UM-DAE CBS
CENTRE FOR EXCELLENCE IN BASIC SCIENCES
Health Centre Building, University of Mumbai,
Kalina Campus, Mumbai -400 098
Phone: 91-22-26524983 | Fax: 91-22-26524982

ANNUAL REPORT
(April 2012 – March 2013)

UM-DAE CBS

University of Mumbai (UM) – Department of Atomic Energy (DAE)
Centre for Excellence in Basic Sciences (CBS)

Annual Report
(April 2012- March 2013)

Preface

CBS has now completed 5 years of its existence. The Centre, which started on a modest scale, initially with only the Physics stream, has now added other streams of Basic Sciences, namely, Mathematics, Chemistry, and Biology since last year. The first batch of students of CBS have graduated in April 2012 with excellent grades, and have since joined for pursuing higher studies in reputed institutions, which includes, seven of them in DAE aided institutions like TIFR, NCBS, NCRA, HRI, CBS etc., two at top US universities, two in UM-BARC collaborative Ph.D programme. One student is working as a professor in a local college. The CBS students have been performing extremely well in national competitive examinations in Physics and Mathematics and have won several laurels. The Centre has established excellent organic linkages with the University Departments and constituent Colleges.

CBS has established modest research facilities for the core faculty appointed. New research labs in Physics, and Chemistry departments have since been added, besides the existing lab in the department of Biology. In addition to carrying out research at CBS, the faculty also collaborate with scientists in other well established research institutions with access to major equipments. The faculty at CBS have been able to produce excellent research publications in reputed international journals. The productivity has been increasing steadily and during the last year alone 21 papers have been published in reputed International Journals.

The construction work of the permanent buildings of CBS are nearly complete and we are planning to inaugurate the buildings by end of April, 2013.

One of the hall marks of CBS is its Visitors' programme. Visiting and Adjunct faculty coming from proximate research institutions contribute immensely to the teaching and research programmes at the Centre. There have been foreign nationals as well who have come and taught courses of lectures to the students. Distinguished scientists, who include several Nobel Laureates, have delivered Colloquia and Public Lectures at CBS.

This document lists all the activities and accomplishments of the Centre during the last one year and it is satisfying to note that CBS has lived up to the dreams of its creators; it has successfully established itself as a brand institution for teaching and research in the area of 'Basic Sciences' and set an example for other Universities to follow, which when accomplished would contribute immensely to the growth and improvement of higher education in the Country.

R. V. Hosur
Director

Contents

1. Preamble

The Centre for Excellence in Basic Sciences (CBS) has been created with the objective of sustaining a brand institution in the field of Basic Sciences on the campus of a University. The principal thrust is to impart high quality undergraduate and post graduate education in the midst of a vibrant research environment with emphasis on the experimental component within a multi-disciplinary framework.

CBS formally came into existence on March 26, 2007, with the signing of a MoU between the University of Mumbai (UoM) and the Department of Atomic Energy (DAE), Government of India. The University made available a 5- acre plot of land in the Kalina campus, Santa Cruz (E), for the construction of permanent buildings while the DAE is providing all the necessary funds. The Centre has *ipso-facto* autonomy with regard to academic, financial and administrative activities.

2. Management of CBS

CBS is managed by a Governing Council consisting of the following members:

- Chairman, AEC and Secretary, DAE - Chairperson
- Vice Chancellor, Mumbai University - Co-Chairperson
- Director, BARC - Member
- Director, TIFR - Member
- Director, IIT-Bombay - Member
- Pro Vice Chancellor, UoM, - Member
- Joint Secretary R&D (DAE) – Member
- Prof. S. K. Joshi, NPL- Member
- Centre Director, CBS - Member Secretary

The academic activities of the Centre are designed and overseen by the Academic Board of the Centre whose current members are:

- Prof. S. M. Chitre, CBS - Chairperson
- Prof. R. V. Hosur, Director, CBS - Member
- Prof. J. V. Narlikar, IUCAA – Member
- Prof. Arvind Kumar, formerly HBCSE - Member
- Prof. M. S. Ragunathan, formerly TIFR - Member
- Prof. J. Maharana, IoP, Bhubaneshwar - Member
- Dr. Swapan Ghosh, BARC - Member
- Prof. Dipan Ghosh, IIT-Bombay - Member
- Prof. N. Mukunda, IISc-Bangalore - Member
- Prof. K. N. Ganesh, IISER-Pune - Member
- Dr. R. R. Puri, HBNI - Member
- Prof. G. D. Yadav, ICT-Mumbai - Member
- Prof. N. Sathyamurthy, IISER, Mohali- Member
- Prof. A. M. Narsale, UoM - Member
- Prof. Deepak Dhar, TIFR - Member
- Dr. S. K. Apte, BARC – Member

3. Teaching
3.1. Faculty
3.1.1. Faculty at CBS

PHYSICS		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2012-2013)**
Prof. S. M. Chitre	Chairperson Academic Board & Emeritus Professor	Fluid Mechanics (P 702), Astronomy and Astrophysics (P 803)
Prof. R. Nagarajan	Emeritus Professor	Physics Laboratory (PL101, PL201, PL501,PL401/402), Electronics and Instrumentations (G201), Electronics Laboratory (GL 201)
Prof. S. B. Patel	Senior Scientist	Mathematical Physics (PCB 301), Nuclear Physics I (P 603)
Prof. S. C. Phatak	Senior Scientist	Computer Basics (G101), Computer Laboratory (GL 101), Advanced Classical Mechanics (P502), Mathematical Physics II (P 401)
Prof. H. C. Pradhan	Senior Scientist / Raja Ramanna Fellow	Mathematics I (M101), Communication Skills (H101), History and Philosophy of Science (H 201), Thermal and Statistical Physics (P 403)
Prof. A. K. Raina	Senior Scientist	Mathematical Physics II (P 602)
Dr. Sujit Tandel	Reader 'F'	Advance Physics Laboratory (PL 701), Experimental Nuclear and Astrophysics (PE 1003)
Dr. Ameeya Bhagwat	Reader 'F'	Classical Electrodynamics I (P 503), Nuclear Physics II (P 705), Electricity, Magnetism and Optics (P 201)
Dr. Gargi Shaw	Reader 'F'	Classical Mechanics (P 301), Physics Laboratory (PL 301, PL601/602)
Dr. M. Hemalatha	Assistant Professor	Physics Laboratory (PL 501), Advance Physics Laboratory (PL 701)
Dr. Bhaskar Khubchandani	Assistant Professor	Computational Mathematics Laboratory (ML 301, GL 401), Optics (P 402)
Dr. Sangita Bose	Assistant Professor	Solid State Physics I (P 703), Advance Physics Laboratory (PL 701)
Dr. Manojendu Chaudhury	Visiting Scientist - II	Computer Basics (G101), Computer Laboratory (GL 101)
Dr. Ananda Hota	Visiting Scientist - II	Nil
Dr. Alkendra Pratap Singh	Visiting Scientist - II	Nil
Dr. Sanjeev Kumar	Visiting Scientist - I	Nil
Dr. Tapan Naskar	Visiting Scientist - I	Nil

CHEMISTRY		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2012-2013)**
Prof. R. V. Hosur	Director	Nil
Dr. Neeraj Agrawal	Reader 'F'	Chemistry Laboratory (CL 101, CL 201, CL 501, CL 701,CBL 601/602), Chemistry-Biology Laboratory (CBL 301, CBL 401), Analytical Chemistry (CB 503), Organic Chemistry I (CB 402), Organic chemistry III (C 803)
Dr. Basir Ahmad	Visiting Scientist - II	Chemistry Laboratory (CL 501, CL 701,CL 201, CBL 601/602), Chemistry-Biology Laboratory (CBL 401), Biophysical Chemistry (C 604)
Dr. Avinash Kale	Visiting Scientist - II	Nil
Dr. Mahendra Patil	Visiting Scientist - I	Chemistry Laboratory (CL 201)
Dr. Sinjan Choudhury	Research Associate - I	Nil

MATHEMATICS		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2012-2013)**
Prof. Balwant Singh	Senior Scientist	Algebra III (M 502), Topology I (M 404), Topology (PE 1004)

BIOLOGY		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2012-2013)**
Dr. Jacinta D'Souza	Reader 'F'	Biology I (B101), Biology Laboratory (BL 101, BL 201), Biology II (B 201), Chemistry Biology Laboratory(CBL 402)
Dr. Uma Ladiwala	Assistant Professor	Biology I (B101), Biology Laboratory (BL 101, BL 201)
Dr. V. L. Sirisha	Research Associate – II	Biology Laboratory (BL 101, BL 201)
Dr. Mahuya Sinha	Research Associate - I	Biology Laboratory (BL 101, BL 201)

3.1.2. Adjunct Faculty

Name of the faculty	Affiliation	Courses taught in CBS
Prof. Swapan Ghosh	Bhabha Atomic Research Centre (BARC)	Chemical Kinetics and Reaction Dynamics (PCB 401), Properties of Matter (C 601), Quantum Chemistry II (C 603)
Dr. Srinivas Krishnagopal	Bhabha Atomic Research Centre (BARC)	Classical Electrodynamics (P 701), Accelerator Physics (P 804)
Prof. Vijay Singh	Homi Bhabha Centre for Science Education	Statistical Mechanics (P 604)
Prof. H. M. Antia	Tata Institute of Fundamental Research, Mumbai	Numerical Methods (G 501), Numerical Methods Laboratory (GL 501)

3.1.3. Visiting Faculty

PHYSICS		
Name of the faculty	**Affiliation**	**Courses taught in CBS**
Dr. Sudhir Jain	Bhabha Atomic Research Centre (BARC)	Physics I (P101), Fluid Mechanics (P 702), Relativistic Quantum Mechanics (P 802)
Dr. Radha Srinivasan	Department of Physics, University of Mumbai	Physics Laboratory (PL101)
Prof. Dipan Ghosh	Indian Institute of Technology, Mumbai	Quantum Information Theory (PE 1007)
Prof. G. Ravindra Kumar	Tata Institute of Fundamental Research, Mumbai	Ultrashort Lasers and Modern Optics (PE 1009)
Dr. P. K. Dasgupta	Siddharth College	Physics Laboratory (PL101)
Dr. Jayashree Chitalay	Ruia College	Physics Laboratory (PL101)
Dr. Anwesh Mazumdar	Homi Bhabha Centre for Science Education	Electricity, Magnetism and Optics (P 201)
Prof. Ajay Patwardhan	*Formerly* St. Xavier College	Mathematical Physics (PCB 301), Thermal and Statistical Physics (P 403)
Prof. Jyoti Rao	Ruia College	Optics (P 402)
Prof. P. Shashidhran	Vertak College	Applied Electronics Laboratory (GL 301), Electronics and Instrumentations (G201)
Prof. Arvind Kumar	*Formerly* Homi Bhabha Centre for Science Education	Quantum Mechanics I (P 501), General Theory of Relativity and Cosmology (PE 1005)
Prof. H. M. Antia	Tata Institute of Fundamental Research, Mumbai	Numerical Methods (G 501), Numerical Methods Laboratory (GL 501)
Dr. Sandhya Ullal	*Formerly* Mithibhai College	Physics Laboratory (PL 501)
Dr. Manohar Nyayate	B. N. Bandodkar college, Thane	Physics Laboratory (PL 501), Physics Labs(PL 601/602)

Dr. Pratap Raychauduri	Tata Institute of Fundamental Research, Mumbai	Solid State Physics I (P 703), Topics in Advanced Condensed Matter Physics (P 805)
Prof. S. K. Singh	Bhabha Atomic Research Centre, Mumbai	Reactor Physics & Radiation Sciences (P 704)
Prof. B. Banerjee,	*Formerly* Tata Institute of Fundamental Research, Mumbai	Nuclear Physics II (P 705)
Prof. B. K. Jain	*Formerly* Bhabha Atomic Research Centre	Nuclear Physics II (P705)
Prof. Sreerup Raychaudhuri	Tata Institute of Fundamental Research, Mumbai	Particle Physics (PE 1001)
Prof. A. Venugopal	Tata Institute of Fundamental Research, Mumbai	Photonics (PE 1002)
Prof. P.C. Agarwal	*Formerly* Tata Institute of Fundamental Research, Mumbai	Experimental Nuclear and Astro-Physics (PE 1003)
Prof. J. V. Narlikar	The Inter-University Centre for Astronomy and Astrophysics	General Theory of Relativity and Cosmology (PE 1005)
Prof. Lokesh Trivedi	Tata Institute of Fundamental Research, Mumbai	Atomic Physics (PE 1006)
Prof. Kartik Patel	Bhabha Atomic Research Centre, Mumbai	Computational Electrodynamics (PE 1008)
Prof. G. Ravindra Kumar	Tata Institute of Fundamental Research, Mumbai	Ultra short Lasers and Modern Optics (PE 1009)
Prof. Wendrich Soars	Vikash College.	Physics Laboratory (PL 101)
Dr. Tushima Basak	Mithibai College, Vile Parle (Previously CBS)	Physics Laboratory (PL 301, PL 601/602)
Ms. Bhagyashree Tarade	University of Mumbai	History and Philosophy of Science (H 201)
Prof. S. H. Patil	Indian Institute of Technology, Mumbai	Quantum Mechanics II (P 601)
Prof. Praveen Pathak	Homi Bhabha Centre for Science Education	Statistical Mechanics (P 604)
Prof. Lakshmi Natarajan	*Formerly* University of Mumbai	Atomic and Molecular Spectroscopy (P 605)
Prof. Sandhya Ullal	Formerly Mithibai College	Physics Laboratory (PL 601/602)
Prof. D. Biswas	Bhabha Atomic Research Centre (BARC)	Non-Linear Dynamics (P 801)
Dr. Rajdeep Sen Sarma	Tata Institute of Fundamental Research, Mumbai	Topics in Advanced Condensed Matter Physics (P 805)
Prof. Rajan Chitalay	Mithibai College, Vile Parle	Electronics and Instrumentations (G201)

MATHEMATICS		
Name of the faculty	**Affiliation**	**Courses taught in CBS**
Dr. Prithwijit De	Homi Bhabha Centre for Science Education	Mathematics I (M 101), Discrete Mathematics (M 304)
Dr. Kiran Kolwankar	R.J. College, Ghatkopar	Mathematical Methods (M 301), Differential Equations and Dynamical Systems (M 605)
Dr. Ajit Kumar	Institute of Chemical Technology	Analysis I (M 302), Computational Mathematics-II (M 606)

Dr. Anuradha Garge	(Previously CBS), University of Mumbai	Algebra I (M 303), Elementary Number Theory(M 403)
Prof. Inder K. Rana	Indian Institute of Technology, Mumbai	Mathematics II (M 201)
Dr. Vikram Aithal	*Previously* CBS	Topology III (M 503)
Prof. B. V. Limaye	Indian Institute of Technology, Mumbai	Functional Analysis (M 701)
Prof. Shripad Garge	Indian Institute of Technology, Mumbai	Commutative Algebra (M 702), Differential Geometry (M 604)
Prof. Anant Shastri	Indian Institute of Technology, Mumbai	Differential Topology (M 703)
Prof. V. D. Sharma	Indian Institute of Technology, Mumbai	Partial Differential Equations (M 704)
Prof. Alladi Subramanyam	Indian Institute of Technology, Mumbai	Stochastic Analysis (M 705), Probability Theory (M 603)
Prof. S. Ramaswamy	NIIT, Rajasthan	Fourier Analysis (M 801)
Prof. Sudhir Ghorpade	Indian Institute of Technology, Mumbai	Algebraic Number Theory (M 802),
Prof. Anant Shastri	Indian Institute of Technology, Mumbai	Algebraic Topology (M 803)
Prof. S. Krishnan	Indian Institute of Technology, Mumbai	Computational Mathematics III (M 804)
Prof. R. R. Simha	*Formerly* Tata Institute of Fundamental Research, Mumbai	Algebraic Geometry and its applications (M 805)
Prof. M. G. Nadkarni	University of Mumbai	Analysis IV (M 601)
Prof. R. C. Cowsik	University of Mumbai	Algebra IV (M 602)
Prof. Narsimhan Chari	Sanghvi College	Analysis II (M 401)
Prof. Ananth Hariharan	Indian Institute of Technology, Mumbai	Algebra II (M 402)

CHEMISTRY		
Name of the faculty	**Affiliation**	**Courses taught in CBS**
Dr. Evans Coutinho	Bombay College of Pharmacy, Mumbai	Chemistry I (C 101)
Dr. Padmakar Sathe	Ramnarain Ruia College	Inorganic Chemistry (CB 302), Chemical Thermodynamics (C 201),
Prof. M. Sudarsanam	University of Mumbai	Chemistry Laboratory (CL 101, CL 501, CL 701, CBL 601/602, CL 201), Chemistry-Biology Laboratory (CBL 301, CBL 401), Analytical Chemistry (CB 503)
Dr. Kalyana Vennetti	*Previously* CBS	Chemistry-Biology Laboratory (CBL 301)
Prof. R.K. Vatsa	Bhabha Atomic Research Centre (BARC)	Chemical Kinetics and Reaction Dynamics (PCB 401)
Sudha Shrivastava	Tata Institute of Fundamental Research, Mumbai	Introductory Spectroscopy (CB 401)
S. H. Mashraqui	University of Mumbai	Organic Chemistry I (CB 402)
A. V. Karnik	University of Mumbai	Organic Chemistry I (CB 402)
Dr. P. K. Madhu	Tata Institute of Fundamental Research, Mumbai	Quantum Chemistry I (C 501)

Prof. Ashok Goswami	Bhabha Atomic Research Centre (BARC)	Nuclear Chemistry (C 702)
Prof. Sunil K. Ghosh	Bhabha Atomic Research Centre (BARC)	Physical Organic Chemistry (C 704), Organometallic and bio-inorganic chemistry (C 703)
Prof. Dipak Palit	Bhabha Atomic Research Centre (BARC)	Introductory Spectroscopy (CB 401), Photochemistry (C 701)
Dr. R. P. Patel	Bhabha Atomic Research Centre (BARC)	Chemistry of Inorganic Molecules II (C 502)
Dr. S. Kannan	Bhabha Atomic Research Centre (BARC)	Chemistry of Inorganic Molecules II (C 502), Inorganic Chemistry III (C 605)
Dr .Lakshamy Ravishankar	V.G.Vaze College of Arts, Science & Commerce	Organic Chemistry II (C 602)
Dr. Gail Carneiro	Sophia College	Organic Chemistry II (C 602)
Dr. C G S Pillai	*Formerly* Bhabha Atomic Research Centre, Mumbai	Chemistry of Materials (C 801)
Dr. P A Hassan	Bhabha Atomic Research Centre (BARC)	Macro and Supra-molecular chemistry (C 802)
Dr. KRS Chandrakumar	Bhabha Atomic Research Centre (BARC)	Macro and Supra-molecular Chemistry (C 802)
Dr. Priti Khedkar	Guru Nanak Khalsa College of Arts, Science& Commerce Matunga	Organic Chemistry III (C 803)

BIOLOGY		
Name of the faculty	**Affiliation**	**Courses taught in CBS**
Dr. Vishal Raut	Bhabha Atomic Research Centre (BARC)	Biology Laboratory (BL 101)
Dr. Gotam Jarori	Tata Institute of Fundamental Research, Mumbai	Biochemistry (CB 301)
Prof. S. Sivakami	*Formerly* University of Mumbai	Biochemistry (CB 301), Biology II (B 201)
Dr. Suchita Bhattacharya	Nil	Advanced Molecular Biology (CB 403)

Earth Science, Energy & Environment etc.		
Name of the faculty	**Affiliation**	**Courses taught in CBS**
Prof. S. R. Dharwadkar	*Formerly* Bhabha Atomic Research Centre, Mumbai	Energy & Environment (G 401)
Prof. S. K. Arora	*Formerly* Bhabha Atomic Research Centre, Mumbai	Earth Science (G 502)
Prof. N. Basavaiah	Indian Institute of Geomagnetism, Navi Mumbai	Earth Science (G 502)
Prof. M.C. Arunan	Homi Bhabha Centre for Science Education	Ethics in Science and IPR (G 601)

3.2. Invited talks/ Lectures given by CBS faculty outside CBS

Prof. R.V. Hosur

- Invited to deliver a talk at *EUROMAR* conference held at Dublin, Ireland, from July 1-5, 2012.
- Invited to deliver a talk at *ICMRBS* held at Lyon, France, from August 14-19, 2012.
- Invited to deliver a talk at *GNR Symposium* held at Bangalore, from January 8-11, 2013.
- Invited to deliver a talk at International Symposium on *"Protein Folding and Dynamics"* held at NCBS Bangalore, from October 13-17, 2012.
- Invited to deliver a talk at the *Indian Chemical Society meeting* held at Bhopal, from December 12, 2012.
- Invited to deliver a talk at *Structural Biology meeting* held at BARC, from December 31, 2012.
- Lecture given on *"NMR spectroscopy"* at Teachers Training Workshop held at Bombay College of Pharmacy, from February 20, 2013.
- Lecture given on *"NMR spectroscopy"* at NMR workshop, held at Reliance Industries from, January 21-23, 2013.
- Lecture given on *"NMR spectroscopy"* at INSPIRE Camp, held at Mata Vaishnudevi University, Jammu from on July 23, 2012.
- Lecture given on *"NMR spectroscopy at Bioinformatics"* workshop, held at Pune University from March 12-14, 2013.

Prof. S. M. Chitre

- Seminar given on *"Solar Astronomy in India"* at the Udaipur Solar Observatory, Udaipur on September, 2012.
- Colloquium on *"Frontiers of Astrophysics"* in the Department of Physics, Mumbai on February, 2013.
- NIUS, Colloquium on *"Frontiers of Astronomy & Astrophysics"* at Homi Bhabha Centre for Science Education, Mumbai on March, 2013.

Prof. R. Nagarajan

- Lecture given on *"Superconductivity"* at Ruia College on 22nd Jan 2013 on the occasion of 'The Late Sitaram N. Ghate memorial'.
- Lecture given on *"physics experiments using microcontroller based equipment PHOENIX and expEYES"* (developed by Dr. Ajith Kumar of Inter University Center for Accelerator Physics, New Delhi of UGC) at the Experimental Physics workshop conducted by Prof. R. Srinivasan at Indian Academy of Sciences, at Bangalore.

Prof. H. C. Pradhan

- Invited to deliver an Inaugural talk at a Workshop on Development of the Manual for NCSC 2012, Central Univrsity, Tezpur on May 2, 2012 on topic titled *"Energy – Explore, Harness and Conserve"*.
- Invited to deliver a Lead talk at Curriculum Group for Middle School Mathematics, State Council of Educational Research and Training, Government of Maharashtra, Pune on May 24, 2012 on topic titled *"Designing a Mathematics Curriculum for All*".
- Seminar given on *"Research Methodology for Education"* for New Ph.D. Students in Education, Navrachana University, Vadodara on September 7, 2012.
- Lecture given on *"Qualitative and Mixed Methods in Educational Research"* as a Course on Research Methodology for Teacher Educators, K J Somaiya College of Education, Mumbai on December 8, 2012.

Dr. S. B. Patel

- Lectures given as a visiting Professor at University of Illinois, Chicago, USA during 12th June, 2012 to 4th August, 2012.

Dr. Jacinta D'Souza

- Invited to deliver an Inaugural talk at the Department of Physics, K. J. Somaiya College of Science and Commerce, Vidyavihar (East) on 12th September, 2012 on the topic titled, *"Flagella: Cellular sensors and movers"*.
- Invited to deliver a talk titled, *"Flagella/Cilia: the mystery matters,"* on 2nd November, 2012 at the Orientation cum Selection camp of NIUS 2012 held at the Homi Bhabha Centre for Science education (TIFR).
- Invited as a Resource Person for the Faculty Development Programme to deliver a talk titled, *"Gene Cloning and Over-expression: Science Inevitable!"* on the 20th of February, 2013. This programme was conducted at the Bombay College of Pharmacy and is organized as an AICTE sponsored Faculty Development Programme on "New Facets of Medicinal Chemistry in Drug Discovery" from 18th February to 2nd March 2013.

Dr. Gargi Shaw

- Lectures given at Mumbai University for Astrophysics course on *"Galactic and extra Galactic"*.

Dr. Ameeya Bhagwat

- Invited to deliver a talk titled *"Recent Developments in the Wigner – Kirkwood Mass Formula"* on November 19-21, 2012, at the International Conference on Recent Trends in Nuclear Physics (ICRTNP-2012), Chitkara University, Himachal Pradesh, India.

- Invited to deliver a talk titled *"Wigner - Kirkwood Mass Formula"* on March 1-2, 2013 at a Workshop on High Performance Computing at Inter University Accelerator Centre, New Delhi.

Dr. M. Hemalatha

- Invited talk on "*Double folding model analysis of elastic scattering of halo nucleus 11Be from 64Zn around Coulomb barrier*" at National conference on nuclear physics, Sambalpur University, Odisha during March 1-3, 2013.
- Invited talk on *"Archaeology with Pelletron"* at Discussion Meeting on Carbon Tuned AMS during April 9-10, 2013.

Dr. Sangita Bose

- Invited to deliver a talk titled "*Size effects in single, isolated superconducting nanoparticles*" at the CECAM workshop "Control and enhancement of superconductivity in conventional and high T_c nanostructures" held in Laussane, Switzerland from 6-8th June, 2012.

Dr. Manojendu Choudhury

- Lectures given on "*Astronomy and related topics*" at the Orientation Cum Selection Camp for Astronomy Olympiad on April-May 2012.
- Lectures given in the Astronomy Olympiad exposure Camp on November 2012.
- Seminar given on *"Electronics and Astronomy: Radio Astronomy and X-ray Astronomy"*, at the BCUD sponsored three day national seminar on "Application of Electronics in Astronomy and Astrophysics" held at KTHM College Nashik on March 28, 2013.

4. Students

National Entrance Screening Test (NEST) -2012

Statistical Data

No. of candidates applied for NEST exam	**15099**
No. of candidates appeared for NEST exam	**10775**
No. of shortlisted candidates	**503**
No. of candidates called for counseling	**405**
No. of candidates admitted in CBS	**35**

4.1. Students Admitted for Academic Year 2012-2013

Sr. No.	M/F	Name (Alphabetical order)	NEST Rank	State
1	M	Agarwal Naman	74	Uttar Pradesh
2	M	Akshay K.	362	Kerala
3	M	Alam Salman	220	Uttar Pradesh
4	M	Amulya Ratnakar	344	Maharashtra
5	F	Anjitha S. G.	40	Kerala
6	M	Ankur	391	Rajasthan
7	F	Dhevi Kaarunya G. G.	39	Tamil Nadu
8	M	Datta Sagnik	142	West Bengal
9	M	Gupta Kaustabh	53	Andhra Pradesh
10	M	Gupta Rishabh	243	Uttar Pradesh
11	M	Howlader Abhishek	1260	Chhattisgarh
12	M	John Regis	305	Kerala
13	M	Kalakuntla Harsha Vardhan Rao	184	Andhra Pradesh
14	M	Kalamkar Prasad Chandrakant	148	Maharashtra
15	M	Kamlesh Deepak	312	Chhattisgarh
16	M	Kumawat Ankit Kumar	515	Rajasthan
17	M	Mandal Pratik Kumar	2380	Odissa
18	F	Meena Priyanka	204	Haryana

Sr. No.	M/F	Name (Alphabetical order)	NEST Rank	State
19	M	Mishra Aishwarya	50	Uttar Pradesh
20	M	Mishra Sanu	88	Madhya Pradesh
21	M	Nikhil S.	144	Kerala
22	F	Ohol Harshada	1874	Maharashtra
23	M	Pillai Anirudh	105	Maharashtra
26	M	Prabhakar Sachin	153	Kerala
24	M	Pradhan Swagat Subhadarshee	484	Odissa
25	M	Sablok Sanchit	37	Madhya Pradesh
27	M	Sant Kamal	1521	Uttarakhand
28	M	Saseendran Sangeeth	489	Uttar Pradesh
29	F	Sivan Aswathi K.	230	Kerala
30	M	Soni Kumud	1903	Uttar Pradesh
31	M	Soni Prateek	258	Rajasthan
32	M	Srivastava Duttatrey Nath	154	Uttar Pradesh
33	M	Vaidya Rohit	176	Maharashtra
34	M	Vaisakh Vij	182	Kerala
35	F	Varawala Lamia Yasir	31	Maharashtra

State wise distribution of students

State	No. of students
Kerala	7
Uttar Pradesh	7
Maharashtra	6
Rajasthan	3
Andhra Pradesh	2
Chhattisgarh	2
Madhya Pradesh	2
Odissa	2
Haryana	1
Tamil Nadu	1
Uttarakhand	1
West Bengal	1
Total	**35**

4.2. Academic achievements by students (The recently graduated batch of students)

The first batch of students graduated in April 2012, 17 out of 19 are now pursuing academic careers in research and/or teaching institutions of repute (Tata Institute of Fundamental Research, Bhabha Atomic Research Centre, Indian Institute of Science, Harish-Chandra Research Institute, Indian Institutes of Technology, and the like) within the country. Two students have gone abroad to pursue doctoral research.

Name of the student	Exam Rank/ Fellowship/Publication	Ph. D./job offer from	Current Status
Lavish Pabbi	• CSIR-UGC-NET Physical Sciences, December 2011, Rank 23 • JEST-2012, Physics, Rank 41 • GATE-2012, Physics, Rank 189 • **Awarded National Photonics Fellowship 2011**	• Ph.D. Offer from Tata Institute of Fundamental Research (TIFR) • Ph.D. Offer from Pennsylvania State University, USA • Ph.D. Offer from University of Maryland, USA • Ph.D. Offer from Duke University, USA • Ph.D. Offer from University of Bristol, UK • Ph.D. Offer from Max Planck Institute, Dresden, Germany • Job Offer from Bhabha Atomic Research Centre (BARC)	Ph.D. offer accepted from Pennsylvania State University, USA
Rashi Verma	• GRE General Score: 328/340 • TOEFL Score: 115/120 • CSIR-NET Physical Sciences, December 2011, Rank 74 • JEST-2012, Physics, Rank 280	• Ph.D. Offer from Boston University, USA • Ph.D. Offer from Virginia University, USA • Ph.D. Offer from University of Toronto, USA	Ph.D. Offer accepted from Boston University, USA

Name of the student	Exam Rank/ Fellowship/Publication	Ph. D./job offer from	Current Status
Mritunjay Kumar Verma	• **CSIR-UGC-NET Physical Sciences, December 2011, Rank 2** • JET 2012 Physics: Rank 10 • GATE 2012 Physics: Rank 10 • **Awarded Shyama Prasad Mukherjee Fellowship in Physics 2012**	• Ph.D. Offer from Harish-Chardra Research Institute (HRI) • Ph.D. Offer from Tata Institute of Fundamental Research (TIFR • Ph.D. Offer from Indian Institute of Technology, Kanpur (IIT-K) • Job Offer from Bhabha Atomic Research Centre (BARC)	Ph. D. offer accepted from Harish-Chandra Research Institute (HRI), Allahabad
Sitender Pratap Kashyap	• CSIR-NET Physical Sciences, December 2011, Rank 81	• Ph.D. Offer from Harish-Chardra Research Institute (HRI) • Ph.D. Offer from Indian Institute of Technology, Kanpur (IIT-K) • Job Offer from Bhabha Atomic Research Centre (BARC)	Ph. D. offer accepted from Harish-Chandra Research Institute (HRI), Allahabad
Deovrat Prasad	• GATE-2012, Physics, Rank 334	• Ph.D. at the Indian Institute of Science (IISc.)	Ph.D. offer accepted from the Indian Institute of Science (IISc.), Bangalore
Akash Suman	• CSIR-UGC-NET Physical Sciences, December 2011, Rank 63	• NIL	Ph.D. offer accepted from the Indian Institute of Science (IISc.), Bangalore

Name of the student	Exam Rank/ Fellowship/Publication	Ph. D./job offer from	Current Status
Sree Krishna Varma Raja P.C.	• **2 Publications** in DAE Symposium on Nuclear Physics 2010: o "Setting up and characterization of 4π -BF3 Neutron Counter". o "Measurement of Neutron Yield and Angular Distribution for Thick NatLi(p, n+x) Reaction"	• Ph.D. Offer from Tata Institute of Fundamental Research (TIFR) • Ph.D. Offer from National Centre for Biological Sciences of TIFR	Ph. D. offer accepted from National Centre for Biological Sciences (NCBS) of TIFR, Bangalore
Parmeshwar Prasad	• GATE Qualified	• Ph.D. Offer from National Centre for Biological Sciences (NCBS) • Ph.D. Offer from Indian Plasma Research (IPR) • M. Tech. Offer from National Institute of Technology (NIT) Kurukshetra	Ph. D. offer accepted from National Centre for Biological Sciences (NCBS) of TIFR, Bangalore
Ninad Jetty	• Joint CSIR-UGC (JRF) NET (Dec. 2011) Rank 57 • GATE 2012 - Rank 319 • JEST 2012 - Rank 350 • **1 publication in American Journal of Physics**	• Selected for Ph.D. in the Department of High Energy Physics at the Tata Institute for Fundamental Research (TIFR), Mumbai. • Selected for Ph.D. in the Department of Physics (Experimental Condensed Matter Physics) at the Indian Institute of Sciences (IISc.), Bangalore. • Selected for Ph.D. at the Raman Research Institute (RRI), Bangalore.	Ph.D. offer accepted from Department of High Energy Physics at the Tata Institute for Fundamental Research (TIFR), Mumbai.

Name of the student	Exam Rank/ Fellowship/Publication	Ph. D./job offer from	Current Status
Udaya Maurya	• CSIR-NET Physical Sciences, December 2011, Rank 27 • JEST-2012, Physics, Rank 73 • GATE-2012, Physics, Rank 289 • JEST-2011, Physics, Rank 49	• Ph.D. Offer from Inter-University Centre for Astronomy and Astrophysics (IUCAA) • Ph.D. Offer from Tata Institute of Fundamental Research (TIFR), Department of Astronomy and Astrophysics (DAA) • Job Offer from Bhabha Atomic Research Centre (BARC)	Ph. D. offer accepted from Department of Astronomy and Astrophysics (DAA) Tata Institute of Fundamental Research (TIFR), Mumbai
Rohit Sharma	• JEST-2012, Physics, Rank 217	• Ph.D. Offer from National Centre for Radio Astronomy (NCRA) of TIFR	Ph.D. Offer accepted from National Centre for Radio Astronomy (NCRA) of TIFR , Pune
Dharmaj Soni	• CSIR-UGC-NET Physical Sciences, December 2011, Rank 9 • JEST-2012, Physics, Rank 5 • GATE-2012, Physics, Rank 55	• Ph.D. Offer from Tata Institute of Fundamental Research (TIFR) • Ph.D. Offer from Indian Institute of Management (IIM), Bangalore • Ph.D. Offer from Indian Institute of Management (IIM), Ranchi • M. Tech. Offer in Applied Optics from Indian Institute of Technology Delhi (IIT-D), Rank 2	-

Name of the student	Exam Rank/ Fellowship/Publication	Ph. D./job offer from	Current Status
Kedar Kolekar	• CSIR-UGC-NET Physical Sciences, December 2011, Rank 51 (LS) • JEST-2012, Physics, Rank 483 • GATE-2012, Physics, Rank 677	• NIL	Job offer as Assistant Professor accepted from Khalsa College, Mumbai
Poonam Kumari	• **Publication in Optical Express** "Optical trapping in an absorbing medium: from optical tweezing to thermal tweezing" (The Board of Editors has recommended the paper for special mention. This will make the paper freely available to the scientific community) • PET Qualified	• Selected for Ph. D from Mumbai University (MU) - Bhabha Atomic Research Centre (BARC) Collaborative Programme in Physics	Ph.D. Offer accepted from MU- BARC Collaborative Programme in Physics
Abhishek Pathak	• GATE qualified • 1 Publication in Physical Review	• Selected for Ph. D from Mumbai University (MU) - Bhabha Atomic Research Centre (BARC) Collaborative Programme in Physics	Ph.D. Offer accepted from MU- BARC Collaborative Programme in Physics
Renu Redhu	• NIL	• Selected for Ph. D from Mumbai University (MU) - Bhabha Atomic Research Centre (BARC) Collaborative Programme in Physics	Ph.D. Offer accepted from MU- BARC Collaborative Programme in Physics
Harsh Nayak	• JEST 2012 - Rank 361	• NIL	JRF in CBS
Shoumi Roy	• UGC-NET Rank 81 • GATE qualified	• NIL	JRF in CBS
Amrtiansh Vats	• NIL	• NIL	JRF in CBS

4.3. Achievements of Current CBS Students

- **International Student Research Internship Fellowship - 2012**

  Mr. Mohanish Borana 4th Year Student awarded International Student Research Internship Fellowship - 2012 of Ecole Polytechnique to carry out research at National Centre for Scientific Research (C.N.R.S) Laboratory which is under the administrative authority of Ministry of Research (Govt. of France).

- **Asian Science Camp – 2012**

  The following students have been selected for Asian Science Camp (ASC) 2012:

  1. Ms. Phalguni Shah 2nd year
  2. Mr. Ajay C.J. 2nd year
  3. Mr. Prateek Garg 2nd year

- **National Initiatives on Undergraduate Science (NIUS) HBCSE/TIFR – 2012**

  Students selected for **NIUS Chemistry Camp**

  1. Ms. Anjitha S. G. 1st year
  2. Mr. Duttatrey Nath Srivastava 1st year
  3. Mr. Sagnik Dutta 1st year

  Students selected for **NIUS Biology Camp**

  1. Ms. Kaarunya Dhevi G. 1st year
  2. Mr. Anirudh V. Pillai 1st year

- **Kishore Vaigyanik Protsahan Yojana (KVPY) – 2012**

The following students have been selected for Kishore Vaigyanik Protsahan Yojana (KVPY) fellowship 2012:

	Name	Year
1.	Sanchit Sablok	1st year
2.	Pillai Anirudh Vinod	1st year
3.	Kaustubh Gupta	1st year

- **Madhava Mathematics Competition - 2013**

Every year 1st, 2nd and 3rd year students participate in the Madhava Mathematics Competition. This year the following students have got Cheer prize in this competition:

1. Mr. Deepak Kamlesh 1st year
2. Ms. Phalguni Shah 2nd year
3. Mr. Karan Kathuria 2nd year
4. Mr. Sahil Joshi 2nd year

- **Khorana Scholar – 2013**

Mr. Mohanish Borana 4th Year Student has been selected from Department of Biotechnology (Govt. of India) and Indo-US Science &Technology Forum for ***KHORANA Scholar*** for the year 2013**.**

- **Joint Entrance Screening Test (JEST- 2013)**

The following CBS students have qualified in the Joint Entrance Screening Test (JEST-2013) for pursuing **Ph. D.** programme:

	Name	Year	Rank
1.	Mr. Aklant Kr. Bhowmick	4th year	08
2.	Mr. Dhruv Ringe	5th year	10
3.	Mr. Sandeep Kumar Sehrawat	5th year	12
4.	Mr. Harsh Nayak	JRF	27
5.	Mr. Sarath Sankar	5th year	28
6.	Mr. Shashank Markande	4th year	66
7.	Mr. Abhishek Mahapatra	5th year	82
8.	Mr. Shashank Pathak	4th year	174
9.	Mr. Praneet Prakash	5th year	200

The following students have qualified in the Joint Entrance Screening Test (JEST-2013) for pursuing **Integrated Ph. D.** programme:

	Name	Year	Rank
1.	Ms. Shilpi Singh	4th year	32
2.	Mr. Saptarshi Das	3rd year	89

4.4. Projects done by final year students

Sr. No.	Name of the Candidate	Guide: Name and Institution	Title of the Project
1.	Abhishek Mohapatra	Guide: Prof. D. Dhar (TIFR)	Theory of fluids and off-diagonal long range order
2.	Sarath Shankar	Prof. D. Dhar (TIFR)	Study of renormalization group method and its application to critical phenomena in polymers
3.	Dhruv Ringe	Prof. S. Raychaudhuri (TIFR)	Missing energy in top quark pair production at the LHC as a probe of large extra dimensions
4.	Praneet Prakash	Prof. M. Krishnamurthy (TIFR)	Basic optics and laser-matter interaction experiments
5.	Niranjan	Dr. Ameeya Bhagwat (CBS)	Study of binding energy with the Wigner-Kirkwood method
6.	Chandan Kumar	Prof. P. Raychaudhuri (TIFR)	Pronounced matching effects in disordered NbN thin films with periodic array of holes
7.	Neha Singh	Prof. P. Ayyub (TIFR)	Control of hydrophobicity of copper nanorod array
8.	Alkesh Yadav	Prof. Srinivas Krishnagopal (BARC)	Laser wakefield acceleration
9.	Saurabh Yadav	Prof. L. Tribedi (TIFR)	Ionization of Ne gas by 10 keV electron impact
10.	Pooja Moundekar	Prof. S. Basu (BARC)	Deposition and characterization of Ni/Zr system by reflectivity techniques
11.	Sandeep Kumar Sehrawat	Dr. Ameeya Bhagwat, CBS	Relativistic mean field theory and some of its applications

5. Research

5.1. Areas of research

Physics

- ***A two-dimensional mixing length theory of convective transport (Prof. S. M. Chitre)***

The research effort was largely concentrated on constructing a two-dimensional mixing length prescription for computing the convective flux for use in 2D axisymmetric stellar evolutionary models. The stellar evolution of massive stars with a radiative alpha-Omega dynamo was also investigated to predict that more massive stars are much less likely to support a dynamo-driven magnetic field than less massive stars. Using the observed angular velocity variations (zonal bands) in the solar convection zone as proxy, the magnetic field in the solar interior was inferred on the assumption that the angular acceleration is predominantly produced by the azimuthal component of the Lorentz force.

- ***Condensed Matter Physics (Prof. R. Nagarajan)***

Superconductivity; Magnetism, Magneto-optic investigations in ferrofluids, Material synthesis, Mossbauer Spectroscopy, Low Temperature Techniques, Solar Energy, and Instrumentation.

- ***Theoretical nuclear and particle physics (Prof. S. C. Phatak)***

Quark models of nucleons and nuclei, quark gluon plasma, nuclear scattering theory, meson-nucleus scattering and computational nuclear physics.

- ***Applications of algebraic geometry to physical and mathematical problems (Prof. A. K. Raina)***

Applications of algebraic geometry to physical and mathematical problems arising out of conformal field theory. Infinite Dimensional Lie Algebras and their application to soliton equations. QFT in 2d; Functional analysis methods to obtain optimal constraints on scattering amplitudes and form factors.

- ***Physics Education (Dr. H. C. Pradhan)***

Trained as theoretical nuclear physicist, Dr. Pradhan's main areas of R&D now are physics education at school and college level and science and mathematics education at school level. His current interests are students' alternative conceptions in physics and mathematics, laboratory development in physics, students' knowledge organization in science and capacity building of undergraduate physics students.

- ***Nuclear Physics, with a focus on gamma-ray spectroscopy (Dr. Sujit Tandel)***

Isomeric states in nuclei: K isomers in superheavy nuclei and in the neutron-rich A~180 mass region Novel shapes and symmetries: Prolate-oblate shape transition at high spins; triaxial superdeformed shapes in nuclei, Collective excitations in rare-earth and actinide nuclei: Rotational structures and nucleon alignments; competition between collective rotation and octupole excitations, Model calculations of deformed nuclei: Cranked shell model calculations using the Woods-Saxon and Nilsson formalisms, Development of new materials, instrumentation and techniques for radiation detection and digital data acquisition systems.

- ***Nuclear structure theory (Dr. Ameeya A. Bhagwat)***

"The study of nuclear masses and the systematics thereof is of immense importance in nuclear physics. With the advent of mass spectrometry, it is possible to measure masses of some of the short-lived nuclei spanning almost the entire periodic table. On the other hand, theoretical determination of the masses is still being vigorously pursued by a large number of groups around the globe. At present, he is involved in the microscopic - macroscopic approach for nuclear masses, using the semi - classical Wigner - Kirkwood method for shell corrections. They have achieved considerable progress in this aspect, and the mass model that has been developed is now comparable with some of the best models available in the literature. Further refinements of the model are in progress.

He is also working on refinement of the relativistic mean field model parameterisation, so as to improvise the description of single particle phenomena without disturbing the good agreement obtained in the description of bulk properties. They have achieved significant progress in this respect, and some of the finer details are now being investigated."

- ***Laser Spectroscopy of Nuclei away from stability (Dr. M. Hemalatha)***

In recent years, high resolution laser spectroscopy has emerged as a powerful tool for investigation of properties of ground and isomeric nuclear states of nuclei away from stability. Since these nuclei can only be produced in small quantities, the experiment requires a high sensitive set-up for the measurement of ground state properties. A high resolution and high sensitive fluorescence cell for the measurement of isotope shifts and hyperfine structure using laser spectroscopy is being developed. The design incorporates various features suitable for the investigation of stable and long-lived radioisotopes (offline) with a provision for adaptation of the cell for study of online species at accelerators. This experimental set up is the first of its kind in India for laser-based nuclear physics investigations. This work is interdisciplinary and involves experimental and theoretical understanding of nuclei away

from stability. This work is being done with the grant of Rs. 17 Lakhs from Board of Research in Nuclear Sciences (BRNS), Department of Atomic Energy (DAE), Government of India under **DAE Young Scientist Research Award** (2012).

- ***Elastic Scattering of Halo Nuclei (Dr. M. Hemalatha)***

There is renewed interest in the study of nuclear reactions due to the observation of exotic phenomena like the neutron halo in nuclei. Halo nuclei, for example 11Li and 11Be, are characterized by a compact core and an extended neutron distribution. One of the interesting aspects is to understand the effect of a halo structure on cross sections at near-Coulomb barrier energies. Around Coulomb barrier, the scattering of light projectiles with heavy targets is influenced by dipole polarizability. The effect of dipole polarization in elastic scattering at near-Coulomb barrier energies is studied using dynamic polarization potential. Investigation using optical model are being carried out.

- ***Astrophysical spectral simulation, Astrochemistry, Photodissociated region (PDR), Studying High-redshifted astrophysical objects, Multi-wavelength Observation Simulation and Theory (Dr. Gargi Shaw)***

Understanding the chemical evolution of the universe, from the nearby low-luminosity star-forming regions within our galaxy to the highest redshift and most luminous galaxies, is a major goal in current astrophysics. Most of our understanding of the chemical and physical evolution of the universe comes from the detailed analysis of the observed spectrum produced by interstellar gas.

Interstellar gas/matter is far from equilibrium and numerical simulations are the best way to decipher the message in the spectrum. The physical state of a non-equilibrium gas is determined by the underlying microphysics and the external environment, mainly the radiation field striking the gas. As a result, the gas properties and its observed spectrum are sensitive to atomic and molecular rate coefficients, composition and density of the gas, and to the sources of energy that enter the region. Due to complicity of these large degrees of freedom, no analytical solutions are possible and a numerical approach is the only option.
She is an active member of the astrophysical spectra simulation group “CLOUDY” which is vastly used among observers to decipherer their observation. The aim of CLOUDY is to predict observed spectra based on ab initio calculation with a minimum number of free parameters.

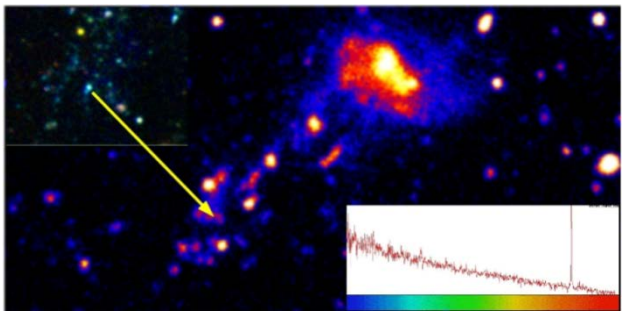
According to the standard Big bang cosmology, the universe was created from a singularity followed by inflation. At the early epoch, matter and radiation was in thermal equilibrium due to Thompson scattering of electrons and photons and the temperature was very high. As the expansion continued, the density decreased and the heating of matter by Thompson scattering failed to overcome the cooling by adiabatic expansion resulting in decreasing temperature. As

the temperature of matter reached about 4000K the recombination starts. At this stage matter changed rapidly from fully ionized to a largely neutral state. The chemical species available from the primordial nucleo-synthesis were H, H+, D, D+, He, and Li which formed molecules such as H_2, HD, LiH, and HeH+. More complex molecules started to form as the Universe evolved.

Deuterium is believed to be created only in Big Bang and [D]/[H] is an important clue to the physics of Big Bang as the formation of pristine D is very sensitive to baryon-to-photon ratio. As deuterium is burnt up in stars more efficiently than H, it is an ideal tracer of star formation and [D]/[H] is expected to be lower in star-forming environments than that predicted by the standard Bing Bang model.

Modeling of Damped Lyman alpha absorbers and their [D]/[H] ratio as a function of redshift to understand the star formation rate as a function of redshift.
She is also involved in Astrochemistry of the interstellar medium to study the abundance and reactions of chemical elements and molecules and their interaction with radiation in the universe.

- ***Discovery of the farthest star born in the wild (Dr. Ananda Hota)***



Multi-wavelength observation of normal and active galaxies. Discovering new objects and detailed case study approach to understand the physical processes behind galaxy-blackhole co-evolution. Those processes include, galaxy merger, AGN-feedback and galaxy infall/accretion on to clusters of galaxies. Combining Giant Meterwave Radio Telescope (GMRT) data with date from world-class telescopes in other wavebands, located in any continent or in space.

- ***High energy astrophysics, accretion (Dr. Manojendu Choudhury)***

Ejection systems involving compact objects - Interested in the phenomenological study of the accreting systems (viz. X-ray binaries, ULXS, symbiotic stars) and investigating the fundamental physical mechanisms and phenomena occurring in these systems, including the ejection of matter in the form of jets and winds observed in these systems.

X-ray and gamma-ray astronomy - Interested in multi-wavelength analyses of the high energy sources and their classification, using data from the optical and radio archives and observatories like GMRT.

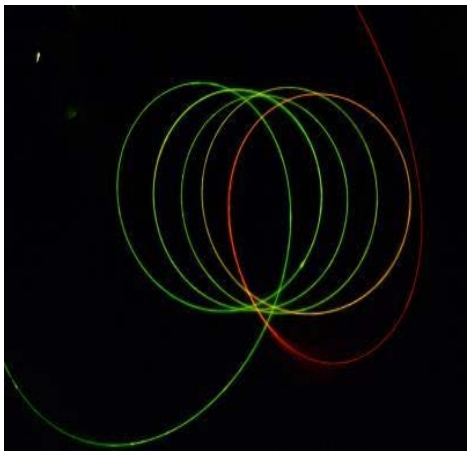
Astronomical software - Expert in the analysis of astronomical data analysis including the installation and maintenance of the various software packages used in astronomy, viz. HEASOFT, AIPS, IRAF, etc. Also working in detector development simulation software and dabbling in magnetohydrodynamical simulation using the freely available software packages.
Astronomy laboratory - Setting up an astronomical laboratory, with emphasis on high energy detectors viz. proportional counters, scintillation detectors and solid state detectors (CZT) tuned for astronomical (satellite based) observations. Also working on other simple experiments having relevance to astronomical observations and research.

- ***Experimental condensed matter physics and nanoscience (Dr.Sangita Bose)***

Our work focuses on the study of the electronic properties of low dimensional materials like thin films and nanomaterials. She has used various transport based spectroscopic techniques like tunneling and Point Contact Andreev Reflection Spectroscopy to study the properties of these materials. Her primary interest is in mesoscopic superconductors and she essentially probes the tunability of superconductivity with decreasing particle size.

- ***Nonlinear phenomena in optical fiber communication systems (Dr. Bhaskar Khubchandani)***

Nonlinear phenomena include four wave mixing, stimulated Raman scattering, self- and cross-phase-modulation; Ultrafast intense pulsed laser beam propagation and diagnostic techniques such as frequency-resolved-optical-gating (FROG) - In particular - GRENOUILLE - a highly simplified version of FROG; Numerical simulation of all the above phenomena using a combination of techniques such as the split-step Fourier method and finite element methods.



Mathematics

- ***Algebraic Geometry and Commutative Algebra (Dr. Balwant Singh)***

Unique factorization domains and divisor class groups, invariants of a unique factorization domain under the action of a finite group, automorphisms and embeddings of algebraic curves, study of singularities and their resolution, the role of Hilbert functions and other numerical characters in resolution, inter-relationships among these characters and their behaviour under a blowing up, differential properties of singularities, Nakai's conjecture

concerning differential operators, the structure of maximally differential ideals, seminormality, subintegrality and its element-wise characterization, the relationship between sub integrality and invertible modules and the Picard group.

Chemistry

- ***Biological Chemistry (Prof. R. V. Hosur)***

The structural characteristics of associated state of plasmodium falciparum P2 protein have been characterized. The folding pathway of the protein has been elucidated and it is observed that the protein follows the 'hydrophobic collapse model'. A new reduced dimensionality NMR experiment has been developed which provides many advantages over previously published pulse sequence for rapid resonance assignment in proteins. A new dual receiver based experimental sequence has been developed which enables acquiring of five dimensional NMR information in three dimensional time frame. A unified strategy for rapid structure determination of proteins has been presented.

- ***Synthetic Chemistry (Dr. Neeraj Agarwal)***

Synthesis of NIR absorbing organic molecules e.g. porphyrins, BODIPy etc. for photovoltaic applications; Synthesis and applications of organometallic complexes for photocatalytic water splitting; Synthesis of dye molecules for the photodynamic therapy of cancers.

- ***Structures and properties of biological molecules, especially proteins, and their relationship to human disease* (*Dr. Basir Ahmad)***

The investigation of the structures and properties of biological molecules, especially proteins, and their relationship to human disease, with particular interest in the fundamental science underlying disorders such as Alzheimer's, Parkinson's disease and systemic amyloidoses. An interdisciplinary approach is used to study the fundamentals of protein aggregation and the mechanism of prevention of misfolding and aggregation at its onset. The methods used are largely experimental, but do include theoretical and computational approaches. In addition to classical molecular biology and biochemical techniques for manipulation of genes and purification of their resulting proteins, the experimental work involves the utilisation of biophysical techniques for the characterisation of the folding and aggregation processes. These include turbidometry, fluorescence, circular dichroism and Fourier-transform infra-red spectroscopies, static and dynamic light scattering, stopped-flow devices. Projects involving nuclear magnetic resonance (NMR), atomic force microscopy (AFM), transmission electron microscopy (TEM), mass spectrometry (MS) and limited proteolysis are feasible through collaborations.

- ***Mechanism and function of mosquito borne diseases (Dr. Avinash Kale)***

1. First approach involves the understanding of the gliding motility mechanism of the apicomplexan (*Plasmodiums*). This would help to understand about how these malarial parasites recognizes the host cells (*Eukaryotes*), which is first step of the invasion machinery. He has adopted structural approach (protein x-ray crystallography, protein NMR, and small angle x-ray scattering (SAXS)) to understand the whole mechanism of the motility and recognition by the apicomplexans. He will also use various biophysical techniques like CD, SPR, fluorescence etc. to in vitro establish the interaction between the respective protein-protein and/or protein-DNA partners.

2. The second approach involves identification and characterization of the novel mosquitocidal toxins present in nature; isolated from *Bacillus* family bacterium. These newly characterized isolates will be extensively investigated using a proteomic approach to pin point the toxic component(S) in the strain. These targets will be cloned, expressed, and purified for further characterization and structural determination.

- ***Chemical catalysis namely, Enzyme catalysis, Transition metal catalysis and Organocatalysis (Dr. Mahendra Patil)***

Using computational methods such as Quantum Mechanics (QM), Molecular Mechanics (MM) and Combined QM/MM methods with specific emphasis on modeling chemical reactions as closely as possible to the reality using computational methods. The objectives of these theoretical studies include elucidation of reaction mechanisms, identification of factors that govern the stereoselectivity, and effects of solvent and additives on the rate of reaction. The ultimate goal of the research is to establish a link between theoretical findings and actual catalysis processes in order to predict new catalytic strategies for the organic chemists.

- ***Biophysical Chemistry (Dr. Sinjan Choudhary)***

Biophysical characterization of Protein misfolding, aggregation/fibrilization and its prevention, mode of action of a wide range of therapeutically active molecules on disease associated proteins, Drug-Protein and Drug-DNA interactions, micelles mediated drug delivery.

Biology

- ***Summary of the projects carried out in the research laboratory (Dr. Jacinta D'Souza)***

Flagella/Cilia are organelles of motility and sensory perception. *Chlamydomonas reinhardtii*, a unicellular chlorophyte swims with two flagella that also serve as watchtowers. Made up of ~650 proteins, the conserved '9+2' architecture acts as a gear and appears to be the first organelle to respond to stress, indicating a crosstalk between the motility and sensory paradigms of this apparatus; this interaction requiring a repertoire of signaling proteins. Harboring ~90 such proteins, we are exploring two of these that 'might' coordinate the

sensory and motility functions. **FAP174** protein interacts with CrRSP3 protein, is localized in C2 of the central pair and may interact with 3 more polypeptides (V. Rao, R. Sarafdar, T. Chowdhary, P. Sivadas, P. Yang). **FAP223** is an axonemal Ca^{2+}-dependent Protein Kinase induced with nutrient starvation, Li stress, and migrates faster when bound to Ca^{2+} (M. Motiwala, M. Sequeira). Current *fap174*-RNAi and *cdpk1*-RNAi lines would help reveal their role in the flagellum.

Characterization of flagellar mutants & proteins: The long-flagella mutants of *C. reinhardtii* exhibit anomalous motion dynamics and seem affected in the ratio of dynein isoforms throughout the flagellar length (Sapna, M. Motiwala, T. Yagi). On the other hand, FAP174 exists as a mixture of monomers and higher aggregates. Efforts aimed at identifying the residues that contribute towards this aggregation have led to mutation of key amino acids; the genes cloned, and the purified proteins are being biophysically characterized (M. Borana, V. Rao, K. Venetti, B. Ahmed). Meanwhile, 3 human ciliopathy proteins are being produced for Raman spectroscopic analysis (S. Yogesha, D. Mathur, C. Santhosh).

Stress physiology: In the process of studying the physiological effects of abiotic stress on *C. reinhardtii*, cells were scored for palmelloidy or apoptosis. Cells exposed to NaCl showed palmelloidy; this physiology is being confirmed by evaluating the cellular lipid, starch and lipopolysaccharide contents (D. Khona, E. Hom). However, oxidative (H_2O_2 & menadione) and osmotic (Glycerol & KCl) stress led to the onset of apoptosis (Sirisha V. L., M. Sinha). On the other hand, intense, ultrashort laser pulses generate *in situ*, e^- and OH^- that damaged plasmid/genomic DNA and caused cellular death (H. Bharambe, M. Sinha, J. A. Dharmadhikari, D. Mathur, A. K. Dharmadhikari); the damage never exceeding 30%. Current experiments with increasing energy profiles and exposure to 1350 and 2200 nm have resulted in ~100% damage in the plasmid DNA.

- ***Research projects (Dr. Uma Ladiwala)***

Raman spectroscopy to identify early changes in adult rat hippocampal progenitors/stem cells on treatment with pro- and anti-inflammatory cytokines. Preliminary experiments with high resolution micro-Raman spectrometry reveal changes at very early time points with pro-inflammatory cytokines that are reversible with pre-treatment with anti-inflammatory cytokines. *Collaboration with Dr. Santhosh Chidangil, Manipal University and Prof Deepak Mathur, TIFR, Mumbai).*

Directed cell growth on laser-patterned surfaces *(Collaboration with Dr. Santhosh Chidangil, Manipal University and Prof Deepak Mathur, TIFR, Mumbai).*

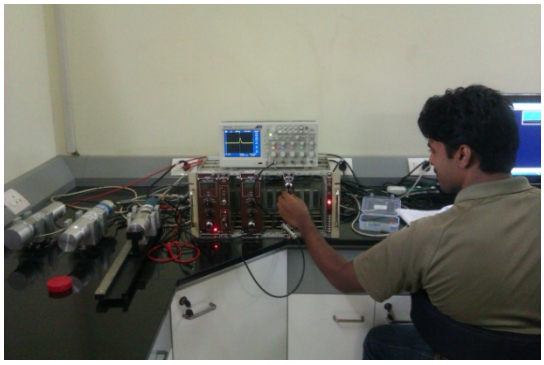
Attenuation of L-amyloid cytotoxicity by SPION-mediated modulation of amyloid aggregation. We have studied the cytotoxicity of L-amyloid to various cells, and looked at the modulation of cytotoxocity by nanoparticle-inhibited amyloid. *(Collaboration with Dr. Bashir Ahmed, CBS and Dr. Varsha Kelkar-Mane, Dept. of Biotechnology, Mumbai University).*

5.2. New laboratories at CBS in the current year

- **Nuclear Physics Laboratory**

The Nuclear Physics Laboratory at CBS was set up during the year 2012. Innovative and open-ended experiments are distinguishing features of the laboratory.

Detectors for a variety of radiation, ranging from gamma and x rays, to alpha and beta particles, neutrons, and also cosmic-ray muons, are included in the laboratory. Energy and slow/fast timing spectroscopy, including coincidence and half-life measurements (spanning the nanoseconds-seconds range) are being performed. Research-grade instrumentation is used for acquiring and processing signals from different detectors. Most experiments are interfaced to computers to enable data collection and subsequent analysis. Students are encouraged to explore every aspect of the experiments in order to obtain a thorough understanding of the underlying Physics.



A large number of measurements are being carried out, with some examples being: (a) Interaction phenomena of gamma rays with matter using scintillation detectors (b) Transition probabilities and selection rules in nuclear decay using semiconductor detectors (c) Internal conversion and x-ray fluorescence measurements (d) Short half-life measurements using fast scintillation detectors/electronics and long half-lives using gas detectors (e) Spectrum analysis and fitting techniques using state-of-the-art software.

Dr. Sujit Tandel and Dr. M. Hemalatha were involved in the development of the laboratory, and during August-November 2012, the first Advanced Course for fourth year students was undertaken. An elective course for final year students is scheduled during January-April 2013. Several students from within and outside CBS have successfully completed long-term projects in the laboratory.

➢ Astronomy Laboratory at CBS

An Astronomy laboratory to be set up at CBS on its campus is nearing realization. Initially it is proposed to set up 3 experiments for which major parts have either been procured or expected to be received shortly. The Experiments are as follows:

1. **Measuring flux of relativistic μ Mesons using a Scintillation Counter – Cerenkov Counter Coincidence telescope :**

The Scintillator, Cerenkov radiator, Photomultipliers, and misc related items have been received and being assembled for testing. Required electronic units such as preamplifiers, post amplifiers, Counter and HV unit have been received and tested. Other electronic circuits like threshold discriminators, coincidence circuits etc in the form of NIM Modules are being procured. A mechanical structure for housing the two detectors has been fabricated in WRIC workshop. It is expected that the experiment will become operational in the later part of this year.

2. **Proportional Counter (PC) as X-ray Detector :**

Mechanical design of a PC was made and it was fabricated by an outside vendor. The PC is now assembled and it is awaiting connection for feeding HV and taking out output signal to be fed to a charge sensitive preamplifier (CSPA). A Multi-Channel Analyzer has just been received to analyze output signal from the PC to construct the energy spectrum. Two radioactive sources (a) Iron-55 (Fe-55) that emits 5.9 keV mono-energetic X-rays and (b) Cadmium – 109 (Cd-109) that produces 22.2 keV X-ray line have also been received. A Turbo-molecular pump based vacuum cum gas filing line and a P-10 gas cylinder have also been fabricated / procured and connected to the PC. The PC

will be filled with gas mixture of 90% Argon + 10 % Methane (called P-10 Gas) at different pressures and detector characteristics like gas gain, energy resolution etc. and their variation with HV , gas pressure etc will be studied by shining X-rays from radioactive sources. It is expected to be ready for student use in the next few months. This experiment will be used to measure thickness of thin sheets of different material by measuring transmission of X-rays. Another experiment will be to determine Mass Absorption Coefficient of different elements at specific X-ray energies by measuring absorption of X-rays of known energy.

3. Cadmium-Zinc-Telluride (CZT) Detector based X-ray Spectrometer :

This is a new generation solid state detector that works at temperatures in the range of + 10º C to -20º C by cooling by a thermoelectric cooler. Its energy resolution (R) is superior to that of a PC. Using X-ray lines of different energies its R will be studied at different energies and variation of R with energy will be measured and its dependence on different parameters of CZT will be inferred. The CZT detector and its signal processing electronics unit have been ordered and expected to be received by the middle of this year.

Additional experiments like (a) determination of Black Body Temperature and Verification of Stephen-Boltzman law (b) Photometer to be used with 30 cm aperture Mumbai University Telescope to measure light curve of bright stars will also be set up in about a year. Possibility of an experiment using Optical Spectrometer at the focal plane of 30 cm telescope to study spectra of the SUN and bright stars is also under investigation.

➢ Condensed Matter Physics Laboratory

Part of the Condensed Matter Physics Laboratory is an undergraduate teaching lab which is typically aimed for 7th-8th semester Physics students. The experiments set up in the lab expose the students to some routine techniques used in condensed matter and materials research. In addition, the students also get to verify proof of principles of some of the topics studied in their theoretical course of Solid State Physics (I) like X-ray diffraction, temperature dependence of electrical conductivity of metals and semiconductors etc.

Experimental set-ups and related experiments offered:

1. **Thin film deposition system**

This is a custom designed system which is capable to grow metallic thin films by two different techniques (a) Thermal evaporation & (b) DC Magnetron sputtering. In this experiment the students learn both the techniques to grow thin films in addition to learning vacuum techniques (which is an integral part of growing thin films). They learn to achieve and measure vacuum in different regimes (from low (10-3 mbar) to high (10-6 mbar).

2. **Table-top X-Ray Diffractometer**

This is a table-top X-Ray Diffractometer of 35kV and 1 mamp source. It is very user friendly and the students can operate it independently. In this experiment, the students learn how to record and analyze a X-ray spectrum of different solid state samples (both single crystalline and polycrystalline). Elemental analysis using x-ray fluorescence is also possible using this instrument.

3. **Closed-cycle Cryostat**

This Closed-cycle cryostat is used to measure electrical transport of solid state samples including thin films in vacuum from room temperature down to 9K. The electrical transport measurements are done using sensitive electronics like the Keithley source meter. In this experiment the students learn how to measure very low resistances using the four probe method. In addition they learn low temperature techniques and to measure electrical resistances as a function of temperature.

This exposes the student to low temperature thermometry. In addition all instruments are interfaced with the computer using GPIB interface and the students are supposed to write their LABVIEW program to interface the instruments and record the data.

4. **High Temperature Furnace**

This is a high temperature furnace (~11000C) used to anneal solid state polycrystalline samples.

The other part of the Condensed Matter Physics Laboratory is a research lab which deals with the study of thin films primarily superconductors. The lab will set up transport based spectroscopic measurement techniques like Point Contact Andreev Reflection Spectroscopy and large area tunnel junctions. In addition, it will also have provision to measure magnetic susceptibility by a two coil mutual inductance technique. These will be in addition to the conventional low temperature transport measurements. We have just procured a cryogen free (3.5 K) system which will be the low temperature platform for the above mentioned developments which are expected by this August. We have started work on three projects (some in collaboration with TIFR) namely:

1. Study of strongly disordered superconductors and other correlated electronic systems using electrolytic gating (Status: Some preliminary results obtained)
2. Superconductivity in Engineered granular thin films. (INSA YS Research grant-15Lakhs for 3 years; 2013-2016) (Status: Initial interesting results obtained as work started before the approval of the project. Manuscript under preparation)
3. Tunneling studies in novel superconductors and nanocomposites (DST-FAST TRACK project-26 Lakhs for 3 years; (2012-2015) (Status: Preparation of nano-superconductors being optimized)

6. Publications

Peer Reviewed Journals

1. Gay, C. D., Abel, N. P., Porter, R. L., Stancil, P. C., Ferland, G. J., **Shaw, G.**, van Hoof, P. A. M., Williams,
   Astrophys. J.2012, ApJ, 746, 78 (2012)
   Rovibrationally Resolved Direct Photodissociation through the Lyman and Werner Transitions of H2 for FUV/X-Ray-irradiated Environments

2. **M. Shalini**, D. Sharma, A.A. Deshpande, D. Mathur, Hema Ramachandran, and N. Kumar
   Eur. Phys. J. D 66: 30 (2012)
   Light scattering from a magnetically tunable dense random medium with dissipation: ferrofluid

3. **Kumari Poonam**, Dharmadhikari, J A, Dharmadhikari, A K, Basu H, Sharma S, Mathur, D
   Optics Express, Vol. 20 Issue 4, pp.4645-4652 (2012)
   Optical trapping in an absorbing medium: from optical tweezing to thermal tweezing

4. S. Banerzee, F. Ali, P. K. Nayak, **N. Agarwal**
   Thin Solid films 520, 2644- 2650 (2012)
   Synthesis, photophysical, electrochemical and thermal studies on carbazole based acceptor molecules for heterojunction solar cell

5. **Uma Ladiwala**, Himanish Basu, Deepak Mathur.
   PLoS ONE, 2012; June 5
   Assembling Neurospheres: Dynamics of Neural Progenitor/Stem Cell Aggregation Probed using an Optical Trap

6. Jithender G. Reddy, **R. V. Hosur**
   Analytical Chemistry, Dec 4;84(23):10404-10 (2012)
   Reduced Dimensionality (4,3)D-HN(C)NH experiment for rapid assignment of $^{1}H^{N}$-^{15}N HSQC peaks in proteins: An analytical tool for protyein folding, proteomics and drug discovery programs

7. Dinesh Kumar,1,* Anmol Gautam,1 and **Ramakrishna V. Hosur2**,*
   J. Struct. Funct. Genom. 13(4):201-12, (2012)
   A unified NMR strategy for high-throughput determination of backbone fold of small proteins.

8. M.K. Rout, J.G. Reddy, M. Phillips, **R. V. Hosur**
   J Biomol Struct Dyn. 2012 Aug 22. [Epub ahead of print]
   Single point mutation induced alterations in the equilibrium structural transitions on the folding landscape of HIV-1 protease

9. Swagata Chakraborty, Susmitha, A. L., **Ramakrishna V. Hosur**
   Magn. Reson. Chem. (rapid communication) 50(9), 587-91 (2012)
   Selective lighting up of segments around Gly, Ala, Ser/Thr in proteins

10. Swagata Chakraborty and **Ramakrishna V. Hosur**
Protein Pept Lett. 19, 1297 – 1301 (2012)
Intrinsic vs environment driven equilibrium folding transitions in GTPase Effector Domain of dynamin: NMR insights

11. P. Mishra, S. Das, L. Panicker, M.V. Hosur, S. Sharma, **R. V. Hosur**
PLoS One. 2012;7(5):e36279. Epub 2012 May 2
NMR insights into folding and self-association of Plasmodium falciparum P2

12. Dinesh Kumar, Aditi Borkar and **Ramakrishna V. Hosur**
Magn. Reson. Chem., 50, 357-363 (2012)
Facile Backbone (1H, 15N, 13Ca and 13C') Assignment of 13C/15N labeled proteins using orthogonal projection planes of HNN and HN(C)N experiments and its Automation

13. A. Borkar, M.K. Rout, **R. V**. **Hosur**
J Biomol Struct Dyn. 2012;29(5):893-903
Denaturation of HIV-1 protease (PR) monomer by acetic acid: mechanistic and trajectory insights from molecular dynamics simulations and NMR

14. Manoj Kumar Rout, Jithender G Reddy, Margaret Phillips and **Ramakrishna V. Hosur**
J Biomol Struct Dyn. 2012 Aug 22. [Epub ahead of print]
Single point mutation induced alterations in the equilibrium structural transitions on the folding landscape of HIV-1 protease

15. Jithendra G. Reddy and **Ramakrishna V. Hosur**
J. Biomol. NMR in press
Parallel acquisition of 3D-HA(CA)NH and 3D-HACACO spectra

16. M. V. Hosur*, R. Chitra, Samarth Hegde, Amit Das, and **R.V. Hosur**
Crystallography Reviews, 19:1, 3-50 (2013)
Low Barrier Hydrogen Bonds in Proteins

17. Pushpa Mishra, Shobona Sharma and Ramakrishna V. Hosur
J Biomol. Struct. Dyn. in press
Residue level description of In-vivo-self-association of *Plasmodium falciparum* P2

18. **Dolly Khona*, Venkatramanan Rao*, Mustafa J. Motiwalla, Sreekrishna Varma P. C.,** Anisha Kashyap, Koel Chaudhary, Seema Shirolikar, Lalit Borde, Jayashree A. Dharmadhikari, Aditya K. Dharmadhikari, Siuli Mukhopadhyaya, D. Mathur and **Jacinta S. D'Souza**
Journal of Biological Physics, **39**: 1–14 *Equal contribution
Anomalies in the motion dynamics of long-flagella mutants of *Chlamydomonas reinhardtii*.

19. **Dolly K. Khona**, Dongre Shounak, Cecelia M. Aarraino, and **Jacinta S. D'Souza**
*FEMS Microbiology Letters, **339**: 39–47*
BolA-like protein from the green chlorophyte *Chlamydomonas reinhardtii* induces biofilm formation in *E. coli*

20. Suruchi Jamkhedkar, Jyotsna Dongerdive, Kavita Jain, Siby Abraham and **Jacinta S. D'Souza,**
*Advances in Bioscience and Biotechnology, **4**, 93-102*
Arrangement of flagella on cells: two flagella clusters emerge.

21. **Motiwalla, M. J.,** Priyanka P. Punyarthi, Mansi K. Mehta, **D'Souza, J. S.** and Kelkar-Mane, V.
*J of Environmental Biotechnology, **34**: 43-49*
Isolation and characterization of poly-capro-lactone degrading strain of *Bacillus pumilus* from the rhizosphere of the mangrove *Sessuvium portulacastrum*.

22. G Ajithkumar, Benjamin Yoo, Dara E Goyal, Peter J Hornsby, Ai-Ling Lin, **Uma Ladiwala,** Vinayak P Dravid, Dhiraj K Sardar
J Mat Chem B 2013; Jan 10 (Impact factor 5.97)
Multimodal bioimaging using a rare earth doped Gd2O2S:Yb/Er phosphor with upconversion luminescence and magnetic resonance properties.

23. P. Mallet, I. Brihuega, **S. Bose**, M.M.. Ugeda, J.M. Gomez Rodriguez, K. Kern and J. Y. Veuillen
Phys. Rev. B 86, 045444 (2012)
Role of pseudospin in quasiparticle interferences in epitaxial graphene, probed by high resolution scanning tunneling microscopy.

24. **N. Kamtekar, A. Pandey, N. Agrawal**, RRS. Pissurlenkar, **M. Borana, B. Ahmad***
PloS one 8 (1), e53499.
Interaction of Multimicrobial Synthetic Inhibitor 1, 2-Bis (2-Benzimidazolyl)-1, 2-Ethanediol with Serum Albumin: Spectroscopic and Computational Studies.

25. **M Borana**, **B Ahmad**
Biophysical Journal 104 (2), 46a (Abstract)
The Conformation of Monomeric Aggregation Precursor States Control the Aggregation of Lysozyme

26. Syed Rafi, **A. Bhagwat**, W. Haider and Y. K. Gambhir
*Phys. Rev. C **86**, 034612 (2012)*
"Brueckner Hartree-Fock Based Optical Potential for Proton - ^{4,6,8}He and Proton - ^{6,7,9,11}Li Scattering"

27. **A. Bhagwat,** X. Viñas, M. Centelles, P. Schuck and R. Wyss
*Phys. Rev. C **86**, 044316 (2012)*
"Wigner – Kirkwood Method for Microscopic-Macroscopic Calculation of Binding Energies – II: Deformed Nuclei"

28. **Nayana Kamtekar**; Anita Pandey; **Neeraj Agrawal**; Raghuvir R S Pissurlenkar; **Mohanish Borana; Basir Ahmad**
PLOS ONE. 8, e53499-e53, 2013
Interaction of Multimicrobial Synthetic Inhibitor 1,2-Bis(2-Benzimidazolyl)-1,2-Ethanediol with Serum Albumin: Spectroscopic and Computational Studies"..

29. **S. K. Tandel, M. Hemalatha**, A. Y. Deo, **S. B. Patel**, R. Palit, T. Trivedi, J. Sethi, S. Saha, D. C. Biswas, and S. Mukhopadhyay
Physical Review C 87, 034319 (2013)
"Evolution of octupole collectivity in 221Th"

30. Dipesh Kr. Das, Anirban Chakraborty, **Mahuya Sinha,** Sekhar Bhattacharjee, Sanjit Dey
International Journal of Radiation Biology,DOI:10.3109/09553002.2013.767989
Assessment of modulatory role of quercetin on gamma radiation mediated biochemical and morphological alterations of Red Blood Cell

31. Dipesh Kr Das, **Mahuya Sinha**, Amitava Khan, Kankana Das, Krishnendu Manna, Sanjit Dey
Epicatechin, International journal of Human Genetics, Int J Hum Genet, 13(1): 59-64 (2013)
Radiation Protection by Major Tea Polyphenol

32. Kunal Sikder, **Mahuya Sinha**, Nilanjan Das, Dipesh Kr. Das, Sanjukta Datta, Sanjit Dey
To be published in Asian Journal of Pharmaceutical and Clinical Research.
Moringa oleifera leaf extract prevents in vitro oxidative DNA damage.

33. **Singh, K. A. P**.; Isobe, H.; Nishida, K.; Shibata, K.
The Astrophysical Journal, Volume 760, Issue 1, article id. 28, 5 pp. (2012), Systematic Motion of Fine-scale Jets and Successive Reconnection in Solar Chromospheric Anemone Jet Observed with the Solar Optical Telescope/Hinode

34. **Singh, K. A. P**.; Isobe, H.; Nishizuka, N.; Nishida, K.; Shibata, K.
The Astrophysical Journal, Volume 759, Issue 1, article id. 33, 14 pp. (2012)., Multiple Plasma Ejections and Intermittent Nature of Magnetic Reconnection in Solar Chromospheric Anemone Jets

35. **Singh, K. A. P.;** Krishan, V.
New Astronomy, Volume 15, Issue 1, p. 119-125.
Alfvén-like mode in partially ionized solar atmosphere

36. **Singh, K. A. P**.; Dwivedi, B. N.
Journal of Plasma Physics, vol. 75, issue 04, p. 517
Effect of steady flow and Newton's cooling on the propagation and damping of small-amplitude prominence plasma oscillations

37. **Singh, K. A. P**.; Dwivedi, B. N.; Hasan, S. S.
Astronomy and Astrophysics, Volume 473, Issue 3, October III 2007, pp.931-936
Spatial damping of compressional MHD waves in prominences

38. **Singh, K. A. P**.; Dwivedi, B. N.
New Astronomy, Volume 12, Issue 6, p. 479-482
Estimation of spicule magnetic field using observed kink waves

39. **Singh, K. A. P**.; Subramanian, Prasad.
Solar Physics, Volume 243, Issue 2, pp.163-169
An Evaluation of Possible Mechanisms for Anomalous Resistivity in the Solar Corona.

40. **Singh, K. A. P**
Journal of Astrophysics and Astronomy, vol. 27, no.2 & 3 P.321-326
Spatial Damping of Linear Compressional Magnetoacoustic Waves in Quiescent Prominences

41. **Raina, A.K**
International J. Of Mathematics, vol.23, no.12 (2012) 125033--1-9
"Fay's Matrix Identity for Vector Bundles on a Curve"

42. Biswas,I., Hurtubise,J., **Raina, A.K**
International J. Of Mathematics, vol.23, no.12 (2012) 1250125--1-6
"Rank one connections on abelian varieties, II".

43. Čorić, I.; Kim, J. H.; Vlaar, T.; **Patil, M**.; Thiel, W.;
Angew. Chem. Int. Ed. 2013, 52, 3490-3493. [Impact factor: 12.730]
List, B. "Brønsted Acid Catalyzed Asymmetric SN2-Type O-Alkylations"

44. **Patil, M**.; Loerbroks, C.; Thiel W.
Org. Lett. 2013, ASAP Article. [Impact factor: 5.862]
"Mechanism of the Pummerer Reaction; A Computational Study."

45. Kumari, D.; Singh, H.; **Patil, M**.; Thiel, W.; Pant, C. S., Banerjee, S.
Thermochimica Acta 2013, Accepted for the Publication. [Impact factor: 2.086]
'Synthesis, Characterization, Thermal and Computational studies of Novel Tetra-Azido Esters as Energetic Plasticizers'

46. Haung, X.; **Patil M**.; Farès, C.; Thiel, W.; Maulide, N.
J. Am. Chem. Soc. 2013, Under Revision. [Impact factor: 9.907]
'Sulfur(IV)-Mediated Transformations; From Ylide Transfer to Metal-Free Arylation of Carbonyl Compounds.'

47. Adrian T.Potter, **Shashikumar M. Chitre** and Christopher A. Tout
Mon. Not. R. Astron. Soc. 424, 2358-2370 (2012)
"Stellar Evolution of massive stars with a radiative alpha-Omega dynamo"

48. **H.M. Antia, Shashikumar M. Chitre** and D.O. Gough
Mon. Not. R. Astron. Soc 428, 470-475 (2013)
"On the magnetic field required for driving the observed angular-velocity variations in the solar convection zone"

49. Pierre Lesaffre, **Shashikumar M. Chitre**, Adrian T. Potter and Christopher A. Tout
*Mon. Not. R. Astron. Soc, ...(2013) *Early on-line publication on 21 March (in press).*
"A two-dimensional mixing length theory of convective transport"

Invited Articles

1. **Jacinta S. D'Souza**, Venkatramanan G. Rao and Dolly K. Khona (**2012**) Biosimilars: twins, but not the clones. CuttingEdge (a monthly magazine published under the auspices of SpincoBiotech), February issue, pages 25-29. (Invited Article for a Magazine)

2. Rakesh Chandarana, **Jacinta S. D'Souza** and Evans Coutinho (**2012**) Glucose Dependent Insulinotropic Polypeptide Receptor (*GIPR*) Chapter in Encyclopedia of Signaling Molecules. Springer-Verlag, pgs. 773-779. (Invited Article for a Book)

3. **H.C.Pradhan** - An extensive interview of mine on Science Education was published in the Marathi weekly Lokprabha, Special National Science Day Issue, March 1, 2013 (pages 12-19)

Papers published in conferences

1. "Spectroscopy of neutron-rich 248-250Cf nuclei", Bulletin of the American Physical Society Vol. 57, No. 9 (Fall 2012 Meeting): http://meetings.aps.org/link/BAPS.2012.DNP.ND.4

2. "Band Structures and Nucleon Alignments in 173,175W", Bulletin of the American Physical Society Vol. 57, No. 9 (Fall 2012 Meeting): http://meetings.aps.org/link/BAPS.2012.DNP.KD.5

3. Elastic scattering of the halo nucleus 11Be on 64Zn, **M. Hemalatha**, International Nuclear Physics Conference (INPC2013), Firenze, Italy, June 2-7, 2013

4. Subshell gap around N=70 for neutron-rich nuclei**, M. Hemalatha**, International Conference Nuclear Structure and Related Topics (NSRT12), Dubna, Russia, July 2-7, 2012.

5. Evolution of octupole collectivity in 221Th, **S.K. Tandel , M. Hemalatha**, A.Y. Deo, **S.B. Patel**, R. Palit, T. Trivedi, J. Sethi, S. Saha, D.C. Biswas, S. Mukhopadhyay, International Nuclear Physics Conference (INPC2013), Firenze, Italy, June 2-7, 2013.

6. Double folding model analysis of elastic scattering of halo nucleus 11Be from 64Zn around Coulomb barrier , **M. Hemalatha**, National conference on nuclear physics (NCNP2013), Sambalpur University, Odisha, (2013) 30.

7. Octupole structures in 221Th , **S.K. Tandel, M. Hemalatha**, A.Y. Deo, **S.B. Patel**, R. Palit, T. Trivedi, J. Sethi, S. Saha, D.C. Biswas, S. Mukhopadhyay, National conference on nuclear physics (NCNP), Sambalpur University, Odisha, (2013) 51.

7. Collaboration of CBS Faculty with other departments, organizations and countries

National

- Tata Institute of Fundamental Research (TIFR), Mumbai
- Bhabha Atomic Research Centre (BARC), Mumbai
- Indian Institute of Technology (IIT-B)
- Department of Biotechnology, University of Mumbai
- Department of Science & Technology (DST)
- Inter-University Accelerator Centre, New Delhi
- Andhra University, Vishakapatnam
- Mumbai University, Mumbai
- Manipal University, Manipal
- National Institute of Immunohematology, Mumbai
- Department of Physics, Aligarh Muslim University, Aligarh
- Department of Physics, IIT-Bombay
- The Inter-University Centre for Astronomy and Astrophysics, Pune
- Raman Research Institute, Bangalore
- Bombay College of Pharmacy, Mumbai
- Indian Institute of Astrophysics, Bangalore
- Defence Institute of Physiology & Allied Sciences (DIPAS), New Delhi

International

- Argonne National Laboratory, USA
- University of Massachusetts Lowell, USA
- Marquette University, USA
- Instituto de Tecnologia Química e Biológica, Portugal

- Institut de Biotechnologie des Plantes, Université Paris-Sud, France
- Department of Physics and Astronomy, Michigan State University, East Lansing, USA.
- Departament d'Estructura i Constituents de la Materia and Institut de Ciencies del Cosmos, Facultat de Fısica, Universitat de Barcelona, Diagonal 647, E-08028 Barcelona, Spain.
- Royal Institute of Technology (KTH), Alba Nova University Centre, S-10691 Stockholm, Sweden.
- Groupe de Physique Théorique, Institut de Physique Nucléaire (IPN), 91406 Orsay Cedex, France.
- University of Kentucky, USA
- University of Georgia, USA
- Michigan State University, USA
- Harvard Medical School, Boston, USA
- Department of Applied Chemistry, Tokyo Metropolitan University ,Tokyo, Japan
- IPN-Orsay, France
- Kwasan and Hida Observatories, Deptt. of Physics and Astronomy, Kyoto University, Japan
- Institute of Space and Astronautical Science, Japanese Aerospace Exploration Agency (JAXA), Japan
- Department of Physics, Nagoya University, Japan
- University of Texas at San Antonio, USA

8. Externally Funded Research Projects

CBS encourages its faculty to write Research Grant proposals to funding agencies. The list of the successful applications is listed below:

Sr. No.	Project Name and Duration	Name of the Faculty	Funding Agency	Amount (Rs.)
1	"Microscopic Global Nuclear Mass Formula"- 3 years	Dr. Ameeya Bhagwat	Department of Science and Technology (DST), Govt. of India	Rs. 21,50,000/-
2	"Numerical simulations of molecular astrophysics and their Spectra - applications to star-forming regions from local to high-redshift universe" - 3 years	Dr. Gargi Shaw	Department of Science and Technology (DST), Govt. of India	Rs. 12,84,000/-
3	"Spectroscopic analyses of flagellar proteins from *Chlamydomonas reinhardtii* and homologous ciliary proteins from human" - 3 years	Dr. Jacinta D'Souza	Department of Biotechnology (*DBT*), Government of India	Rs. 61,61,000/-
4	"New Bodipy derivatives and their anthracene-fused-porphyrin composites for the up-conversation of energy' - 3 years	Dr. Neeraj Agarwal	Department of Science and Technology (DST), Govt. of India	Rs. 21,00,000/-
5	"Tunneling studies in novel superconductors and nanocomposites" – 3 years	Dr. Sangita Bose	Department of Science and Technology (DST), Govt. of India	Rs.26,00,000/-
6	"Superconductivity in engineered granular thin films"- 3 years	Dr. Sangita Bose	Indian National Science Academy (INSA)	Rs. 15,00,000/-
7	"Laser Spectroscopy of Exotic Nuclei"- 3 years	Dr. M. Hemalatha	Board of Research in Nuclear Sciences (BRNS), Department of Atomic Energy (DAE), Government of India under DAE Young Scientist Research Award (2012)	Rs. 17,00,000/-

9. Academic Events organized by CBS

- **National Symposium on "Frontiers of Biophysics, Biotechnology & Bioinformatics" and 37th Annual Meeting of the Indian Biophysical Society (IBS)**

National Symposium on **"Frontiers of Biophysics, Biotechnology & Bioinformatics"** and **37th Annual Meeting of the Indian Biophysical Society (IBS)** were organized by Department of Biophysics, University of Mumbai and Centre for Excellence in Basic Sciences between January 13-16, 2013.

In this event the **'Prof. GNR Memorial Lecture'** was delivered by **Prof. Nenad Ban**, a distinguished professor from the Institute of Molecular Biology and Biophysics, ETH, Surich, Swizerland.

Over **275** scientists have participated from various parts of India and overseas countries like USA, Poland, Japan, Singapore, Russia, Germany, UK etc. in this event. Overall **fifty experts** from abroad and India have presented their latest work and discussed the research work in various areas of Biophysics.

The symposium featured 32 invited talks and 18 oral presentations. In addition to this there were more than 150 scientific posters which were presented by young scientist and faculties from India and aboard.

For the first time, e-book of symposium abstract was made available through IBS website as well as University of Mumbai website.

- Arranged special lecture on January 08, 2013 of **Dr. Angelika Sebald of the York University** on the process of arranging exchange visits of students to do projects at CBS and York University.

10. Colloquia

CBS organizes colloquium on alternate Tuesdays on topics of academic interest by reputed speakers / researchers to facilitate the exchange of ideas. A list of the colloquium conducted during April 2012 to March 2013 is reproduced below:

Colloquium Series (April 2012 – March 2013)

Sr. No.	Date	Topic	Name of the Speaker
1.	10.04.2012	"History and Physics of Superconductivity".	Prof. Krishnendu Sengupta, Indian Association for the Cultivation of Sciences, Kolkata
2.	17.04.2012	"Quantum Chaos".	Prof. Sudhir Jain, BARC
3.	10.08.2012	"Structured Innovation"	Prof. Basant Rajan, CEO at Coriolis Technologies Pvt. Ltd
4.	04.09.2012	"Unification of Fundamental Forces"	Prof. J. Maharana, Institute of Physics, Bhubaneswar
5.	18.09.2012	"Acharya Jagadis Chandra Bose -- The Inventor of Wireless".	Prof. M. V. Pitke
6.	09.10.2012	"Nuclear spectroscopy at the limits of Coulomb stability: A journey towards the highest shells".	Dr. Sujit Tandel, CBS
7.	16.10.2012	"Science and cooking: from physico-bio-chemistry to culinary art."	Dr. Christophe Lavelle, Principal investigator at the CNRS (French National Scientific Research Agency) and co-head of the "Nuclear Architecture and Dynamics" scientific network (CNRS GDR 3536).
8.	30.10.2012	"Convex sets and Convex functions"	Prof. Sundararaja Ramaswamy, NIIT University , Rajasthan

Sr. No.	Date	Topic	Name of the Speaker
9.	06.11.2012	"A Glimpse of the X-ray Universe"	Prof. P. C. Agrawal, CBS
10.	15.01.2013	"Near Threshold Resonances and their Role in Nuclear Physics".	Prof. B. K. Jain, DST Ramanna Fellow
11.	29.01.2013	"Topology and Geometry of Surfaces".	Prof. Nitin Nitsure, Tata Institute of Fundamental Research
12.	12.02.2013	"When science meets the eye".	Prof.D. Balasubramanian, Director of Research L V Prasad Eye Institute (LVPEI),Hyderabad
13.	19.02.2013	"Quantum Physics meets Biology: Case of Avian Magnetoreception"	Prof. Jayendra N Bandyopadhyay, Department of Physics, BITS Pilani, Rajasthan
14.	05.03.2013	"Particle Accelerators 4: The Next Generation".	Dr. Srinivas Krishnagopal, BARC/CBS
15.	12.03.2013	Rejoice that you will do basic research	Dr. Dinesh Kumar Srivastava, Director, Variable Energy Cyclotron Centre, Kolkata

11. Science Club

This is an event organized by the CBS Science Club, once a week in the CBS Seminar Room. It provides a platform where students present the work they have done during their project-work in vacations or otherwise during the semester. These projects may have been done in any science research institute in India (including CBS), wherever the student feels one might be best exposed to the subject. While preparing for and giving seminars, students also develop the necessary skills required for giving a scientific presentation.

Apart from project-work, students are also encouraged to pick topics from the wide spectrum of their academic interests, and present these to their peers, making a point about what fascinates them in that particular subject. With this, not only does one share one's interests with others, but also spark somebody else's interest in a field that one might be unaware of. These 'Student Seminars' are open to all.

Sr. No.	Date	Title	Name of the student
1.	04.09.2012	Real Scalar Field on a Lattice	Mr. Dhruv Ringe, 5th year student
2.	14.08.2012	The Random Walk & Electrical Networks	Mr. Ashish Chandra, 3rd year student
3.	21.08.2012	Quasar Line Absorption	Mayank Singh, 3rd year student
4.	28.08.2012	The 3-C Chemical Game @ Ecole Polytechnique	Mohanish Borana, 4th year student
5.	11.09.2012	Growth of Disordered Superconductors and Little Parks Experiment	Chandan Kumar, 5th year student
6.	18.09.2012	Function generating Prime Numbers	Deepak Kamlesh, 1st year student
7.	30.10.2012	Optimization in Elementary Geometry	Koushik Senapati, 3rd year student
8.	29.01.2013	“Laser Cooling & Trapping”	Mr. B. T. Ashwin Kumar, 3rd year student
9.	12.03.2013	“Time-keepers of the Universe: Pulsars”	Mr. Amar Deo Chandra, 4th year student

12.Social and other activities

12.1. Jigyasa-The Science Quiz

The Science Quiz 2012 was an attempt by CBS students to address the undergraduate science students of various colleges by giving them a chance to showcase their scientific aptitude and intelligence at a common platform. The annual event started in 2011 by the efforts of CBS students Mohanish Borana, Amit Seta, Saranyo Moitra, Plawan Das and Ram Shila of Qunata-3 as part of CBS Science club activity jumped by leaps and bound this year and an astonishing 78 students from various Mumbai colleges appeared for the screening test held on October 9, 2012. Quanta-4 was the organizer of the event this year along with members of CBS Science club under the guidance of Prof. Ajay Patwardhan. Questions were all designed by Quanta 4 students namely Vikash Kumar, Nivin Mothi, Harsh Bhatt, Mayank Singh, Jyotirmoy Roy, Rakvi Shrivasthava, Ashish Chandra, Koushik Senapati, B.T. Ashwin Kumar , Chaitanya K.K. ,Saptarshi Das etc while Mohanish Borana, Amit Seta, Saranyo Moitra etc provided necessary support for organization and motivation this time.

From 78 students who appeared in screening round, 5 teams of 3 students each were selected for final quiz round hosted by Mayank Singh and Laxmi Sindhu. This year edition had an additional clause that students have to appear for screening itself in a team of 3 and every member had to clear the cutoff individually. Final session had four rounds that tested the students in different aspects like oral quiz tested the aptitude of participants, analytical and experimental mindset were judged on the basis of demonstrations round, the innovative skills were checked in third round where the participants were asked to set questions for one another from a set of unseen passages followed by a rapid fire round. Special care was taken to avoid knowledge based questions and bring all the teams on equal footing.

Team of CBS students Ajay C.J., Ayush Kumar Mandwal and Prashant Kumar Chauhan were the winners of 2012 edition taking back home Rs.2500/- as cash prize. Teams of Duttatrey Nath, Rishab Gupta, Kaustub Gupta and Sanchit Sablok, Aishwaraya Mishra and Rahul Vaidiya were joint runner up and bagged a prize amount of Rs.1500/- each. Jigyasa has now become an important annual event in CBS extracurricular calendar giving a platform to CBScients to showcase their managerial skills as well as giving a common stage to many budding scientists to interact with their peers.

Jigyasa Quiz conducted in UM-DAE CBS

12.2. Sports

Ragnarock: This is a weeklong sports event where different types of sporting events are organized and includes both indoor and outdoor games. This sport event is open not only for students but also academic and admin staff of CBS. This year it was held during 6th January 2013 to 20th January 2013. The winners of the sports events were declared on 26th January 2013.

Sports Activities at CBS

12.2. ORIS

ORIS, the celebration of expression was in a Mood Pink this year, Pink representing happiness and joy. It was organized on the 9th and 10th of February.

Day 1 saw an origami workshop by Prof. Nagarajan followed by an open painting session on paper. The art materials were provided by the club and the participants were to paint their feelings on the topic and represent 'Pink' in their own way. There was a good participation from CBScients, faculty and staff.

Day 2 started with a candle making workshop, and continued till the end of the day. Parallel to this, a second longer painting session on canvas was held with background classical music to instigate the artists.

On both the days, an exhibition of the recent artworks of the CBS students was done, which had many outside visitors. Another themed project, 'Theme Gray' was undertaken as an antagonistic and darker approach to the central them of joy. A pop art panel, gothic photography, art installations, gothic; metal audio-video installations were put up in a dark room exhibition.

Prior to the ORIS days, as a part of the art and craft initiative, the studio was covered in a huge themed collage of newspapers, color paper cuttings, origami pieces and small paintings to create a joyous art-fantasy ambience.

All the artworks created on the two days are kept for viewing in the CBS library and can also be viewed on our official Facebook Page,https://www.facebook.com/CbsArtClub.

(ORIS is an open art festival held every year in February, on the weekend falling in the Valentine week, as a part of the CBS Art Club activity).

12.3. Musical Programme

Dhwani: An annual musical concert where eminent artists are invited to perform. Apart from the artists, CBS students also exhibit their talents in singing and music. Dhwani, the musical evening, aim to enrich the vibrant academic ambiance of CBS with a classical vocal rendition by a distinguished artist.

This year this event was held on 03rd April, 2012 and organized at the Prof. D. N. Marshall Memorial Hall of the J.N.U. Library, University of Mumbai. At the Dhwani 2012 event, Dr. Hemala Ranade from Indian Institute of Technology, Bombay was the invited artist. She presented varied shades of the vocal tradition of classical music like *multani* and *yaman* etc. It was followed by performance by Dr. Anuradha Garge who is faculty member for Mathematics Department of UM-DAE CBS.

Student participation included exposition of diverse forms of music like classical, semi-classical, pop, rock, etc.

*** ***

Nurturing talent...promoting excellence

मौलिक विज्ञान प्रकर्ष केन्द्र

UM-DAE CBS
CENTRE FOR EXCELLENCE IN BASIC SCIENCES
Health Centre Building, University of Mumbai,
Kalina Campus, Mumbai -400 098
Phone: 91-22-26524983 | Fax: 91-22-26524982
Web: www.cbs.ac.in