance we prove that computing the rank, over Q, of matrices that are symmetric, non-negative and diagonally dominant, exactly characterises deterministic log-space computation by Turing machines..

We next turn to optimisation problems associated with matrix rank and briefly survey the applications of these problems in proving lower bounds in circuit complexity theory. Motivated by these applications we study the complexity of computing the rigidity of a matrix: the minimum number of entries of the matrix that need to be changed in order to bring down the rank below a given value. We consider several variants of the problem, and characterise them in terms of complexity classes. In particular, we prove complexity theoretic characterisations for the problem when restricted to 0-1 matrices, and k is bounded by a constant. We also note that, in general, over F2 , approximating the minimum number of changes needed up to a

constant factor is NP-hard. We then consider the bounded norm variant of the problem, where changed matrix entries can diûer from the original entries by at most a pre-speciûed amount. We note that it is NP-hard to compute this too.

We next attempt to construct explicit matrices which have super-linear rigidity. In this setting, we formulate the problem using the language of algebraic geometry, and prove tight maximal bounds for a speciûc family of matrices over C. Wethenstudy continuity properties of matrix rigidity function, and prove that rigidity function is not semi-conituous in general, but for some special families of matrices, there is semi-continuity property. In the setting of the lower bounds, we apply and extend some known combintorial techniques to show almost optim allower and upper bounds that for rigidity of a restricted triangular matrices.

Publications

1. Nutan Limaye, Meena Mahajan and Jalayal M.N.Sarma. Evaluating Monotone Circuits on Cylinders, Planes and Tori. In *Proceedings of 23rd International Symposium on Theoretical Science (STACS),* volume 3884 of *Lecture Notes in Computer Science,* pages 660-671, February 2006. Journal Version to appear in *Computational Complexity* under the title "Improved Upper Bounds for Monotone Circuit Value: Some Restrictions and Generalisations".

2. Meena Mahajan and Jalayal M.N.Sarma. On the Thickness of Branching programs. Presented at Workshop on Computational Complexity and Decidability in Algebra (WCCDS 2007), Ekaterinburg, Russia, September 2007.

3. Meena Mahajan and Jalayal M.N.Sarma. A Note on Evaluating Crossing Limited circuits. Manuscript, June, 2007

4. Meena Mahajan and Jalayal M.N.Sarma. On the Complexity of Matrix Rank and Rigidity. In *Proceedings of 2nd International Computer Science Symposium in Russia (CSR),* volume 4649 of *Lecture Notes in Computer Science,* pages 269-280, September 2007. Journal version to appear in the special issue of *Theory of computing Systems.*

5. Meena Mahajan and Jalayal M.N.Sarma. Rigidity of a Simple Extended Lower Traingular Matrix. To appear in Information Processing Letters, February 2008. http://dx.doi.org/10.1016/j.ipl.2008.02.010.

6. Abhinav Kumar, Satyanarayana V. Lokam, Vijay Patankar, and Jayalal M.N.Sarma. Using Elimination Theory to Construct Rigid Matrices. Manuscript, April 2008.

Annexure 6

Titles of M.Tech. Theses

Sl. No.	Name of the Students	Title of the Thesis	Date of issue of Provisional Certificate
1.	Lt. Cdr. Satyabrat. Mohapatra	Development of Auto Impedance of Matching Unit	9.3.2009
2.	Lt. Cdr. Trilochan Singh Saggu	RF Amplifier, 300 WATT, 2-30 MHz	9.3.2009
3.	Lt. Cdr. Anup Shukla	Development of 250W 150 MHZ RF Pulse Amplifier	9.3.2009
4.	Lt. Cdr. Shailender Gupta	Development of Algorithm for the Low Level RF System (LLRF) of Low Energy High Intensity Proton Accelerator	9.3.2009

Annexure 7

Receipts & Payments for the financial year ending on 31.3.2009

RECEIPTS & PAYMENTS ACCOUNT
FOR THE FINANCIAL YEAR ENDING ON 31.03.2009

Payment	Amt.(Rs.)	Amt.(Rs.)	Receipt	Amt.(Rs.)	Amt.(Rs.)
Honararium paid to			Opening balance	2,069,646.00	2,069,646.00
Prof. J C Mondel		1,200.00			
			Receipt/Admission/ Registration Fees	2,121,000.00	
Re-imbursement of tution fees		14,104.00	Less: - Refund of fees	5,000.00	2,116,000.00
Miscellaneous expenditure		5,470.00	Bank Interest on savings as on 30.06.2008	34,446.00	
Bank Charges (charges for o/s cheques)		120.00	as on 31.12.2008	49,977.00	84,423.00
Excess of Income over Expenditure (represented by bank balance in a/c 3012832251-2 as on 31.03.09)		4,249,175.00			
		4,270,069.00			**4,270,069.00**

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