Nurturing talent...promoting excellence

मौलिक विज्ञान प्रकर्ष केन्द्र

UM-DAE CEBS
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 2014 - March 2015)

Annual Report

(April 2014 - March 2015)

UM-DAE CEBS

University of Mumbai (UM) – Department of Atomic Energy (DAE)

Centre for Excellence in Basic Sciences (CEBS)

Director's Message

The University of Mumbai - Department of Atomic Energy (UM-DAE) Centre for Excellence in Basic Sciences (CEBS) has had yet another successful year, thus completing eight years of its existence, on the campus of the University of Mumbai at Kalina. The Centre that started on a modest scale, initially with only the Physics stream, has now all the other major streams of basic sciences, namely, Mathematics, Chemistry, and Biology. The Centre has established excellent organic linkages with the University Departments and affiliated colleges of the University.

This year, the fourth batch of students graduated in the Integrated five year M.Sc. programme of the Centre. It is very satisfying to mention that almost all the students who have passed out from CEBS till now are currently pursuing their Ph.D. in prestigious institutions, both within India and abroad. The number of students being admitted to CEBS is increasing progressively, and today it stands at 45 per year. The Centre has been gaining in popularity across the country, as can be seen from the fact that, the number of students registering for its entrance test, namely, the National Entrance Screening Test (NEST), which is conducted jointly by CEBS and NISER-Bhubaneshwar, a sister institution of DAE with similar mandate, has increased from 3300 in the first year to more than 46,000 in the last year.

CEBS regularly organizes various workshops, seminars, public lectures, refreshers courses etc by itself and sometimes jointly with the University of Mumbai. It has also started students exchange programmes with other institutions. Last year, York University deputed two students to study and do research in CEBS under the guidance of our faculty and we are in the process of deputing our students to do a semester long project at the York University.

One of the hallmarks of CEBS is its visitors' programme. Visiting and Adjunct Faculty coming from proximate research institutions such as TIFR, BARC, HBCSE, IIT-B, HBNI contribute significantly 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 CEBS.

CEBS has established modest research facilities for its core faculty. In addition to carrying out research at CEBS, the faculty members also collaborate with scientists in other research institutions and gain access to major equipments. Students from institutes across India come to CEBS to carry out semester-long projects under the guidance of our core faculty and to avail of the laboratory facilities here. The faculty at CEBS have been able to produce excellent research

publications in reputed international journals. The productivity has been increasing steadily and during the last year alone 52 papers have been published in reputed international journals. The faculty members have successfully secured grants for their research projects from external funding agencies such as DST, DBT, BRNS etc.

The students at CEBS have initiated various academic and social activities such as Jigyaasa, Ragnarock, sports competitions, etc which have attracted students from other colleges in the city. The construction work of the permanent buildings of CEBS has been completed and students have been allotted hostel accommodation in the new CEBS hostels with effect from August 2014.

This document lists all the activities and accomplishments of the Centre during the last one year and it is satisfying to note that CEBS 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. The idea behind setting up an institution like CEBS has received positive attention from other educational institutions across the country. A few universities in India have been in touch with the faculty members of CEBS to seek guidance to set up similar institutions in their state universities. CEBS hopes to 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.

I am thankful to the Brochure Committee for preparing this document.

R. V. Hosur
Director

Contents

Preamble

1. Preamble

The Centre for Excellence in Basic Sciences (CEBS) 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 postgraduate education in the midst of a vibrant research environment with emphasis on the experimental component within a multi-disciplinary framework. The undergraduate training is structured in such a manner so as to facilitate and attract young students to the frontiers of exciting research in the physical, mathematical, chemical and life sciences, with special emphasis on programmes related to energy sciences.

CEBS has now completed 8 years of its existence. The Centre now offers all four streams of Basic Science courses, namely, Physics, Mathematics, Chemistry and Biology. The first three batches of CEBS students have graduated in April 2012, April 2013 and April 2014 respectively with excellent grades, and have since joined reputed institutions and Universities for pursuing higher studies. These include among others, DAE-aided institutions such as TIFR, NCBS, NCRA, HRI, BARC Training School, top US universities etc. In general, CEBS students have been performing exceedingly well in national competitive examinations and have won several laurels.

CEBS has enabled creation of high quality research ambiance on the Mumbai University Campus. This is reflected by the large number of publications in high impact journals, most of these involving CEBS undergraduate students. On the average about 50 papers are published every year by CEBS Faculty.

In the years to come, CEBS plans to expand the scope of its activities, and enhance the existing linkages with the UoM and other scientific institutions across India. Apart from advancing knowledge through innovative teaching methodology and scholarly research, CEBS also plans to create a cordial and vibrant atmosphere at the Centre for the overall development of student life – both academic and social.

Governing Council and Academic Board of the Centre

2. Governing Council of the Centre

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

Dr. R. K. Sinha Secretary to the Government of India Department of Atomic Energy, and Chairman, Atomic Energy Commission Anushakti Bhavan, C. S. M. Marg Mumbai – 400 001	Chairperson
Dr. Rajan Welukar Vice - Chancellor University of Mumbai Fort Campus, Mumbai – 400 032	Co-Chairperson
Dr. Sekhar Basu Director Bhabha Atomic Research Centre Trombay, Mumbai – 400 085	Member
Dr. M. Barma Director Tata Institute of Fundamental Research Homi Bhabha Road Mumbai – 400 005	Member
Dr. Devang Khakhar Director Indian Institute of Technology, Bombay Powai, Mumbai – 400 076	Member
Dr. Naresh Chandra Pro Vice Chancellor University of Mumbai Fort Campus, Mumbai – 400 032	Member

Shri. Pradeep R Baviskar — Member
Joint Secretary (R&D)
Department of Atomic Energy
Anushakti Bhavan, C.S.M. Marg
Mumbai – 400 001

Prof. S. K. Joshi — Member
Room No. 250
National Physical Laboratory
Dr. K.S. Krishnan Road
New Delhi - 110 012

Prof. R. V. Hosur — Member Secretary
Director
UM-DAE CEBS
University of Mumbai
Kalina Campus, Mumbai – 400 098

Academic Board of the Centre

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 — Chairperson
Emeritus Professor
UM-DAE CEBS
University of Mumbai
Kalina Campus, Mumbai – 400 098

Prof. J. V. Narlikar — Member
Formerly Inter-University Centre for
Astronomy and Astrophysics (IUCAA)
Post Bag 4, Ganeshkhind
Pune University Campus, Pune - 411 007

Prof. Arvind Kumar — Member
Homi Bhabha Centre for Science Education
V. N. Purav Marg, Mankhurd
Mumbai – 400 088

Prof. M. S. Raghunathan — Member
National Centre for Mathematics
Indian Institute of Technology – Bombay
Powai, Mumbai – 400 076

Prof. J. Maharana — Member
Institute of Physics
Sachivalaya Marg
Bhubaneshwar, Orissa - 751 005

Dr. Swapan Ghosh — Member
Head, Theoretical Chemistry Section
Bhabha Atomic Research Centre
Trombay, Mumbai – 400 085

Prof. Dipan Kumar Ghosh — Member
Indian Institute of Technology – Bombay
Powai, Mumbai – 400 076

Prof. N. Mukunda — Member
Centre for High Energy Physics
Indian Institute of Science
Bangalore – 560 012

Prof. K. N. Ganesh — Member
Director
Indian Institute of Science
Education and Research (IISER)
Dr. Homi Bhabha Road
Pashan, Pune – 411 008

Prof. R. R. Puri — Member
Indian Institute of Technology – Gandhinagar
B103, Sukun Chandkedha
S. G. Road, Ahmedabad – 382 424

Prof. G. D. Yadav — Member
Vice Chancellor
Institute of Chemical Technology
Mumbai – 400 019

Prof. N. Sathyamurthy Director Indian Institute of Science Education and Research (IISER) Mohali, MGSIPA Complex, Sector 26 Chandigarh – 160 019	Member
Prof. A. M. Narsale UM-DAE CEBS University of Mumbai Kalina Campus Mumbai – 400 098	Member
Prof. Deepak Dhar Department of Theoretical Physics Tata Institute of Fundamental Research Homi Bhabha Road, Colaba Mumbai - 400 005	Member
Dr. S. K. Apte Bio-Medical Group and Head Molecular Biology Division Bhabha Atomic Research Centre Trombay, Mumbai - 400 085	Member
Prof. M. K. Pejavar Dean Science Faculty University of Mumbai Fort Campus, Mumbai – 400 032	Member
Prof. R. V. Hosur Director UM-DAE CEBS University of Mumbai Kalina Campus, Mumbai – 400 098	Member - Secretary

Faculty

3. Faculty

3.1 Core Faculty

PHYSICS		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2014-2015)**
Prof. S. M. Chitre	Chairperson Academic Board & Emeritus Professor	Physics II (P 201) Fluid Mechanics (P 702) Astronomy and Astrophysics (P 803)
Prof. R. Nagarajan	Emeritus Professor	Physics Laboratory (PL101, PL201) Electronics and Instrumentations (G201) Electronics and Instrumentation Laboratory (GL 201) Experimental Techniques (PE 1002)
Dr. Sujit Tandel	UGC Associate Professor	Statistical Techniques and Applications (G 401) Nuclear Physics - I (P 603) Advanced Physics Laboratory (PL 701)
Dr. Ameeya Bhagwat	Reader 'F'	Numerical Analysis (G 501) Numerical Methods Laboratory (GL 501)
Dr. Gargi Shaw	Reader 'F'	Physics Laboratory (PL 301, PL 401) Astronomy and Astrophysics (P 803)
Dr. Sangita Bose	Reader 'F'	Solid State Physics – I (P 703) Advance Condensed Matter Physics (P 804) Chemistry of Materials (C 801) Advance Physics Laboratory (PL 701)
Dr. Ananda Hota	UGC Assistant Professor	Astronomy and Astrophysics (P 803)
Dr. M. Hemalatha	Assistant Professor	Optics (P 303) Physics Laboratory (PL 501, 601) Nuclear Physics - I (P 603) Advance Physics Laboratory (PL 701)
Dr. Bhaskar Khubchandani	Assistant Professor	Optics (P 303) Computational Laboratory (GL 401)
Dr. Manojendu Choudhury	Visiting Scientist II	Statistical Techniques and Applications (G 401) Computer Basics (G 101) Computer Laboratory (GL 101)

		Experimental Advanced Astronomy and Astrophysics (P 805) Advanced Physics Laboratory (PL 801) Numerical Analysis (G 501) Numerical Methods Laboratory (GL 501)
Dr. Alkendra Pratap Singh	Visiting Scientist II	-
Dr. Kaushik Sengupta	Visiting Scientist II	Physics Laboratory (PL 501, PL 601)
Dr. Sanjeev Kumar	Visiting Scientist I	Physics Laboratory (PL 501, PL 601)
Dr. Tapan Naskar	Visiting Scientist I	Classical Mechanics and Special Relativity (P 302) General Relativity and Cosmology (PE 1004)
Dr. P. Brijesh	Visiting Scientist I	-
Dr. Neelam Upadhyay	Visiting Scientist I	-
Dr. Bhooshan Paradakar	Research Associate II	-
Dr. Jayashree Roy	Research Associate I	-

CHEMISTRY		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2014-2015)**
Dr. Neeraj Agrawal	Reader 'F'	Chemistry Laboratory (CL 101, CL 601) Chemistry-Biology Laboratory (CBL 301) Advanced Chemistry Laboratory (CL 701, CL 801) Analytical Chemistry (CB 503) Introductorily Spectroscopy (CB 401)
Dr. Basir Ahmad	UGC Assistant Professor	Biochemistry (CB 301) Biophysical Chemistry (CB 601) Chemistry Laboratory (CL 201, CL 501) Chemistry-Biology Laboratory (CBL 301) Advanced Chemistry Laboratory (CL 701, CL 801) Advanced Chemical Biology (CE 1001)
Dr. Avinash Kale	Visiting	Biophysical Chemistry (CB 601)

	Scientist II	Chemistry Laboratory (CL 201, CL 501) Chemistry-Biology Laboratory (CBL 301) Advanced Chemistry Laboratory (CL 701, CL 801)
Dr. Mahendra Patil	Visiting Scientist I	Organic Chemistry I – (CB 303) Organic Chemistry III – (C 801) Chemistry Laboratory (CL 101) Chemistry-Biology Laboratory (CBL 401) Advanced Chemistry Laboratory (CL 701, CL 801)
Dr. Sinjan Choudhury	Research Associate I	Chemistry Laboratory (CL 501) Biophysical Chemistry (CB 601) Chemistry-Biology Laboratory (CBL 402)
Dr. Anushree Bhattacharya	Research Associate I	-

MATHEMATICS		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2014-2015)**
Dr. Shameek Paul	Research Associate I	Mathematics II (M 201) Foundations (M 301) Partial Differential Equations (M 704) Algebraic Number Theory (M 802)

BIOLOGY		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2014-2015)**
Dr. Jacinta D'Souza	Reader 'F'	Biology I (B 101) Advanced Molecular Biology (CB 403) Biology Laboratory (BL 501) Chemistry-Biology Laboratory (CBL 401)
Dr. Uma Ladiwala	Assistant Professor	Biology I (B 101) Immunology (B 602) Biology Laboratory (BL 601)
Dr. Manu Lopus	Visiting Scientist II	Genetics (B 501) Advanced Cell biology (B 502) Biodiversity of Microbes, Animals and Plants (B 601) Animal Physiology (B 602)
Dr. V. L. Sirisha	Visiting Scientist I	Biology Laboratory (BL 101, BL 201)
Dr. Madhura Pradhan	Research Associate I	-

Dr. Seema Parte	Research Associate I	-

3.2 Senior Scientists

Name of the faculty	Stream	Courses taught in the Academic Year (2014-2015)
Prof. Balwant Singh	Mathematics	Commutative Algebra (M 702) Advanced Commutative Algebra and Applications (ME 1006)
Prof. S. C. Phatak	Physics	Computer Basics (G 101) Computer Laboratory (GL 101) Special Relativity (P 403) Classical Mechanics (P 502)
Prof. H. C. Pradhan	Physics	Communication Skills (H 101) Ethics in Science & Intellectual Property Rights (H 601)
Prof. A. K. Raina	Physics	Mathematical Physics II (P 401) Classical Electrodynamics (P 701)
Prof. S. Kailas	Physics	Experimental Techniques (PE 1002)
Prof. A. M. Narsale	Physics	Electronics and Instrumentation (G 201)
Prof. Vijay Singh	Physics	Quantum Mechanics (P 501) Statistical Mechanics (P 403)

3.3 DBT, DST, UGC Scientists

Name of the faculty	Affiliation	Stream	Courses taught in the Academic Year (2014-2015)
Dr. Subhojit Sen	Ramalingaswami Fellow	Biology	Genetics (B 501) Biology Laboratory (BL 101, BL 201, BL 601)
Dr. Prachi Chandrachud	Dr. D. C. Kothari Fellow	Physics	Advanced Condensed Matter Physics (P 804)
Dr. Tripti Bameta	DST Inspire Faculty	Physics	Physics II (P 201)
Dr. Ishita Mehta	DST Inspire Faculty	Biology	Chemistry Biology Laboratory(CBL 401) Biodiversity of Microbes, Animals and Plants (B 601)
Dr. Sanved Kolekar	DST Inspire Faculty	Physics	-

3.4 Adjunct Faculty

Name of the faculty	Affiliation	Courses taught in the Academic Year (2014-2015)
Dr. Swapan Ghosh	Bhabha Atomic Research Centre (BARC), Mumbai	Chemical Kinetics and Reaction Dynamics (CBP 401) Quantum Chemistry I (C 501) Properties of Matter (C 605) Quantum Chemistry and Group Theory (C 604)
Dr. Srinivas Krishnagopal	Bhabha Atomic Research Centre (BARC), Mumbai	Electromagnetism (P 503) Accelerator Physics (P 803)
Prof. H. M. Antia	Tata Institute of Fundamental Research (TIFR) Mumbai	-
Dr. Sudhir R. Jain	Bhabha Atomic Research Centre (BARC), Mumbai	Physics I (P 101) Physics II (P 201) Glimpse of Contemporary Science (G 202) Fluid Mechanics (P 701) Foundations of Statistical Mechanics (PE 1002)
Prof. Lokesh Tribedi	Tata Institute of Fundamental Research (TIFR) Mumbai	-
Prof. C.S. Rajan	Tata Institute of Fundamental Research (TIFR) Mumbai	Topology (M 803) Lie Groups (ME 1002)
Prof. Sreerup Raychaudhuri	Tata Institute of Fundamental Research (TIFR) Mumbai	Quantum Field Theory (PE 1001)
Dr. D.K. Palit	Bhabha Atomic Research Centre (BARC), Mumbai	Introductory Spectroscopy(CB 401) Photochemistry (C 701)
Prof. G. Ravindrakumar	Tata Institute of Fundamental Research (TIFR) Mumbai	Quantum Optics (PE 1013)
Prof. Raju V. Ramanujan	School of Materials Science and Engineering, Singapore	-

Prof. Narasimhan Chari	D.J. Sanghvi College	Topology II (M 503) Analysis IV (M601) Coding Theory & Cryptography (ME 1005)

3.5 Distinguished Guest Faculty

Name of the faculty	Affiliation	Stream	Courses taught in the Academic Year (2014-2015)
Prof. S. S. Jha	*Formerly* Tata Institute of Fundamental Research (TIFR) Mumbai	Physics	Classical Mechanics (P 502)
Prof. P.C. Agrawal	*Formerly* Tata Institute of Fundamental Research (TIFR) Mumbai	Physics	Experimental Advanced Astronomy and Astrophysics (P 805) Advanced Physics Laboratory (PL 801)
Prof. Chandrashekhar Khare	University of California (Los Angeles)	Mathematics	-
Prof. Shrinivas Kulkarni	California Institute of Technology (Caltech)	Physics	-

3.6 Visiting Faculty

PHYSICS		
Name of the faculty	**Affiliation**	**Courses taught in CEBS Academic Year (2014-2015)**
Dr. Anwesh Majumdar	Homi Bhabha Centre for Science Education (HBCSE), Mumbai	Electricity & Magnetism (P 302)
Prof. Arvind Kumar	*Formerly* Homi Bhabha Centre for Science Education (HBCSE), Mumbai	Quantum Mechanics II (P 601), Quantum Mechanics III (P 702) General Relativity and Cosmology (PE 1004)
Dr. D. Biswas	Bhabha Atomic Research Centre (BARC), Mumbai	Non-Linear Dynamics and Chaos (P 703)
Prof. D. C. Kothari	University of Mumbai	Nanotechnology (PE 1011)

Prof. D. Narasimha	Tata Institute of Fundamental Research (TIFR), Mumbai	General Relativity & Cosmology (PE 1004)
Prof. Dipan Ghosh	Indian Institute of Technology (IIT-B), Mumbai	Quantum Computing & Information (PE 1007)
Prof. G. Ravindrakumar	Tata Institute of Fundamental Research (TIFR), Mumbai	Quantum Optics (PE 1013)
Prof. J. V. Narlikar	The Inter-University Centre for Astronomy and Astrophysics (IUCAA) Pune	General Relativity & Cosmology (PE 1004)
Prof. Jyoti Rao	Ruia College	Physics II (P 201), Waves & Oscillations (P 304)
Dr. Karthik Subbu	Mithibhai College	Applied Electronics Laboratory (GL 301)
Dr. Kartik Patel	Bhabha Atomic Research Centre (BARC), Mumbai	Computational Electrodynamics (PE 1010)
Prof. Lakshmi Natarajan	*Formerly* University of Mumbai	Atomic and Molecular Spectroscopy (P 604)
Prof. Lokesh Tribedi	Tata Institute of Fundamental Research (TIFR), Mumbai	Advanced Atomic Physics (PE 1012)
Prof. Manohar Nyayate	B. N. Bandodkar College, Thane	Physics Laboratory (PL 501, PL 601)
Prof. Manoranjan Guchait	Tata Institute of Fundamental Research (TIFR), Mumbai	Particle Physics (PE 1014)
Dr. P. K. Dasgupta	Siddharth College	Physics Laboratory (PL 101, PL 201)
Dr. P. Shashidhran	Vertak College	Applied Electronics Laboratory (GL 301) Electronics and Instrumentations (G 201) Electronics Laboratory (GL 201)
Prof. Pratap Raychauduri	Tata Institute of Fundamental Research (TIFR), Mumbai	Advanced Condensed Matter Physics (P 804)
Dr. Praveen Pathak	Homi Bhabha Centre for Science Education (HBCSE), Mumbai	Electricity & Magnetism (P 302), Statistical Mechanics I (P 403)

Dr. Radha Srinivasan	University of Mumbai	Physics Laboratory (PL 101, PL 201)
Prof. S. H. Patil	Indian Institute of Technology (IIT-B), Mumbai	Mathematical Physics (M 301), Advanced Statistical Mechanics (PE 1002)
Dr. Sandhya Ullal	*Formerly* Mithibhai College	Physics Laboratory (PL 101, PL 201, PL 501)
Dr. Tushima Basak	Mithibai College, Vile Parle	Physics Laboratory (PL 301, PL 401)
Prof. Wendrich Soars	Vikash College	Physics Laboratory (PL 101, PL 201) Electronics Laboratory (GL 201) Applied Electronics Laboratory (GL 301)

MATHEMATICS		
Name of the faculty	**Affiliation**	**Courses taught in CEBS Academic Year (2014-2015)**
Prof. A.K. Pani	Indian Institute of Technology (IIT-B), Mumbai	Partial Differential Equations (M 704)
Dr. Ajit Kumar	Institute of Chemical Technology (ICT), Mumbai	Computational Mathematics - I (M 305), Computational Mathematics II (M 405, M605)
Prof. Alladi Subramanyam	Indian Institute of Technology (IIT-B), Mumbai	Stochastic Analysis (M 804) Probability Theory (M 504)
Prof. Anant Shastri	Indian Institute of Technology (IIT-B), Mumbai	Differential Topology (M 703)
Prof. Ananth Hariharan	Indian Institute of Technology (IIT-B), Mumbai	Algebra III (M 502) Algebra IV (M 602)
Dr. Aniket Sule	Homi Bhabha Centre for Science Education (HBCSE), Mumbai	Mathematics I & II (M 100, 200)
Prof. Inder K. Rana	Indian Institute of Technology (IIT-B), Mumbai	Analysis I (M 302), Topology I (M 401)
Dr. Joseph Amalnathan	Bhabha Atomic Research Centre (BARC), Mumbai	Mathematics I (M 101)

Prof. Jyotsa Dani	*Formerly,* St. Xavier College	Elementary Number Theory (M 403), Analysis III (M 501)
Prof Jyotsna Prajapat	University of Mumbai	Differential Geometry and Applications (M 603)
Prof. Kiran Kolwankar	R. J. College, Ghatkopar	Fractals and Applications (ME 1003)
Prof. M. G. Nadkarni	University of Mumbai	Mathematics II (M 201) Functional Analysis III (M 701)
Prof. Mahadeo Bakare	*Formerly,* University of Mumbai	Fourier Analysis (M 801)
Prof. Parvati Shastri	Indian Institute of Technology (IIT-B), Mumbai	Algebra –I (M 303), Algebra –II (M 402)
Dr. Prithwijit De	Homi Bhabha Centre for Science Education (HBCSE), Mumbai	Mathematics I (M 101), Differential Equations & Dynamics System (M 604) Graph Theory (ME 1009)
Prof. R. C. Cowsik	University of Mumbai	Discrete Mathematics (M 304), Topics in Algebraic Geometry (ME 1004)
Prof. R. M. Pawale	University of Mumbai	Analysis –II (M 401)
Prof. R. R. Simha	*Formerly* Tata Institute of Fundamental Research (TIFR), Mumbai	Analysis- IV (M 601)
Dr. Richard D'Souza	Bhabha Atomic Research Centre (BARC), Mumbai	Mathematics II (M 201)
Prof. S. Krishnan	Indian Institute of Technology (IIT-B), Mumbai	Representation Theory of Finite Groups (M 705), Computational Mathematics III (M 805)
Prof. Sandeep Juneja	Tata Institute of Fundamental Research (TIFR), Mumbai	Financial Mathematics (ME 1008)
Prof. Siddharth Bhattacharya	Tata Institute of Fundamental Research (TIFR), Mumbai	Introduction to Ergodic Theory (ME 1007)
Dr. Swapnil Jawkar	Homi Bhabha Centre for Science Education (HBCSE), Mumbai	Mathematics I & II (M 100, 200)
Prof. Vijaylaxmi Trivedi	Tata Institute of Fundamental Research (TIFR), Mumbai	Algebraic Number Theory (M 803)

CHEMISTRY		
Name of the faculty	**Affiliation**	**Courses taught in CEBS Academic Year (2014-2015)**
Dr. Alok S amanta	Bhabha Atomic Research Centre (BARC), Mumbai	Advanced Quantum Chemistry (CE 1001), Statistical Mechanics (CE 1002)
Dr. B. S. Tomar	Bhabha Atomic Research Centre (BARC), Mumbai	Nuclear Chemistry (C 702)
Dr. C G S Pillai	*Formerly* Bhabha Atomic Research Centre (BARC), Mumbai	Chemistry of Materials (C 801)
Dr. Daily Devis	Tata Institute of Fundamental Research (TIFR), Mumbai	Chemistry Laboratory (CL 701)
Prof. Evans Coutinho	Bombay College of Pharmacy, Mumbai	Chemistry I (C 101), Medicinal Chemistry (CE 1003), Molecular Modeling and Drug Design (CE 1004)
Dr. Gail Carneiro	Sophia College	Organic Chemistry (C 503)
Dr. Gomati Sridhar	KVS Menon College	Organic Chemistry – I (CB 303), Organic Chemistry –III (C 603, C 803)
Dr. KRS Chandrakumar	Bhabha Atomic Research Centre (BARC), Mumbai	Macro and Supra-molecular Chemistry (C 802)
Dr. Lakshamy Ravishankar	V.G.Vaze College of Arts, Science & Commerce	Organic Chemistry II (C 503)
Prof. M. Sudarsanam	University of Mumbai	Chemistry Laboratory (CL 101, CL 501, CL 701, CL 201) Chemistry-Biology Laboratory (CBL 301, CBL 401, CBL 601) Analytical Chemistry (CB 503)
Dr. Niharendu Chaudhary	Bhabha Atomic Research Centre (BARC), Mumbai	Statistical Mechanics (CE 1002)
Dr. P. A. Hassan	Bhabha Atomic Research Centre (BARC), Mumbai	Macro and Supra-molecular Chemistry (C 802) Nano Materials and Soft Condensed Matter (CE 1002)
Prof. Padmakar Sathe	Ramnarain Ruia College	Inorganic Chemistry (CB 302) Chemistry II (C 201)
Dr. R.K. Vatsa	Bhabha Atomic Research Centre (BARC), Mumbai	Chemical Kinetics and Reaction Dynamics (PCB 401)
Prof. Raghuvir Pissurlenkar	Bombay College of Pharmacy, Mumbai	Chemistry I (C 101)

Dr. Rahul Tripathi	Bhabha Atomic Research Centre (BARC), Mumbai	Nuclear Chemistry (C 702)
Dr. S. Kannan	Bhabha Atomic Research Centre (BARC), Mumbai	Inorganic Chemistry II (C 502) Inorganic Chemistry III (C 602)
Dr. Sudha Srivastava	Tata Institute of Fundamental Research (TIFR), Mumbai	Introductory Spectroscopy (CB 401)
Dr. Sunil K. Ghosh	Bhabha Atomic Research Centre (BARC), Mumbai	Physical Organic Chemistry (C 704)
Dr. Tanuja Parulekar	SIWS College	Organic Chemistry – I (CB 303), Organic Chemistry –III (C 603, C 803)
Dr. Vinayak Rane	Tata Institute of Fundamental Research (TIFR), Mumbai	Atomic & Molecular Spectroscopy (C 601, C 804)

BIOLOGY		
Name of the faculty	**Affiliation**	**Courses taught in CEBS Academic Year (2014-2015)**
Dr. Aparna Kotekar	iGenetic Diagnostics Pvt Ltd	Molecular Biology (CB 403)
Prof. B. J. Rao	Tata Institute of Fundamental Research (TIFR), Mumbai	Advanced Molecular Biology (CB 403)
Dr. Bhaskar Saha	St. Xaviers College, Mumbai	Cell Biology II (B 502) Developmental Biology (B 701)
Dr. Champakali Ayyub	Tata Institute of Fundamental Research (TIFR), Mumbai	Biology Laboratory (BL 501)
Prof. G.K. Rao	*Formerly* Central Institute of Fisheries Education, Versova	Genetics (B 501)
Dr. Hema Ramachandran	Sophia College, Mumbai	Neurobiology (B 801)
Dr. Hemalatha Subramaniam	Sophia College, Mumbai	Neurobiology (B 801)
Dr. J. Sainis	*Formerly* Bhabha Atomic Research Centre (BARC), Mumbai	Plant Physiology (B 603)

Prof. Krishanu Ray	Tata Institute of Fundamental Research (TIFR), Mumbai	Cell Biology (CB 301) Advanced Cell Biology (B 502)
Dr. Leon Pareira	Freelancer	Biotechnology (B 804) Biology Laboratory (BL 801)
Prof. M. M Johri	*Formerly* Tata Institute of Fundamental Research (TIFR), Mumbai	Plant Physiology (B 603)
Dr. Mandar Karkhanis	South Indian Welfare Society College	Microbiology (B 703)
Dr. Medha Rajadhyaksha	Sophia College, Mumbai	Neurobiology (B 801)
Prof. S. Sivakami	*Formerly* University of Mumbai	Biochemistry (CB 301) Biochemistry II (CB 402)
Dr. Sagarika Damle	K.C. College, Mumbai	Biodiversity (B 601) Plant Biology (B 702)
Dr. Sandeepan Mukharjee	Haffkine Institute, Mumbai	Virology (B 704)
Dr. Sarada Bulchand	Tata Institute of Fundamental Research (TIFR), Mumbai	Bioimaging (B 802)
Dr. Shatrupa Sinha	Freelancer	Bioimaging (B 802)
Dr. Shreyasi Thakur	Tata Institute of Fundamental Research (TIFR), Mumbai	Bioimaging (B 802)
Prof. Sudha Gangal	INSA Member	Immunology (B 602)
Prof. Supreet Saini	Indian Institute of Technology (IIT-B), Mumbai	Bioinformatics (B 803)
Prof. Surekha Zingde	Advanced Centre for Treatment, Research and Education in Cancer (ACTREC) , Mumbai	Biology II (B 201)
Dr. Tara Hariharan	D. Y. Patil International School	Biodiversity of Microbes, Animals and Plants (B 601), Biology – I (B 101)
Dr. V. Shanthini	Vivekanand College, Mumbai	Microbiology (B 703)
Dr. Vainav Patel	National Institute of Research in Reproductive Health, (NIRRH), Mumbai	Immunology (B 602)
Dr. Yasmin Khan	Sophia College, Mumbai	Neurobiology (B 801)

General subjects etc.		
Name of the faculty	**Affiliation**	**Courses taught in CEBS Academic Year (2014-2015)**
Prof. M. C. Arunan	Homi Bhabha Centre for Science Education (HBCSE), Mumbai	Ethics in Science and IPR (G 601)
Prof. Nilufer Bharucha	*Formerly* University of Mumbai	World Literature (H 301)
Prof. Sridhar Rajeswaran	University of Mumbai	World Literature (H 301)
Dr. N. S. Basavaiya	Bhabha Atomic Research Centre (BARC), Mumbai	Earth Science (G 501)
Dr. S P Anand	Indian Institute of Geomagnetism (IIGM)	Earth Science (G 501)
Dr. S. K. Arora	Bhabha Atomic Research Centre (BARC), Mumbai	Earth Science (G 501)

Administration & Support

4.1 Administration

Name of Staff	Designation
Mr. K. P. Balakrishnan	Registrar
Dr. Jayant Kayarkar	Consultant (Admin & Accounts)
Mr. Kishore Menon	Advisor
Mr. B. L. Bhargava	Consultant (Building & Construction)
Mr. Milind Ashrit	Consultant (Finance)
Mr. Deepak P Hate	Consultant (Purchase)
Ms. Swati V. Kolekar	Office Superintendent (Admin)
Ms. Vaishali M. Kedar	Office Superintendent (Admin)
Ms. Rupali Shringare	Office Superintendent (Finance)
Ms. Neha Dandekar	Office Superintendent (Finance)
Mr. Prashant Gurav	Systems Assistant
Mr. Amit Shetkar	Library Attendant
Ms. Veena Naik	Office Assistant (Purchase & Store)
Mr. Nitesh Kadam	Hostel Assistant
Ms. Divya Sukumaran	Office Assistant (Multi Skill)
Ms. Vaibhavi Nerurkar	Office Assistant (Finance)
Mr. Maruti Khot	Office Attendant
Mr. Tushar Bandkar	Technician (Electrical)

4.2 Support

Laboratory Attendants

Mr. Ram M. Soure	Lab Attendant (Physics)
Mr. Dinesh B. Desai	Lab Attendant (Physics)
Mr. Santosh Sood	Lab Attendant (Biology)
Ms. Rupesh Kamtekar	Lab Attendant (Chemistry)
Mr. Abhay Bakalkar	Lab Attendant (Nuclear Physics & Computer)
Mr. Harish Hira Singh	Lab Attendant (Biology)
Mr. Rahul Shinde	Lab Attendant (Biology)

Scientific Assistants

Mr. Kanak Gawde	Scientific Assistant (Biology)
Ms. Nayana Kamtekar	Scientific Assistant (Chemistry)
Ms. Sonali Shiriskar	Scientific Assistant (Chemistry)
Mr. Ajayweer Gautam	Scientific Assistant (Biology)

Senior Project Assistant (SPA)

Ms. Marilyn Sequeira	(SPA)	Biology

Junior Project Assistant (JPA)

Ms. Pradnya G. Parab	(JPA)	Physics
Ms. Shivani Muthu	(JPA)	Chemistry
Mr. Domnic Colvin	(JPA)	Chemistry
Ms. Samridhi Phatak	(JPA)	Chemistry
Mr. Snehal Kaginkar	(JPA)	Biology
Ms. Tejashree Mahaddalkar	(JPA)	Biology
Ms. Pooja Potadar	(JPA)	Biology
Ms. Prabhjyot Bhui	(JPA)	Physics

Students

5. Students

5.1 National Entrance Screening Test -2014

Year wise statistical data of NEST is given below

Year	Students enrolled for the Test	Students appeared for the Test
2007	~5600	~3300
2008	~8200	~7000
2009	14105	12036
2010	16686	9453
2011	~14500	9691
2012	15099	10775
2013	24543	19436
2014	45519	29645

5.2 Admitted students for the academic Year 2014-2015

Sr. No	Name	M/F	State of Origin
1.	Aakash Butolia	M	Rajasthan
2.	Abhijith M	M	Kerala
3.	Abhinav Singh	M	Maharashtra
4.	Abhishek Panchal	M	Gujarat
5.	Aditya Singh Rajput	M	Uttar Pradesh
6.	Anjali Jayachandran	F	Kerala
7.	Ankita Gupta	F	Uttar Pradesh
8.	Anton Swaminathan Iyer	M	Rajasthan
9.	Anumita Kumari	F	Jharkhand
10.	Anup Kumar	M	Bihar
11.	Ashish Beck	M	Odisha
12.	Bitarka Bisai	F	West Bengal
13.	Charu Shardul	M	Uttar Pradesh

14.	Dwiti Krushna Das	M	Odisha
15.	Fahid Latheef A.	M	Kerala
16.	Jaseem Ihsan K.	M	Kerala
17.	John James	M	Kerala
18.	Maithreyi R	F	Tamilnadu
19.	Malati Tudu	F	Odisha
20.	Neeraja P S	F	Kerala
21.	Nikita Gupta	F	Chhattisgarh
22.	Poonam Singh	F	Uttar Pradesh
23.	Prashant Gupta	M	Madhya Pradesh
24.	Prashant Mishra	M	Uttar Pradesh
25.	Rashmi Chaudhary	F	Uttar Pradesh
26.	Ritika Dhundhwal	F	Rajasthan
27.	Sharayu Umakant Ghodeswar	F	Maharashtra
28.	Shraddha Singh	F	Uttar Pradesh
29.	Shreya Pramanik	F	Assam
30.	Siddharth Rajesh Sharma	M	Rajasthan
31.	Sunil Rampuria	M	West Bengal
32.	Swapnil Shankar	M	Jharkhand
33.	Swarnim Shashank	M	Uttar Pradesh
34.	Tejas Parasram Singar	M	Maharashtra

GEOGRAPHICAL DISTRIBUTION

State of origin	No of students
Rajasthan	4
West Bengal	2
Uttar Pradesh	8
Tamilnadu	1
Odisha	3
Maharashtra	3
Madhya Pradesh	1
Kerala	6
Jharkand	2
Gujarat	1
Chattisgarh	1
Bihar	1
Assam	1
Total	**34**

5.3 Achievements of the students

- **Asian Science Camp 2014**
  The following students were selected and participated in the Eighth Asian Science Camp - 2014 which was held at NTU, Singapore during 24-29 August 2014.
  1. Mr. Vishwajit E.S.
  2. Mr. Somasundaram S.

- **Mimansa** is the national level annual science quiz-cum-challenge organised by the students of IISER, Pune.
  The following students were finalist in this:
  1. Mr. Swagat Pradhan
  2. Mr. Sanchit Sablok
  3. Mr. Deepak Kamlesh
  4. Mr. Aishwarya Mishra

- **National Initiative on Undergraduate Science (NIUS) 2014**
  - Student selected for *NIUS Physics Camp:*
    Ms. Shraddha Singh
  - Student selected for *NIUS Biology Camp*
    Mr. Prashant Mishra and Ms. Sharayu Ghodeshwar
  - Student selected for *NIUS Chemistry Camp*
    Ms. Anjali Jaychandran and Ms. Maithreyi Ramakrishnan

- **Joint Entrance Screening Test (JEST -2015)**
  1. Mr. Jyotirmoy Roy 40 99.17
  2. Mr. Saurabh Wajhal 208 95.52
  3. Mr. Mayank Singh 287 93.64

- **Kishore Vaigyanik Protsahan Yojana (KVPY) 2014**

  The following students were selected for the Kishore Vaigyanik Protsahan Yojana (KVPY) fellowship 2014

  1. Ms. Shraddha Agrawal 1st
  2. Mr. Vishwajith E. S. 1st
  3. Mr. Upnishad Sharma 1st

5.4 Current status of students who graduated in the year 2015

Name of the student	Offer received	Offer accepted
Mr. Mayank Singh	➢ McGill University, Canada, ➢ University of Minnesota, USA, ➢ University of Illinois at Chicago, USA	McGill University, Canada
Ms. Nivin Mothi	➢ University of California Merced, USA	University of California Merced, USA.
Mr. Harsh Bhatt	➢ BARC, India, ➢ National University of Singapore, Singapore ➢ University of British Columbia, Canada; University of Warwick, UK	BARC, India
Ms. Galaxy Gupta	➢ IIT-Madras, India ➢ IIT-Delhi, India	IIT-Madras, India
Mr. Pratik M. Kumbhar	➢ University of Geneva, Switzerland, ➢ CEA, Cadarche, France in collaboration with University of Nice, France	University of Geneva, Switzerland
Mr. Bojja Aditya Reddy	➢ University of Geneva, Switzerland ➢ Institute of Science & Technology, Austria, ➢ Michigan Technical University, USA, ➢ ICFO, Spain, ➢ University of Alberta, Canada	University of Geneva, Switzerland
Ms. K.J. Karthika	➢ State University of New York, Buffalo, USA	State University of New York, Buffalo, USA
Mr. S. Prashanth	➢ University of Kansas, USA	University of Kansas, USA
Ms. Akanksha Vishwakarma	➢ Deutsches Elektronen-Synchrotron - DESY, Germany	Deutsches Elektronen-Synchrotron - DESY, Germany
Ms. Pooja Chandrakar	➢ Brandeis University, USA	Brandeis University, USA

Mr. Ashwin Kumar Boddeti	➢ Physikalisches Institut, University of Bonn, Germany ➢ School of Physics and Astronomy, University of Nottingham, UK	Physikalisches Institut, University of Bonn, Germany
Ms. Shalini Gupta	➢ Phillips University of Marburg, Germany ➢ Australian National University	Phillips University of Marburg, Germany
Ms. Rakvi	➢ Cornell University, USA ➢ Ohio State University, USA, ➢ Louisiana State University, USA, ➢ Institute of Mathematical Science, IMSc, Chennai, India	Cornell University, USA
Mr. Koushik Senapati	➢ University of Queensland, Australia	University of Queensland, Australia
Mr. Sanoj	➢ University of Illinois, Chicago, USA ➢ Michigan Technological University, USA	University of Illinois, Chicago, USA

5.5 M.Sc. dissertation projects done by final year students :

Sr. No.	Name of the Student	Guide	Brief Title
Mathematics			
1.	Ms. Galaxy Gupta	Prof. R. R. Simha (Ex UM)	Artin Approximation Therorem
2.	Mr. Pratik Kumbhar	Prof. A. K. Pani (IIT-B)	Local Discontinuous Galekin Method
3.	Mr. Love Narwar	Prof. Prithwijit De (HBCSE)	Flows in Graphs
4.	Mr. Koushik Sengupta	Prof. Amitava Bhattacharya (TIFR)	Enumeration
5.	Mr. Vinay Soni	Prof. Madhumita Gangopadhyay (UM)	Partial Differential Equations

6.	Mr. S. Prashanth	Prof. C. S. Rajan (TIFR)	Number Theory
Physics			
7.	Ms. Shubhangi Gupta	Prof. Y. Sasidhar (IIT-B)	Turn Propensity and the role of turn residues in the formation of the beta-hairpin in staphylococcal nuclease: A Comparative study
8.	Mr. Saranyo Moitra	Prof. D. Dhar (TIFR)	Existence of Phase Transitions in ID Ising Models with long Range Interactions
9.	Mr. Shanshank Markande	Prof. V. Tripathi (TIFR)	Study of Phase of the Kitaev Heisenberg model in the presence of magnetic field
10.	Ms Santwana Dubey	Prof. R. Palit (TIFR)	Pulse shape analysis for particle identification using radiation detectors
11.	Ms. Shilpi Singh	Prof. S. Ghosh (TIFR)	Building of a low temperature Hall effect and resistivity measurement setup and study of temperature dependence of mobility and carrier concentration in semiconductors
12.	Mr. S. Gholam Wahid	Dr. Sujit Tandel (CEBS)	Study of neutron rich nuclei through transfer reactions using large gamma detector arrays
13.	Mr. Shashank Pathak	Prof. Deepak Mathur (TIFR)	Laser assisted, absorber-induced nucleation and crystal growth
14.	Ms. Angana Model	Prof. S. Basu (BARC)	Deposition and Characterization of Ni-Ge thin films
15.	Mr. Amit Seta	Prof. Anwesh Mazumdar (TIFR)	Seismic Characterization of the red giant branch
16.	Mr. Navneeta Katyan	Prof. Pushan Ayyub (TIFR)	Size dependent melting point variation of silver nanoparticles
17.	Mr. Aklant Kumar Bhowmick	Prof. Sreerup Rauchaudhuri (TIFR)	Determination of higgs boson properties through rare processes using large hadron collider
18.	Ms. Kriti Gupta	Prof. S. Ghosh (TIFR)	Non-Equilibrium reactive processes in the condensed phase: Effect of Initial state

19.	Mr. Amar Deo Chandra	Prof. P. C. Agrawal (CEBS)	Spectral studies of X-ray pulsar Vela X-1 using Rossi X-ray timing explorer (RXTE)
20.	Mr. Jamshed Ali K. A.	Prof. P. C Agrawal (CEBS)	X-Ray Binaries
Chemistry			
21.	Ms. Nivin Mothi	Dr. Basir Ahmad (CEBS)	A Mechanistic Model for Amorphous Protein Aggregation and its Prevention
22.	Mr. Vikash Kumar	Prof. A. V. S. R. Koti (TIFR)	Site-directed mutagenesis to construct tryptophan mutants of SUMO proteins and their characterization using fluorescence spectroscopy'
23.	Ms. Karthika K. Jairaj	Prof. B. L. V. Prasad (NCL)	Surface modification of polyetherimide films for biomedical applications
24.	Mr. Sanoj Raj	Prof. S. K. Ghosh (BARC)	Ellucidating adsorption properties of graphene and its analogoues through multiscale molecular modelling and simulation

5.6 Senior Research Fellow (SRF) and Junior Research Fellow (JRF)

Mr. Mr. Venkataramana G. Rao	(SRF)	Biology
Ms. Dolly Khona	(SRF)	Biology
Mr. Sushil Samant	(SRF)	Physics
Ms. Katherine Rawlins	(JRF)	Physics
Ms. Namrata Maladkar	(JRF)	Physics
Ms. Swati Dixit	(JRF)	Chemistry
Mr. S. Gholam Wahid	(JRF)	Physics
Mr. Plawan Das	(JRF)	Mathematics

Awards and Honors

6. Awards and Honors

R. V. Hosur

- Elected to the ISMAR Council
- Distinguished Alumnus Award of IIT-Bombay 2015

S. Kailas

- Awarded the DAE Raja Ramanna Fellowship
- DAE Group Achievement award

R. Nagarajan

- Member, Subject Board, Department of Physics, University of Mumbai
- Member, Syllabus Committees for Laboratory Course and Experimental Techniques course, Department of Physics, University of Mumbai

Jacinta D'Souza

- INSA-CICS Travel Award, **2014** to attend the 16th Intl. Conference on Cell and Molecular Biology of *Chlamydomonas*, held from the 8th to 13th June, **2014** in San Franscisco, USA.
- Best Poster Award (Poster titled, 'Identification of Protein Interactomes from the green chlorophyte *Chlamydomonas reinhardtii*', JS D'Souza, VG Rao, DK Khona, Sirisha VL and MP Sequeira) at the one-day Conclave of C-CAMP, NCBS held on 14th November, **2014**.
- Third Prize for the poster titled, 'Synthesis of metallic nanoparticles and its application in PCR product enhancement' presented by Sourabh Mehta, JS D'Souza and Muthurajan H, at the National Seminar on Applications of Nanobiotechnology in Medicine, Agriculture and Environment, held on the 16th of March, **2015**, held under UGC-SAP (DRS-I)

Gargi Shaw

- Visiting Associateship at IUCAA for a period of three years with effect from August 1, 2014 till July 31, 2017

Ameeya Bhagwat

- Elected as Life member of NASI, Allahabad

Sangita Bose

- Women's Excellence award from SERB-2014

Manojendu Choudhury

- Team Leader (Observer) of the Indian Contingent to the International Olympiad on Astronomy and Astrophysics held at Volos, Greece, July 27 – August 05, 2013.

Subhojit Sen

- Best Poster Award in the International Conference on Bacterial Expressions, National Centre for Biological Sciences.

Manu Lopus

- Selected to participate and present current research at the Young Investigators' Meet, Srinagar, organized by Department of Biotechnology, Govt. of India, and the Wellcome Trust.

V. L. Sirisha

- Awarded Young Scientist Travel Fellowship from the Department of Science & Technology (DST), Govt. of India under International Travel Support Scheme (ITS) Committee for attending 16th international conference on cell and molecular biology of chlamydomonas, Pacific Grove, California held during 8th -13th June 2014.

Research Activities

7. 1 Research Activities in Department of Physics

S. M. Chitre

Solar and Stellar Physics

Over the past one year, the principal research activity has been a continuation of the collaborative investigation to study the underlying mechanism responsible for driving the solar activity cycle. The main thrust of this work is to infer the global magnetic field and the meridional circulation flow pattern in the interior, particularly in the convection zone of the Sun, using the observed temporally varying internal solar angular velocity.

Assuming the azimuthal force arises from the combined action of Reynold stresses, Maxwell stresses and the angular momentum transport by large-scale meridional circulation in the solar interior, it is proposed to undertake a truly dynamic seismic study to probe the internal magnetic field and its time variation with the solar cycle.

The helioseismic observations have established that the rotation profile in the solar convection zone has both radial and latitudinal dependence. It is, therefore, necessary to develop a two-dimensional mixing-length formulation for describing the energy and angular momentum transport for constructing stellar evolutionary models for 2D axisymmetric rotating stars.

A new project was initiated to investigate the role of neutrals in the cool stellar atmospheres. It turns out the operation of Hall effect and Ambipolar diffusion in the presence of electrons, ions and neutrals results in the sharpening of magnetic field structures that leads to the creation of current sheets and the accompanying reconnection sites. This could be the process responsible for the release of magnetic energy and energetic particles, thus providing the basis for explosive events such as flares and huge mass ejections of the Sun.

S. Kailas

Charged Particle Induced Nuclear Fission Reaction – Progress and Prospects

The nuclear fission phenomenon continues to be an enigma, even after 75 years of its discovery. The key drivers of nuclear fission research are: Structure, Dynamics and Dissipation. The various phenomenon associated with nuclear fission are influenced by the above three aspects. Considerable progress has been made in the

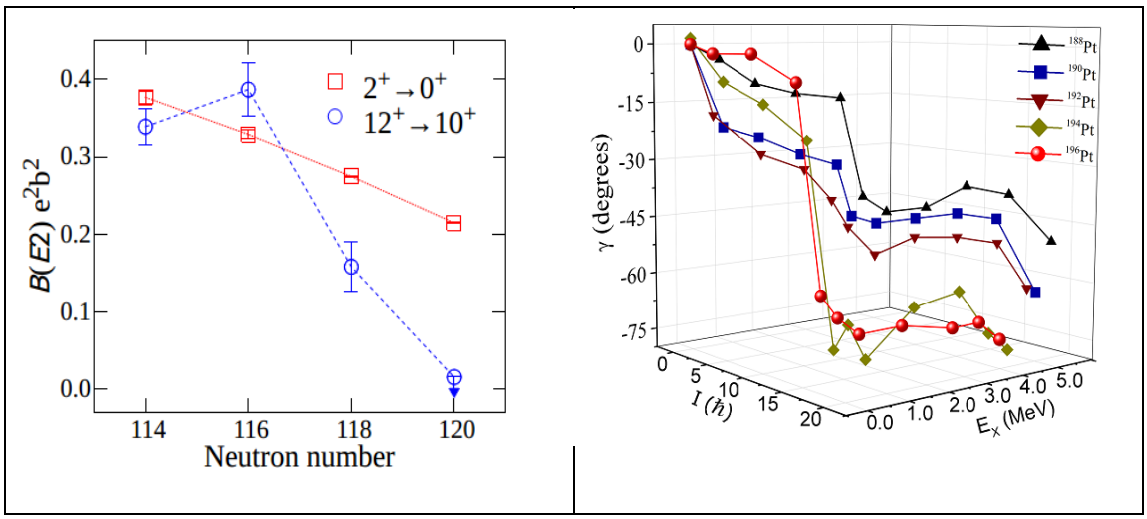
understanding of this complex phenomenon involving large scale collective motion of the fissioning nucleus at extreme deformation and moderately large excitation. Nuclear structure, shell effects, entrance channel dynamics, statistical and dynamical aspects, dissipation effects- influencing the fission fragment angular distribution, mass distribution, pre-fission neutron emission phenomena are all investigated in detail using the modern accelerator facilities with versatile detectors. A comprehensive review article has been written covering the progress made in this field in the last 75 years. The prospects for future research are also indicated in this review article.

(S. Kailas and K. Mahata, Pramana. J. Phys. 83 ,851 (2014))

Sujit Tandel

Isomers and oblate rotation in neutron-rich Pt isotopes

Rotation-aligned isomeric states and associated oblate collective sequences are established in neutron-rich even Pt isotopes. Reduced *E2* transition probabilities for the de-excitation of the 12^+ isomers indicate an abrupt and unexpected quenching of oblate collectivity around neutron number *N*=120. Structure and shape evolution at high spin in the neutron-rich region is found to be markedly different from observations in the lighter isotopes.



Coexisting shape- and high-K isomers in the shape transitional nucleus ^{188}Pt

A high-spin study of the shape transitional nucleus ^{188}Pt reveals the unusual coexistence of both shape and *K*-isomeric states. Reduced *B(E2)* transition probabilities for decays from these states inferred from the data clearly establish

their hindered character. In addition to other excited structures, a rotational band built upon the *K* isomer is identified, and its configuration has been assigned through an analysis of alignments and branching ratios. The shape evolution with spin in this nucleus has been inferred from both experimental observables and cranking calculations. The yrast positive parity structure appears to evolve from a near-prolate deformed shape through triaxial at intermediate excitation, and eventually to oblate at the highest spins.

Pu, Cm, Cf nuclei under rotational stress: role of higher-order deformations

Fast-rotating N=151 isotones ^{245}Pu, ^{247}Cm and ^{249}Cf have been studied through inelastic excitation and transfer reactions with radioactive targets. While all have a ground-state band built on a $\nu j_{15/2}$-[734]9/2 Nilsson configuration, new excited bands have also been observed in each isotone. These odd-N excited bands allow a comparison of the alignment behavior for two different configurations, where the $\nu j_{15/2}$ alignment is either blocked or allowed. The effect of higher order deformations is explored through cranking calculations, which help clarify the elusive nature of $\nu j_{15/2}$ alignments.

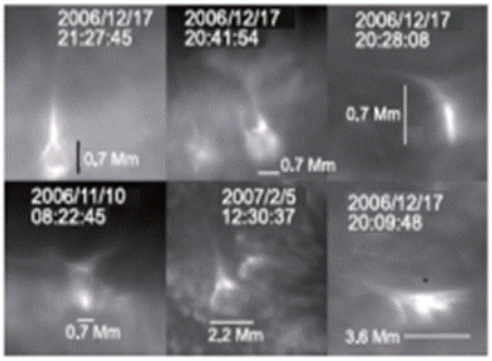
Transverse wobbling in ^{135}Pr

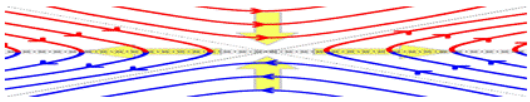
A pair of transverse wobbling bands is observed in the nucleus ^{135}Pr. The wobbling is characterized by ΔI=1, *E2* transitions between the bands, and a decrease in the wobbling energy confirms its transverse nature. Additionally, a transition from transverse wobbling to a three-quasiparticle band comprised of strong magnetic dipole transitions is observed. These observations conform well to results from calculations with the tilted axis cranking model and the quasiparticle rotor model.

Alkendra Pratap Singh

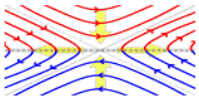
The Sun and Earth are connected with each other through the magnetic fields which play an important role in channelling the mass and energy towards the Earth. So, in order to pin point the causal relationship between solar disturbances and the terrestrial effects, it is crucial to understand the structure and dynamics of the solar atmosphere in great detail. In this regard, a formulation for mean-field dynamo in the partially ionized layers of the Sun has been developed.

Magnetic Reconnection In Partially Ionized Solar Atmosphere

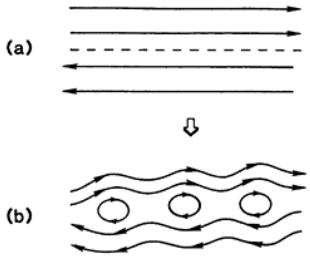




Sweet-Parker Reconnection



Petschek Reconnection



Tearing Mode Instability

Chromospheric Anemone Jets observed by Solar Optical Telescope onboard Hinode are shown above. The solar chromosphere is partially ionized. Magnetic reconnection is an ubiquitous phenomenon in which nearly-antiparallel field lines interact and reconfigure, quickly releasing magnetic energy, and accelerating and heating plasma. Jets caused by magnetic reconnection at various heights in the solar atmosphere might supply mass from the lower to the upper solar atmosphere. Moreover, the sudden deformation of magnetic structures in the magnetic reconnection process generates Magnetohydrodynamic waves, and it is possible that these waves heat the corona. The jets observed in the chromosphere is strongly connected to magnetic reconnection in partially ionized plasma. Whether and how fast magnetic reconnection in the solar chromosphere is not clear. More so, there is not much understanding on how Sweet-Parker, Petscheck and Tearing Mode are related with each other. One of the focus of our research at CBS is on the physics of partially ionized solar atmosphere.

High-resolution observations from Solar Optical Telescope Hinode have shown presence of ubiquitous chromospheric anemone jets in the solar chromosphere (Shibata et al. 2007; also see figure). The presence of these jets features imply that magnetic reconnection similar to that in the corona is occurring at a much smaller spatial scale throughout the chromosphere and suggest that the heating of the solar chromosphere and corona may be related to small-scale ubiquitous reconnection. Recent observations from SOT/Hinode reported by Singh et al. (2012) have shown multiple plasma ejections and the intermittent nature of magnetic reconnection in the solar chromosphere, highlighting the need for fast reconnection to occur in highly collisional plasma. However, the physical process through which fast magnetic reconnection occurs in partially ionized plasma, like the solar chromosphere, is not fully understood. Based on the observations and simulations, a theoretical model has been proposed for magnetic reconnection in partially ionized solar atmosphere.

Gargi Shaw

Physical conditions in three high-z H_2-bearing DLAs: implications for grain size

Damped Lyman *a* absorbers (DLAs) are intergalactic clouds characterized by the highest H I column densities, N(H I) ≥ $10^{20.3}$ cm^{-2}. They trace bulk of the neutral hydrogen at high redshift and are considered to be the progenitors of present-day disc galaxies. DLAs are detected in absorption along the line-of-sight to luminous high-redshift sources such as quasars or gamma-ray bursts. They have performed detailed numerical simulation of 3 DLAs: at z_{abs} = 2.3377 towards LBQS 1232 + 082, at z_{abs} = 2.41837 towards SDSS J143912.04+111740.5 and at z_{abs} = 2.6265 towards FBQS J081240.6+320808.

It is well known that the H_2 formation can occur in the gas phase as well as on the surface of dust grains. However, the grain surface route is the dominant formation mechanism in the metal-enriched H I gas. The formation rate of H_2 on grains depends on various parameters such as dust-grain type, dust and gas temperature, hydrogen density and total available grain surface area. Thus, numerical simulations of H_2-bearing DLAs can be an effective tool to probe grain properties of these systems. Since H_2 is detected in various rotational levels, the density, radiation field and temperature of the gas can be derived. The conventional notation for the various levels is H_2 (v, J), where v is the vibrational level and J is the rotational level. Besides, C I which has an ionisation potential 11.2 eV, is known to trace H_2. Its fine structure levels $^3P_0$, $^3P_1$ and $^3P_2$, which we denote as C I*, C I** and C I*** respectively, also determine gas density through their mutual ratios. Hence, observations of the fine structure levels of C I along with the rotational levels of H_2, can be used to constrain models of cold gas in DLAs quite well.

They used the spectral synthesis code CLOUDY version c13.03 to model these DLAs. This code is based on a self-consistent calculation of thermal, ionization, and chemical balance of gas and dust exposed to a source of radiation. Using very few parameters they reproduced the observed column densities satisfactorily. The above three DLAs are well-reproduced constant-pressure clouds in the radiation field due to *in situ* star formation. They find that a blackbody radiation field with temperature 4×10^4 K is incident from both sides on the DLAs at z_{abs} = 2.4 and 2.6. The intensity of the UV radiation field is 10^{-4} and 5 × 10^{-4} ergs cm^{-3} s^{-1} respectively for the 2 systems. The DLA at z_{abs} = 2.3, however, is irradiated by hard X-ray radiation from a very massive star with ionization parameter -5.9. We find that grains in the high-redshift DLAs that we have modelled are smaller in size than in the local ISM. The smaller grains can be due to either smaller grains distributed by the MRN size distribution, or ISM-sized grains following a power-law distribution with an index lower than the MRN distribution. The

two scenarios produce almost identical column densities for various species and hence, it is not possible to single out one of them as the more likely case. The cosmic ray ionization rates for H in the 3 systems we have modelled are 6.3×10^{-17},1.4×10^{-15} and 2×10^{-17} s^{-1} respectively. They span a range ~ 2dex. This indicates that the ionization produced by cosmic rays in high-z DLAs varies for different sightlines. The cosmic ray ionization rate in the Galactic ISM too, varies along different lines-of-sight. This suggests that the cosmic ray ionization rate at high redshift is also not uniform, and encourages further probing along various sightlines. They also present our predictions for species whose transitions may lie outside the wavelength range of observations, but whose log column densities are higher than 12.50 (cm^{-2}). They predict C II*, OH, OH^+ and H_2O for the DLA at z_{abs} = 2.4, and OH and HCl for the DLA at z_{abs} = 2.6.

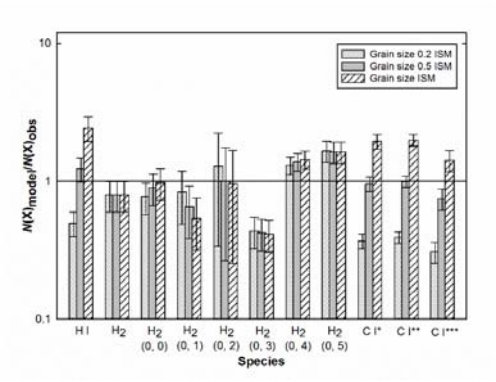


Figure 1.The plot shows the ratio of model-to-observed column densities for H I, C I and H2 for the DLA at zabs = 2.3377. Grain size is varied with all other parameters of the model held fixed. The errors have been calculated by considering the ratio of our model predictions with the upper and lower limits of observed column density. The best-fitting model is clearly the one with grains of size 0.5 times the ISM grain size.

Accelerator and Beam Physics Group
Sushil Samant, Bhooshan Paradkar, P. Brijesh , Srinivas Krishnagopal

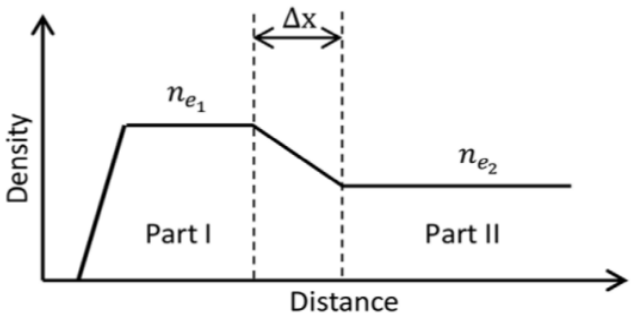
Compact Proton Accelerator using Laser-Solid Interaction

The radiation pressure of ultra-intense lasers (intensity > 10^{21} W/cm^2) can be used to accelerate extremely thin (of the order of nano-meters) solid targets. Recent studies have shown that such types of interaction have the potential to produce the next generation of compact ion sources for various applications in medical physics, nuclear physics etc. Although considered to be quite promising, the physics of such acceleration mechanisms is still poorly understood due to the extremely non-linear nature of the laser-plasma interaction at such high intensities. They are currently investigating the influence of electron heating and laser self-transparency on the energy spread of the accelerated proton beam. In 2D particle-in-cell simulations using WARP, they have observed that the laser pulse duration strongly affects the electron temperature and proton energy spread. Typically, they see that the longer pulse duration results in stronger electron heating and broader proton spectrum.

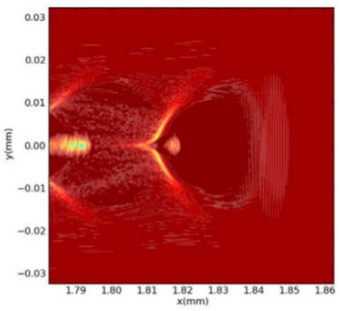
Currently, they are investigating possible physical mechanisms to explain these simulation results.

X-ray Lasers using Laser Wakefield Electron Acceleration (LWFA)

In order to realize a LWFA-based Free-Electron Laser (FEL) it is crucial to address the issue of poor beam quality in LWFA. Typically, to drive an FEL the electron source should be able to deliver kA current beams with < 1% energy spread and 1 pi-mm-mrad emittance. Therefore, the main focus of their electron acceleration research activity is to work towards generating high quality 1 GeV electron source with these parameters, using the 3D simulation code VORPAL. For producing such high brightness beams, they have investigated the effect of laser pulse shape and temporal duration and found that negative skew (slow rise and sharp fall) pulses lead to better beam quality than positive skew (sharp rise and slow fall) and Gaussian pulses. They have also investigated controlled injection schemes and acceleration with inhomogeneous plasma density profiles(Fig. 1a). In recent work, they have demonstrated that with density transition injection it is possible to obtain an electron beam that is bright enough to lase a UV FEL (Fig. 1b). They are now working on pushing this to shorter wavelengths.



1a



1b

Fig. 1a: Plasma density profile for controlled injection Fig. 1b: Bubble accelerated electrons

Sangita Bose

Superconductivity in Engineered granular thin films

Superconducting films with periodic array of holes shows an interesting property of matching effects (periodic oscillations in superconducting properties like critical current with magnetic field with the period commensurate with the flux quantum).

We wanted to understand the origin of this effect in these systems which has been mostly attributed to any one of the two competing effects of quantum interference (QI) and commensurate pinning (CP). For this they grew films of superconducting NbN on anodic alumina membranes (AAM) with two different pore diameters-35 and 18 nm. We also tuned the disorder of the NbN films in order to tune the coherence length and penetration depth. They measured the screening response of the films using a newly developed "two coil mutual inductance technique" in our lab. This technique helped us probe the effect deep in the superconducting state which was not possible by the earlier conventional measurements of magneto-resistance. They reported this new technique to probe matching effects in the anti-dot films in **Applied Physics Letters, 103, 262601 (2013)**. They have also measured different physical quantities like the magneto-resistance, critical current, dynamical screening response, critical temperature and the superconducting energy gap as a function of magnetic field. The superconducting energy gap was measured by tunneling spectroscopy by making tunnel junctions of NbN/Nb_2O_5/Ag. In our experiments, all dynamical quantities which can be influenced by the flux line motion under an external drive showed pronounced matching effects. However, the superconducting energy gap which is a true thermodynamic quantity did not show any periodic variation with magnetic fields for the same films. In addition the temperature window for the survival of the matching effect increased with increase in the disorder of the films and it extended to as low as $0.09T_{c0}$ for the most disordered film. Their results indicate that CP leading to vortex-vortex interaction is the dominant mechanism for the observed matching effects in these superconducting anti-dot films. These results have appeared in **Superconductor Science and Technology 28 (5), 055007 (2015)**.

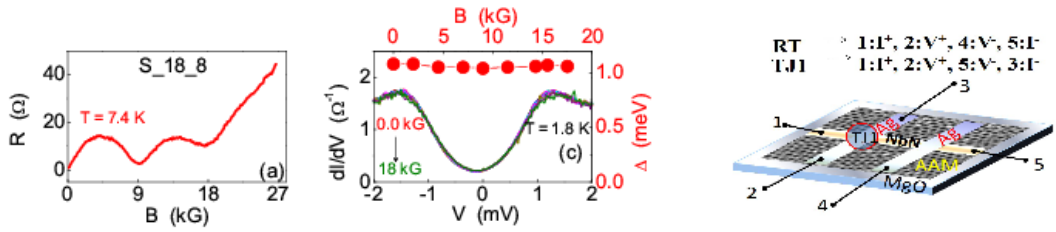


Figure 1 Left panel: Magneto-resistance of the NbN anti-dot film with pore diameter of 18 nm and a T_c of 8 K showing the matching effects. Mid panel: Tunneling conductance of the same film measured at T = 1.8 K at different magnetic fields showing no matching effect. Right Panel: Schematic of the tunnel junction device made on the NbN anti-dot film.

Ameeya Bhagwat

a) The Microscopic – Macroscopic calculation of ground state nuclear masses using the semi – classical Wigner-Kirkwood approach for shell corrections
b) Development of a nuclear mass formula, based on the trace formulas
c) Investigation of importance of non-locality in the nucleon – nucleus scattering at low energies.
d) Brückner – Hartree – Fock Approach:

Wigner – Kirkwood approach for binding energies

The Microscopic – Macroscopic (Mic – Mac) models of nuclear binding energies are based on the well – known Strutinsky theorem, according to which, the nuclear binding energy can be written as sum of a smooth part, and an oscillatory part. The latter is often referred to as shell correction. The smooth part is normally taken from the liquid drop model. In the present work, the shell corrections are obtained by using the semi – classical Wigner – Kirkwood expansion of the one body density matrix. WK expansion is carried out upto the fourth order in Planck's constant. The pairing correlations, important for open shell nuclei, are taken into account in the approximate particle number projected Lipkin – Nogami scheme. We have shown that such a scheme is indeed very reliable. The framework has been applied to a large set of 561 even – even nuclei with $Z \geq 8$ and $N \geq 8$. In all three deformation degrees of freedom (β_2, β_4, γ) have been considered. The resulting *rms* deviation was found to be merely 610 keV. Reliability of the model has been further demonstrated by applying it to the proton and neutron drip lines as well as in the superheavy mass region. Recently, we have extended these calculations to the domain of the phenomenon of spontaneous fission. In particular, the mic – mac mass model based on the Wigner – Kirkwood averaging scheme that we have developed, has been employed to estimate of spontaneous fission half-lives of some superheavy nuclei. In this estimate we restrict ourselves to the same deformation space used in the description of the ground-state masses, i.e. β_2, β_4, and γ deformation degrees of freedom. Certainly it is true that this deformation space is, in general, not enough to describe precisely some aspects involved in the complex fission phenomenon. However, we have shown that our WK model with only these three deformation degrees of freedom is able, within a restricted set of superheavy elements, to predict spontaneous fission half-lives in rather good agreement with the corresponding experimental values. This work is being carried out in collaboration with Prof. Peter Schuck, Prof. Xavier Vinyas, Prof. Mario Centelles and Prof. Ramon A. Wyss.

Trace formula Inspired Mass Formula for Nuclear Ground State

A simple formula for ground state nuclear masses based on the microscopic - macroscopic approach has been proposed. Considering a set of 2353 nuclei with $Z \geq 8$ and $N \geq 8$, the formula yields an *rms* deviation of just 266 keV, which is one of the smallest deviation reported in the literature so far. The formula has been tested extensively for a large number of systems including the loosely bound proton rich nuclei, superheavy nuclei and spontaneous cluster emitters, establishing the reliability of the proposed formula. The proposed formula has a major advantage: it allows one to parameterise the fluctuating part of the ground state energy reliably. This result is very interesting and important, since the fluctuating part of the energy is related directly to the trace formula, which in turn encodes the interaction itself. A reliable parameterisation of such kind has been reported for the first time in the literature.

Investigation of importance of non-locality in the nucleon – nucleus scattering at low energies

The important problem of contribution of non – local effects in the optical model, particularly for loosely bound projectiles at low energies are being investigated. The necessary formalism has been developed, and at present, we are in the process of validation of the formalism. The work is being done in collaboration with Dr. Neelam Upadhyay (CEBS) and Prof. B. K. Jain (BARC).

Brückner – Hartree – Fock Approach

Worked on proton – nucleus scattering within the framework of Brückner Hartree Fock approach. Stable as well as loosely bound nuclei have been investigated. This work was done in collaboration with Prof. Wasi Haider (Aligarh Muslim University) and his group.

M. Hemalatha

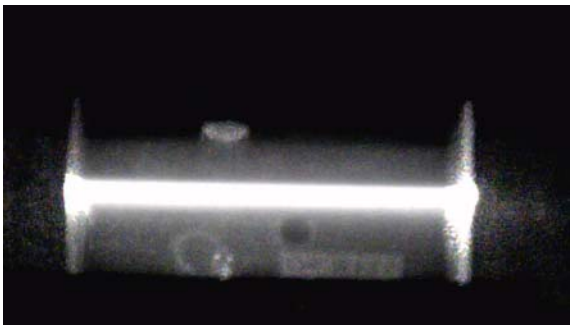
Laser Spectroscopy of stable nuclei and nuclei away from stability

A high sensitive fluorescence cell is being developed for measurement of atomic isotope shift (IS)and hyperfine structure (Hfs) of stable and radioactive isotopes using laser spectroscopic methods. This experimental set up is the first of its kind in India for laser based nuclear physics investigations. This research work is being carried out with the funding received under the Young Scientist Research Award

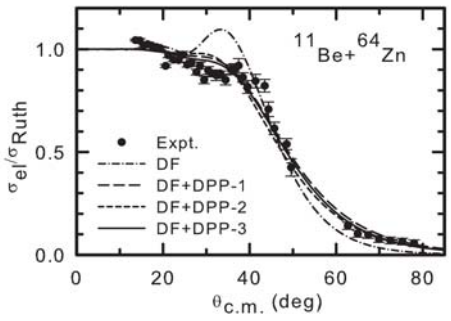
(YSRA – 2012). This work is interdisciplinary and involves nuclear physics, atomic spectroscopy, lasers, accelerators and reactors. Techniques that have high sensitivity and resolution would be required in the near future as new nuclei are being produced in increasing numbers at accelerated radioactive ion beam facilities. The development of fluorescence cell that enables online measurement of short-lived nuclei produced in small amounts at accelerators using laser spectroscopy is important. The highly accurate measurements of isotope shifts which are sensitive to small changes in the mean-square charge radii, will provide considerable insight to these issues. Presently, the design and fabrication of the fluorescence cell for the laser spectroscopy is in progress. Initial testing is being carried out with cesium atoms and laser-induced fluorescence in atomic beam is being carried out. The observed laser-induced fluorescence with cesium atoms is displayed in the figure.

Elastic scattering of halo nuclei

Elastic scattering, though a well-understood phenomenon, has recently attracted considerable interest due to its role in the understanding of the properties of halo nuclei, such as ^{11}Li and ^{11}Be. Halo nuclei have unusual features: small binding energy and a large interaction cross section. It is expected that elastic scattering angular distributions for halo nuclei would exhibit anomalous behaviour. This effect, due to the weakly bound nature of halo projectiles, makes the coupling to the continuum relevant and can be taken into account by introducing dynamic polarization potential in the optical potential. Recently, a significant reduction in elastic scattering cross section has been experimentally observed for ^{11} Be scattering off a ^{64} Zn target at a centre-of-mass energy of 24.5 MeV. Elastic scattering cross section for ^{11}Be + ^{64}Zn has been investigated in the framework of the double folding model with and without dynamic polarization potential. The calculated differential cross section with the inclusion of the imaginary part of the dynamic polarization potential (DPP) to the double folded potential show a suppression in the Coulomb-nuclear interference region as depicted in the figure.



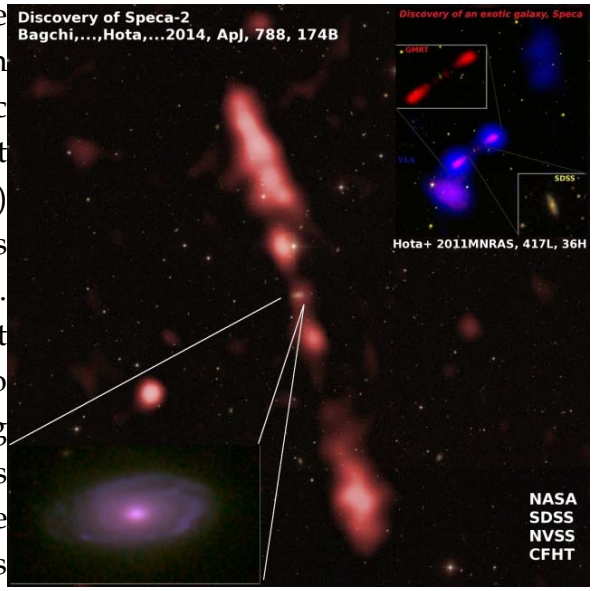
Laser-induced fluorescence of Cs atoms



Calculated cross section with and without DPP

Ananda Hota

Giant relativistic Jet from giant spiral galaxy with uper massive black hole



Recently the second case of Speca-like exotic galaxy (Speca: Hota et al. 2011) an extremely rare case of giant mega-parsec (Mpc) scale radio jets emerging from giant and massive spiral galaxy (J 2345-0449) hosting a super-massive black hole has been discovered by Bagchi et al. (2014). Since the beginning of radio astronomy it is well-known that large relativistic radio jets with magnetised plasma emitting synchrotron radiation are always associated with elliptical early-type galaxies. The standard understanding has been that a spinning super-massive black hole is needed for launching such a jet. This required condition is naturally achieved when two large galaxies collide, with massive central black hole in each of them, to form an elliptical galaxy. In the process both the massive black holes coalesce and grow in mass and spin. In 1998, Ledlow et al. discovered the first odd-ball case of a large radio galaxy with a disk/spiral host. After 12 long years, Hota et al (2011) found the second case and named it Speca. Speca has yet another property which makes it an exotic object. The radio lobes extends to 1.3 Mpc and the radio jet activity is episodic or intermittent. It is not clear why in some rare instances, super-massive black holes stop accreting gas surrounding them, or at least accrete in a mode which does not produce radio jet, for several million years and then start again. Speca does this start-stop-start not just twice but thrice, in that sense having three pairs of lobes is also extremely rare, this is only the second case known so far. This nature was evident only in the 325MHz (wavelength 90 cm) data from Giant Meterwave Radio Telescope (GMRT), world's largest radio telescope at meter wavelength, located near Pune.

Soon after this, in 2014, Bagchi et al. found the second Speca, case of a giant radio jets (1.6 Mpc) from a spiral galaxy, J2345-0449, the clearest case of a spiral galaxy so far. Surprisingly, this too is an episodic and a double-double radio galaxy. The host spiral galaxy is rotating extremely fast, nearly at 430 km per second. When followed up with the 8m Japanese Subaru Telescope, Speca also shows extremely fast rotation, nearly 370 km per second (Hota et al. 2014). Our current analyses to put these rare objects in perspective, hint that probably these galaxies are suggesting alternate

route to form massive spinning black holes (required to create large radio jets) other than galaxy-galaxy merger. Likely that they are accreating directly from filaments or cosmic-web. They being most-massive and avoiding clusters of galaxies are likely the massive-spirals hosting super-massive black holes formed very early in the cosmic history. With the recent release of all sky images from the GMRT data at 150 MHz (TGSS), at the highest resolution and sensitivity at such low radio frequencies, the chance of discovering Speca-like objects has increased many fold and this will help hunt and understand first super-massive black holes in first galaxies in our Universe.

References: Ledlow, M. J., Owen, F. N., & Keel, W. C. 1998, ApJ, 495, 227
Hota et al. 2011, MNRAS, 417, L36
Bagchi, Vivek, Vikram, Hota et al. 2014, ApJ, 788, 174
Hota et al. 2014 http://arxiv.org/abs/1402.3674

R. Nagarajan

Magneto-optical studies in ferro-fluids

The investigations of interaction of light with ferro-fluids were continued. The studies were carried out in ferrofluids of magnetite of different particle sizes (10 to 50 nm), in different media and under application of external magnetic field. Light source was a 10 mW He-Ne polarized laser. Eternal magnetic field was 0-2000 G produced by an electromagnet. It was shown that the pattern of scattering of light was different for water medium and for kerocene. In the case of water mediun, no specific light scattering is found in the absence of magnetic field, whereas, in the presence of magnetic field a vertical streak is formed. This is attributed to formation of chains by the magnetic nano-particles in the presence of magnetic field. Formation of these chains was verified by optical microscope observation in the presence of magnetic field. In the case of kerosene medium, a near circular diffraction pattern is formed, even in the absence of external magnetic field. This is attributed to thermal lensing effect. Application of magnetic field changes the shape of the diffraction pattern. Thermal lensing effect seem to dominate over the chain formation effect.

The pattern formation is found to be rather slow (~hundred milliseconds), Its details are being studied as a function of time.

7.2 Research Activities in Department of Chemistry

R. V. Hosur

Novel multidimensional NMR pulse sequences have been developed for rapid assignment of backbone and some selected side chain resonances in proteins. These employ dual receivers and correlate 6-7 nuclei at the same time. Structural insights have been derived in the case of P2 protein of Plasmodium falciparum. It has been demonstrated that the protein is intrinsically a molten globule even in the associated state and this helps easy adaptability as per the requirement of various interactors of the protein. The influence of some polyols and curcumin on the kinetics of protein aggregation has been investigated.

Reduced Dimensionality NMR pulse sequences

Protein NMR spectroscopy has expanded dramatically over the last decade into a powerful tool for the study of their structure, dynamics, and interactions. The primary requirement for all such investigations is sequence specific resonance assignment. The demand now is to obtain this information as rapidly as possible, and in all types of protein systems, stable/unstable, soluble/insoluble, small/big, structured/unstructured, etc. In this context, we introduced two reduced dimensionality experiments −(3,2)D- hNCOcanH and (3,2)D- hNcoCAnH− which enhance the previously described 2D NMR based assignment methods quite significantly. Both the experiments can be recorded in just about 2-3 hours' each and hence would be of immense value for high-throughput structural proteomics and drug – discovery research. The applicability of the method has been demonstrated using alpha-helical bovine apo calbindin-D9k P43M mutant (75 aa) protein. Automated assignment of this data using AUTOBA has been presented which enhances the utility of these experiments. The backbone resonance assignments so derived are utilized to estimate secondary structures and the backbone fold using web based algorithms. Taken together, we believe that the method and the protocol proposed here can be used for routine high-throughput structural studies of proteins (Jithender G. Reddy and R. V. Hosur).

Resonance assignment in intrinsically disordered proteins poses a great challenge because of poor chemical shift dispersion in most of the nuclei that are commonly monitored. Reduced dimensionality experiments where more than one nuclei are co-evolved simultaneously along one of the time axes of a multi-dimensional NMR experiment help to resolve this problem partially, and one can conceive of different combinations of nuclei for co-evolution depending upon the magnetization transfer

pathways and the desired information content in the spectrum. We presented a reduced dimensionality (RD) experiment, (4,3)D-hNCOCAnH, which uses a combination of CO and CA chemical shifts along one of the axes of the 3-dimensional spectrum, to improve spectral dispersion on one hand, and provide information on four backbone atoms of every residue - HN, N, CA and CO chemical shifts - from a single experiment, on the other. The experiment provides multiple unidirectional sequential ($i \rightarrow i-1$) amide 1H correlations along different planes of the spectrum enabling easy assignment of most nuclei along the protein backbone. Occasional ambiguities that may arise due to degeneracy of amide proton chemical shifts are proposed to be resolved using the HNN experiment described previously. Application of the experiment and the assignment protocol have been demonstrated using intrinsically disordered a-synuclein (140 aa) protein (Jithender G. Reddy and R. V. Hosur).

While the protein backbone serves to provide a scaffold, the side chains interact directly with the ligands and play crucial roles in the functions. Such investigations will be greatly facilitated, if there are rapid methods for obtaining exhaustive information with minimum of NMR experimentation. In this context, we have presented a pulse sequence which exploits the recently introduced technique of parallel detection multiple nuclei, e.g. ^{1}H and ^{13}C, and results in two 3D- data sets simultaneously. These yield complete backbone resonance assignment ($^{1}H^{N}$, ^{15}N, ^{13}CO, $^{1}H\alpha/^{13}C\alpha$, and $^{1}H\beta/^{13}C\beta$ chemical shifts) and side chain assignment of D, E, N and Q residues. Such an exhaustive assignment has the potential of yielding accurate 3D structures using one or more of several algorithms which calculate structures of the molecules very reliably on the basis of NMR chemical shifts alone. The side chain assignments of D, E, N, and Q will be extremely valuable for interaction studies with different ligands; D, E side chains are known to be involved in majority of catalytic activities. Utility of this experiment has been demonstrated with Ca^{+2} bound M-crystallin, which contains largely D, E, N and Q residues at the metal binding sites (Jithender G. Reddy and R. V. Hosur).

Solution Structure of Plasmodium falciparum P2

The P2 protein in *Plasmodium falciparum* has a high tendency to oligomerize, which seems to drive many of its non-ribosomal functions. During nuclear division of the parasite inside RBC, P2 translocates to the RBC surface as a tetramer. From a systematic study using variety of biophysical techniques, NMR spectral characteristics and relaxation dispersion measurements under different conditions of pH and/or urea concentrations, we deduce that (i) PfP2, an almost entirely helical protein, forms a molten globule monomer at low pH, (ii) at physiological pH, and at

micro-molar concentrations, PfP2 is a stable tetramer wherein two dimers associate sideways with close packing of helices at the interface, and (iii) the molten globule characteristic of the monomer is preserved in the tetramer. This dynamism in the structure of PfP2 may have functional implications since it is known that different kinds of oligomers are transiently formed in the parasite (Pushpa Mishra, Sinjan Chaudhury, Disha Sengupta, Sujoy Mukherjee, Shobhona Sharma and R. V. Hosur).

Intrinsically disordered proteins or such domains in globular proteins are believed to be playing important roles in protein functions by virtue of their ability to adapt themselves to requirements of different binding partners and thereby accord high specificity to the interaction. Eukaryotic ribosomal stalk is made up of a supramolecular assembly of P0, P1 and P2 proteins. In *Plasmodium falciparum*, homo-oligomers of P2 are also seen which seem to be involved in many non-ribosomal functions of the protein in the parasite, and in all of these the protein interacts with different interactors. We showed by extensive ^{15}N NMR relaxation studies that the C-terminal stretch of about 45 residues of the protein always remains as a flexible disordered domain, regardless of the state of association of the protein. The relaxation behaviors and the derived rotational correlation times for this portion of the protein are essentially the same in the presence of different concentrations of urea which produce different mixtures of PfP2 oligomers in rapid exchange, whereas the rest of the protein shows substantial variations with urea concentration in the relaxation behaviors. In other words, the C-terminal domain behaves as if it were an independent intrinsically disordered peptide. This would augment the notion that the C-terminal domain of PfP2 would be acting as a scavenger for different interactors depending upon the different functions of the protein inside the parasite (Pushpa Mishra and R. V. Hosur).

Solution Structure of TgP2

Toxoplasma gondii is an apicomplexan parasite which causes toxoplasmosis. Toxoplasma P2 (TgP2) is a ribosomal protein and exists as supramolecular assembly with other proteins in the ribosome. It is also shown that TgP2 is involved in some extra ribosomal functions. However, till date the protein has evaded structural characterization by any of the known techniques. In this background, we reported a systematic study using a variety of biophysical techniques and NMR, under different conditions of pH and temperature, and deduce that TgP2 consists of only helices and unstructured regions, is a monomer at low pH but forms multimers at higher pH, and has intrinsically a molten globule structure. The C-terminal half is flexible and the helices are concentrated in the N-terminal half of the chain. The dynamism inherent to the molten globule structure may have functional implications for its

extra-ribosomal functions. This structural characteristic is in contrast to that of human P2 protein which is known to form a stable dimer (Pushpa Mishra and R. V. Hosur).

Kinetics of Protein Aggregation

Interactions of small molecule inhibitors with protein aggregates have been studied extensively, but how these inhibitors modulate aggregation kinetics parameters is little understood. In this work, we investigated the ability of two potential aggregation inhibiting drugs, curcumin and kaempferol, to control the kinetic parameters of aggregation reaction. Using thioflavin T fluorescence and static light scattering, the kinetics parameters such as amplitude, elongation rate constant and lag time of guanidine hydrochloride-induced aggregation reactions of hen egg white lysozyme were studied. We observed a contrasting effect of inhibitors on the kinetics parameters when aggregation reactions were measured by these two probes. The interactions of these inhibitors with hen egg white lysozyme were investigated using fluorescence quench titration method and molecular dynamics simulations coupled with binding free energy calculations. We conclude that both the inhibitors prolong nucleation of amyloid aggregation through binding to region of the protein which is known to form the core of the protein fibril, but once the nucleus is formed the rate of elongation is not affected by the inhibitors. This work would provide insight into the mechanism of aggregation inhibition by these potential drug molecules (Mohanish S. Borana, Pushpa Mishra, Raghuvir R. S. Pissurlenkar, Ramakrishna V. Hosur, Basir Ahmad)

Neeraj Agarwal

Synthesis and characterization of materials for applications in photovoltaics
Photocatalytic water splitting
Synthesis of new BODIPy for photodynamic therapy etc.

Photocatalytic water splitting

Recently they undertook a new exciting project on the photocatalytic splitting of water to produce hydrogen. Iridium complexes and new porphyrin derivatives were synthesized and characterized. These complexes are aimed to be used as photosensitizers in water splitting along with the new derivatives of cobaloximes. Ground and excited state energy levels were measured for Iridium complexes and porphrin derivatives using photophysical and electrochemical methods. Preliminary

studies showed their potential in the splitting of water. Quantification of hydrogen production and catalyst performance is under investigation.

New BODIPY derivatives for biological applications

Mono and di-heteroaryl-4,4'-difluoro-8-(aryl)-4-bora-3a,4a-diaza-s-indacene (BODIPy) (**1-5**) were synthesized using Suzuki-Miyaura couplings. Hetero aryl substitution on 3- or 3,5- positions caused large bathochromic shifts (up to ~150 nm) in absorption (569-652 nm) and fluorescence maxima (586-679 nm) in comparison to classical BODIPy. Quantum yields were found to be as high as 0.65. Singlet oxygen production activities of these compounds were studied by monitoring the absorbance quenching of 1,3-diphenylisobenzofuran, on exposure to light (> 600 nm). Cellular uptake of compound **4** was demonstrated using cervical cancer cells and fibroblast cell line and was confirmed by the images obtained using confocal microscope.

In another approach to synthesize the BODIPY derivatives for biological application, nucleophilic substitution on 3-bromo/3,5-dibromo-4,4'-difluoro-8-(aryl)-4-bora-3a,4a-diaza-s-indacene (BODIPY) with neat pyrrole afforded the derivatives of mono and di-pyrrole-4,4'-difluoro-8-(aryl)-4-bora-3a,4a-diaza-s-indacene **1-4** in good yields. Large bathochromic shifts, upto ~170 nm in absorption maxima (575-675 nm), and upto ~180 nm in fluorescence maxima (603-698 nm) were observed. Electrochemical studies were carried out to calculate the oxidation and reduction potential and eventually HOMO and LUMO energy levels. Theoretical studies of **1-4** provide the insight on their dihedral angles, singlet and triplet energy levels. Theoretical and experimental photo-physical studies were correlated.

Recently, C-H arylation of BODIPY without using Pd catalyst was developed and its detailed reaction mechanism was studied. We describe the easy synthesis of heteroaryl-4,4'-difluoro-8-(aryl)-4-bora-3a,4a-diaza-s-indacene (BODIPy) in cost effective way without using any precious metal catalyst. Heteroaryl diazonium salts and BODIPy were used with ferrocene to synthesize heteroaryl BODIPy. This reaction proceeds with the radical C-H arylation which was proved by the control reactions with radical scavengers, DFT calculations and EPR.

Basir Ahmad

Protein misfolding, aggregation and human diseases

Proteins are the primary components of the molecular machinery that make life possible. They often work in the form of specific three-dimensional structure or multi-protein complexes. This means that intramolecular and/or intermolecular self-assembly must take place in order for a protein to reach the structure that allows it to do its function. On the other hand, incorrect self-assembly of the protein may result into toxic or loss of its biological function. Protein aggregation is the incorrect self-assembly of protein into insoluble structure. Most often, this is accomplished by the intramolecular self-assembly of polypeptide into a transient structure that contains patches of hydrophobic residues on the surface, thus forcing the molecules for intermolecular self-assembly. Aggregation is a common problem underlying a variety of biochemical/biomedical situation, ranging from amyloid formation in abnormal disease states (such as Alzheimer's and Parkinson's disease) to the production of therapeutic proteins (e.g. inclusion bodies), to the stability and delivery of protein drugs

His research interests are focused on the investigation of the molecular mechanism of protein aggregation and in the development of drugs that can prevent aggregation. Much of the work is highly interdisciplinary that includes concepts and methods of Molecular Biophysics, Molecular Biology, Protein Chemistry, Protein Engineering and Biochemistry. The methods I use are largely experimental, but do include theoretical and computational approaches.
Following projects were completed.

1. Effects of hesperidin, a flavanone glycoside interaction on the conformation, stability, and aggregation of lysozyme: multispectroscopic and molecular dynamic simulation studies.
2. Attenuation of lysozyme amyloid cytotoxicity by SPION-mediated modulation of amyloid aggregation.
3. Thermal induced unfolding of human serum albumin isomers: assigning residual α helices to domain II.
4. Effects of 2-amino-8-hydroxyquinoline interaction on the conformation of physiological isomers of human serum albumin.

Avinash Kale

Actin regulation in Apicomplexans

The milestones achieved:

1) Purification for actin from Bovine muscle is optimized.
2) Currently we are working towards understanding the polymerization process for Actin using Biophysical techniques.
3) Clones for the actin regulators in Apicomplexan are procured.
4) Currently working on a manuscript of a review article titled: "Actin regulation in Apicomplexan: the structural, functional, and evolution story so far".
5) Currently collaborating with Dr. Supreet Saini (IIT,Bombay) to prepare a mathematical model to understand the actin regulation in Apicomplexan (*Plasmodium falciparum*).
6) We are working towards molecular dynamics studies to understand the conformational changes that Actin undergo on binding to its regulators namely Profilin and Actin depolymerizing Factors (ADFs).
7) Currently work is in progress to test the effects of nano-particles and small compounds on actin polymerization.

Isolation and identification of the novel bacterium having mosquito larvae-cidal activity

The milestones achieved:

1) Mosquito breeding facility has been successfully developed at Haffkine Institute.
2) Ethical clearance for the project has been obtained.
3) About 300 bacterial isolates have been collected from different locations of Mumbai and its suburban areas.
4) High throughput screening is in process to test the larvae-cidal activity of these strains. So far two strains seem to show significant toxicity.
5) We had also started the work on differential proteomics at Haffkines to understand the differential toxicity of the bacterial strains.
6) We are also working towards the structure analysis of the recombinant Binary toxins, namely BinA and BinB.

Structural studies of Holliday Junction resolvase, RecU from B.subtilis

This project is in collaboration with Dr. John Rafferty from University of Sheffiled, United Kingdom. We had solved the 3.2A crystal structure of a protein-DNA

complex. Currently we are working towards the Small Angle X-ray Scattering (SAXS) data to understand the flexibility of the protein. Also we are working towards molecular dynamic simulations (on super computer Param Yuva-II) to better understand the interaction of RecU with Holliday junction.

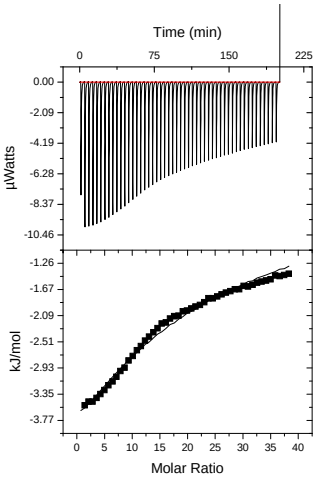
FAP174 from Chlamydomonas reinhardtii

This project is in collaboration with Dr. Jacinta D'Souza (CEBS). We had successfully carried out preliminary thermo-fluorescence assays to screen for the optimal conditions for the protein. We also had set-up crystallization screens for the wild type protein and few initial hits have been obtained. Work is to start on the optimization of these crystals.

Sinjan Choudhary

Molten globule nature of Plasmodium falciparum P2 homo-tetramer

Plasmodium falciparum P2 (PfP2), a ribosomal stalk protein, is known to perform extra-ribosomal functions. It forms homo-oligomers and such oligomeric PfP2 protein translocates through the parasite-infected red cell to the erythrocyte surface. Structural characterization of PfP2 was done by using a combination of isothermal titration calorimetry (ITC), differential scanning calorimetry (DSC), circular dichroism spectroscopy (CD), fluorescence spectroscopy and nuclear magnetic resonance spectroscopy (NMR). It is observed that the PfP2 oligomers have secondary structure but lack well defined tertiary structure. The DSC results showed lack of thermal transition. The ANS binding studies with fluorescence spectroscopy, and Isothermal Titration Calorimetry suggest the presence of some hydrophobic cleft on PfP2.



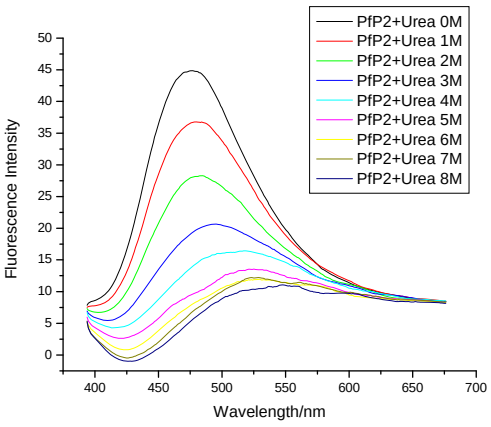


Figure 1: ITC and fluorescence results confirming the presence of intermediate partially folded state in PfP2.

The work provides insights into oligomerization-associated functions of *Plasmodium* P2 protein and help in understanding the diverse functions of the protein. The work is completed and published in Biochemistry and Biophysics Reports in March, 2015.

Structural Characterization of Ribosomal Protein P2 from apicomplexan parasite, Toxoplasma gondii

Toxoplasma gondii is an apicomplexan parasite which causes toxoplasmosis. Toxoplasma P2 (TgP2) is a ribosomal protein and exists as supramolecular assembly with other proteins in the ribosome. It is also shown that TgP2 is involved in some extra ribosomal functions. However, till date the protein has evaded structural characterization by any of the known techniques. In this background, we have done a systematic study using a variety of biophysical techniques and NMR, under different conditions of pH and temperature. The studies deduce that TgP2 consists of only helices and unstructured regions, is a monomer at low pH but forms multimers at higher pH, and has intrinsically a molten globule structure. The C-terminal half is flexible and the helices are concentrated in the N-terminal half of the chain. The dynamism inherent to the molten globule structure may have functional implications for its extra-ribosomal functions. This structural characteristic is in contrast to that of human P2 protein which is known to form a stable dimer. The work is completed and published in Biophysical Chemistry in March, 2015.

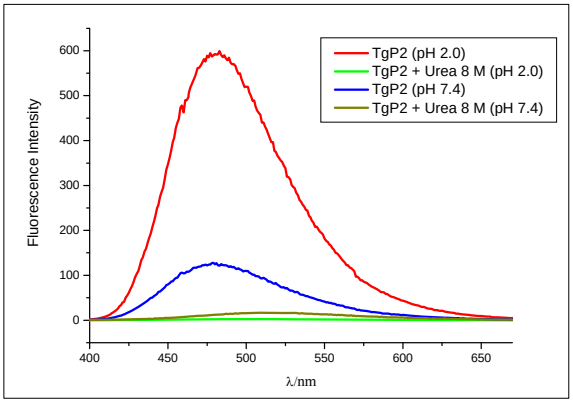


Figure 2: Binding of 200×10^{-3} mM ANS to 20×10^{-3} mM TgP2 at pH 2.0 and 7.4 in absence and presence of 8 M urea.

Spectroscopic and calorimetric studies of mechanism of aggregation of bovine pancreatic insulin and its prevention in presence of osmolytes: Biophysical approach

Understanding the mechanism of protein aggregation and its prevention is the basis of therapeutic strategies for amyloidosis. A combination of calorimetry, spectroscopy and microscopy has been used to understand the nature of interactions of osmolytes trehalose, citrulline, proline, sorbitol and betaine with the protein at different stages of the fibrilization of bovine pancreatic insulin. Based on ThT fluorescence emission intensities and microscopic images, the nucleation, elongation, and saturation phases of the fibrilization have been identified.

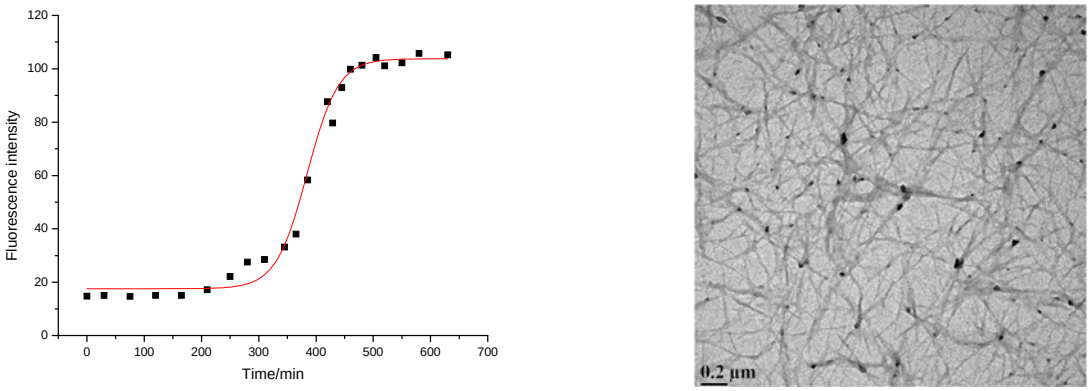


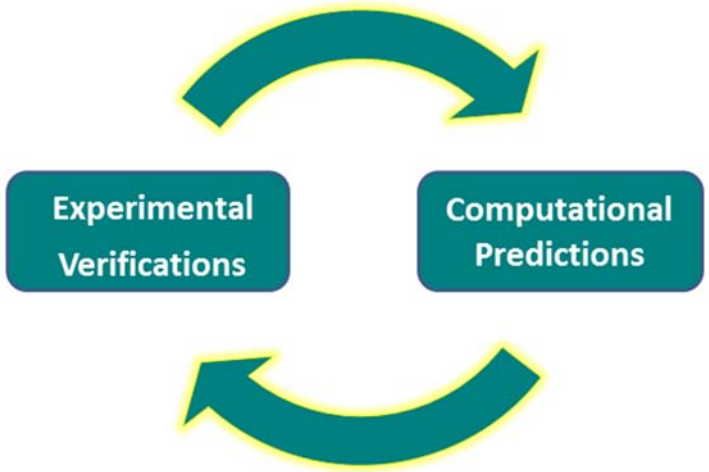
Figure 3: Thioflavin T binding assay and transmission electron microscopy shows the formation of insulin fibrils.

Isothermal titration calorimetry and differential scanning calorimetry permit a quantitative understanding of the nature of interactions of these osmolytes with various conformational states of insulin at different stages of fibrilization/aggregation based on heat of interactions. This work is completed and manuscript is under preparation.

Mahendra Patil

His research work in the field of chemical catalysis combines elements of computational chemistry and organic synthesis to device new catalytic strategies for organic conversions. Detailed mechanistic investigations of reactions play a crucial role in method development for the organic conversions. His group employs a suite of computational approaches to investigate the mechanism of catalytic conversions and to identify the factors which control the selectivity of the reaction. Insight

obtained through computational investigations is used to develop new synthetic methodologies with the particular emphasis on creating novel concepts in catalysis.



Key research areas: Chemical Catalysis: Organocatalysis, Transition metal catalysis

The major focus of my research program is to understand the mechanism and reactivity of organic reactions using computational and experimental tools with a specific emphasis on asymmetric conversions. Asymmetric catalysis represents a highly dynamic area in organic chemistry. The field of asymmetric catalysis has played a crucial role in producing enantiomerically pure compounds for pharmaceutical, agrochemical, and industrial applications. Despite significant advances in asymmetric catalysis, the development of new catalytic systems for the asymmetric transformations has always remained a challenging objective to the organic chemists. Notably, current practices in the catalyst discovery often rely on the expensive and serendipitous optimization of reaction conditions. Application of computational approaches for the discovery of new catalysts can be useful in reducing experimental efforts in environment-benign manner. The mechanistic and structural insights provided by computational investigations may help in rational designing of catalyst prior to experimental endeavors. Ultimate goal of his research is to develop new catalysts or catalytic strategies for the organic reactions using combinations of computational and experimental approaches.

Manish Patil

Nano-materials: Ferromagnetic transition metal oxides, catalysis,optics.
Thin Film Nanostructures: Pulsed Electron Deposition technique.
Nanocatalysis: metal or transition metal oxides (Cu, CuO, Ferrites)
New research efforts on Micro/Nanostructures of anthracene derivatives.

The main steps of the research program involve

1) The development of new methodologies for the preparation of well defined nanoparticles.
2) Reactivity studies as a function of size, morphology and chemical environment.
3) The development and application of new theoretical methods for understanding and predicting the structure and reactivity of metal containing nanoparticles.
4) Methods of characterization : XRD, SEM, UV, FT-IR, TEM

Rectangular shape micro plates Nanowires

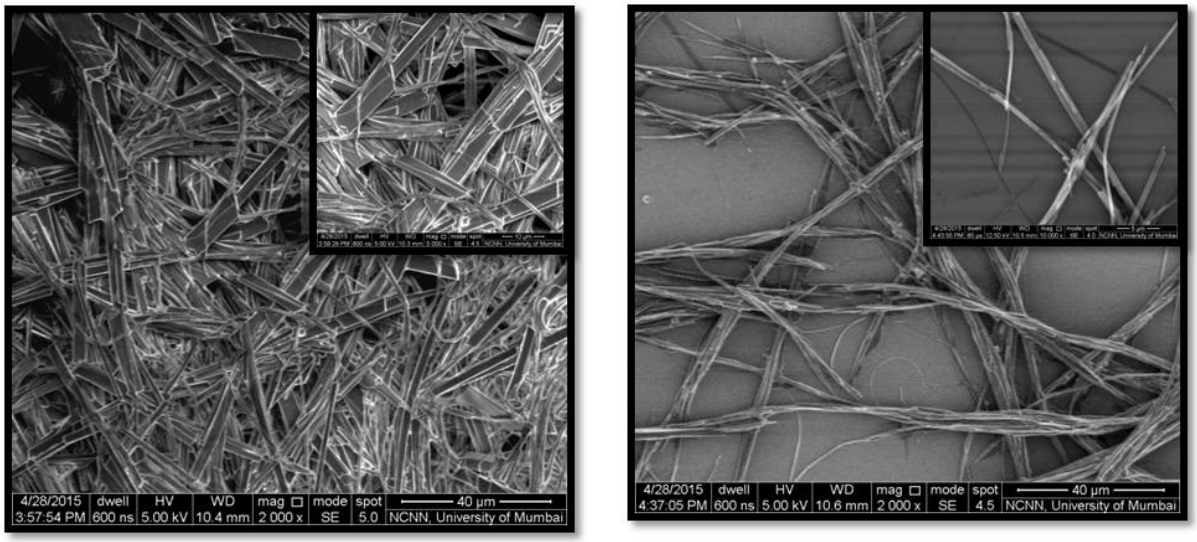


Figure: SEM images of different morphologies of anthracene derivative.

7.3 Research Activities in Department of Biology

Jacinta D'Souza

Identification, Isolation and Characterization of Multiprotein complexes in the green chlorophyte, Chlamydomonas reinhardtii

Considered as cellular workhorses, proteins participate in almost every process within cells, rarely act alone and interact with each other for carrying out the diverse cellular functions. These interactions are at the core of the entire interactomics system of any living cell and so, unsurprisingly, aberrant interactions are the basis of multiple diseases, such as Alzheimer's, ciliopathies, cancer, etc. Broadly classified as stable and transient, the former invariably is a structural part of the cell; while, the latter assemble and disassemble with the cellular need. They use the unicellular, biflagellated, green alga, *Chlamydomonas reinhardtii* as a model organism to identify, isolate and characterize protein complexes involved in ciliary diseases and stress physiology.

For identifying stable complexes, they have selected the conserved '9+2' flagella of this organism that comprises of microtubular filaments, central pair, radial spokes, dynein motors, matrix proteins, Flagellar Associated Proteins (FAPs) and interconnections joining these sub-structures. Several flagellar mutants have contributed towards understanding flagellar formation and function; however, the molecular mechanism of motility remains elusive. With second messengers such as Ca^{2+} and cAMP that regulate motility, the spatial organization of effector signaling proteins such as cAMP-dependent protein kinase (PKA), which respond to these messengers becomes critical. A-kinase anchoring proteins (AKAPs) are known to *in vitro* interact with the RIIa domain in the PKA holoenzyme. However, AKAP97 in *Chlamydomonas* flagellar radial spoke (RS) actually binds to proteins that have no commonality with PKA other than a RIIa-like domain. We found a *Chlamydomonas* Flagellar Associated Protein (FAP) 174 orthologous to MYCBP-1, a protein that binds to AKAPs and Myc onco-protein. FAP174 localizes to the nucleus, flagella, transition zone, basal bodies; and, binds AKAP240 previously identified in the C2 portion of the central pair (CP) apparatus that operates with RS to control dynein-driven flagellar beating. Flagellar extract containing FAP174 co-purified AKAP240 and novel proteins in the C1b and C2b projections. AKAP240 is orthologous to CCDC108 required for avian sperm motility; is homologous to hydin, a molecule in the C2b projection that causes hydrocephaly. They postulate that FAP174 binds to flagellar AKAP240 to form a novel complex that physically couple two major CP projections. This study sheds new light on MYCBP-1, the CP and the common principle in

assembly of the motility control center and PKA anchoring (VG Rao, R Sarafdar, T Chowdhary, P Sivadas, P Yang, JS D'Souza). Characteristic of all RIIa proteins, *in silico* analyses revealed helix-loop-helix in the N-terminus. Using several techniques, t showed that FAP174 exists as a heterogeneous mixture of monomer, dimer, hexamer or higher aggregates. The reducing conditions with DTT provided a clue for the dimerization *via* cysteine disulphide bridges; mutation of which (C46A) led to monomer formation. Two stretches of VLV (21st and 24th positions) revealed a role in inhibition of monomer. The Dimerization Docking domain is now being mapped (VG Rao, Y Ashtkar, E Martis, EC Coutinho, S Chidangil, JS D'Souza).

For identification of transient protein complexes, a stress-induced physiological model was established. *Chlamydomonas reinhardtii* is free-living under favorable conditions; but, when exposed to stress agents, either dies or forms multicellular 'palmelloids'; the latter accumulates lipids, starch and extracellular polysaccharides (DK Khona, S Shirolikar, M Deodhar, E Hom and JS D'Souza). Palmelloids are formed at lower NaCl concentrations; while concentrations >200 mM necrose the cells. On the other hand, oxidative stress agents (H_2O_2 and Menadione) induce a caspase-dependent PCD (Sirisha *et al*, 2014; 2015) and, those exposed to KCl reported a mitochondrion-mediated, caspase-independent PCD. Interestingly, exposure to osmotic stress conditions (Sorbitol) did not apoptose nor necrose the cells (VL Sirisha, K Gawde, S Shirolikar, JS D'Souza). Meanwhile, *in silico* analyses showed that *C. reinhardtii* genome harbours several molecular players akin to those involved in metazoan apoptosis (Kasuba *et al*, 2015). Of these, two metacaspases (CrMCI and CrMCII) were compared with the conventional caspases; and, CrMCII showed features similar to those of the mammalian caspase-3 protein. The CrMCII gene was therefore isolated, cloned and the protein molecular complex is being identified (CK Kasuba and JS D'Souza).

They have used novel methods of producing Silver and Gold nanoparticles. Monodispersity has always been one of the major concerns in their synthesis. We have synthesized Au and Ag nanoparticles using tryptone as the biomaterial. Characterization using standard spectroscopic methods (UV-Visible spectroscopy, FTIR), microscopy (SEM) and biophysical techniques (DLS and zeta potential); have shown that spherical (~10 nm diameter) highly monodispersed particles were synthesized. The FTIR study confirmed that the particles were capped with peptides and protein. We are now using these nanoparticles for several applications. (Saurabh Mehta, JS D'Souza and Muthurajan Harries).

Subhojit Sen

Epigenetics of Behaviour and Diseases, funded by Ramalingaswami Fellowship & CEBS

Histone proteins wrap ~147bp of DNA to form the basic unit of chromatin, a nucleosome, which in turn dictates accessibility that regulates heritable gene expression, the fundamental crux of 'Epigenetics'. Our hypothesis is aimed at understanding how histone modifications and DNA methylation interplay with each other to package the genome which in turn drives epigenetic diseases such as cancer, more so, how epigenetics is modulated by environmental influences that predispose us. In lieu, we have developed a phenotype based epigenetic assay in *Chlamydomonas reinhardtii*, a unicellular algal model system, to test environmental influences on epigenetic modulations, including CpG DNA methylation. The "Epigenetic Assay" developed by Snehal Kaginkar involves semi-quantitative scoring of an epigenetic phenotype by using a spot-dilution based assay, wherein we were able to assay for different insertional clones (fig 1) for differential responses to the DNA demethylation drug deoxyazacytidine (Decitabine, DAC, a DNA methyltransferase inhibitor). Further developing on this assay in different formats with a

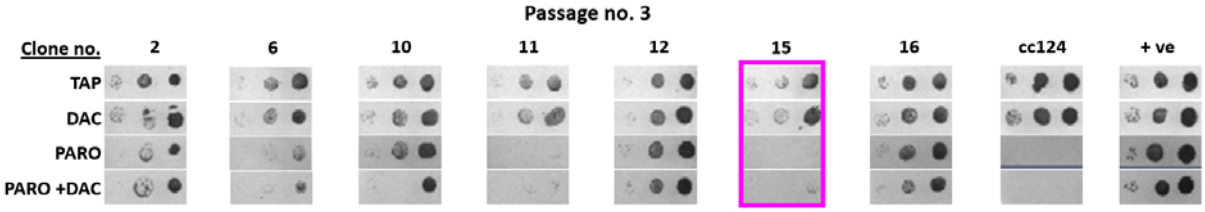


Fig 1: Spot assay for scoring the Epigenetic Phenotype – a comparison of the two controls TAP and DAC against the same populations grown on test plates Paro and Paro+DAC. Clone 6, 10 and 15 are responsive.

collection of other plant derived and known epigenetically active inorganic compounds, we have conclusively observed a correlation between DNA methylation and epigenetic phenotypes in *Chlamydomonas*. Interestingly, by characterizing a battery of epigenetically responsive clones Upnishad Sharma and John James were able to elucidate differential modes of action for the plant derived compounds by developing a gradient plate technique (fig 2).

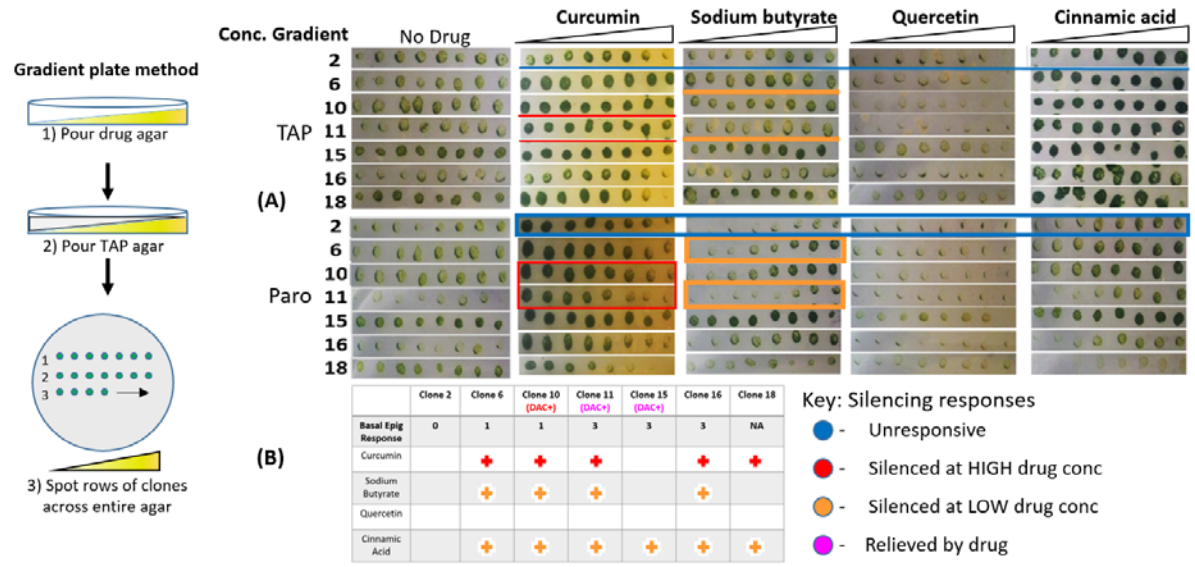


Fig 2: Gradient plate assay to test epigenetic responses of clones against different drugs

Chlamydomonas being an epigenetically naïve system lacks standardized nucleosome mapping technologies. Nicole D'Souza and Pooja Potdar have developed novel molecular epigenetic assays to generate nucleosome ladders. Using a quick and cost-effective controlled exposure to nuclei, have exploited both, an endogenous nuclease as well as micrococcal nuclease (MNase) to create polynucleosomal ladders (fig 3). These will not only help us develop PCR based epigenetic maps for candidate genes but map the whole epigenome as well.

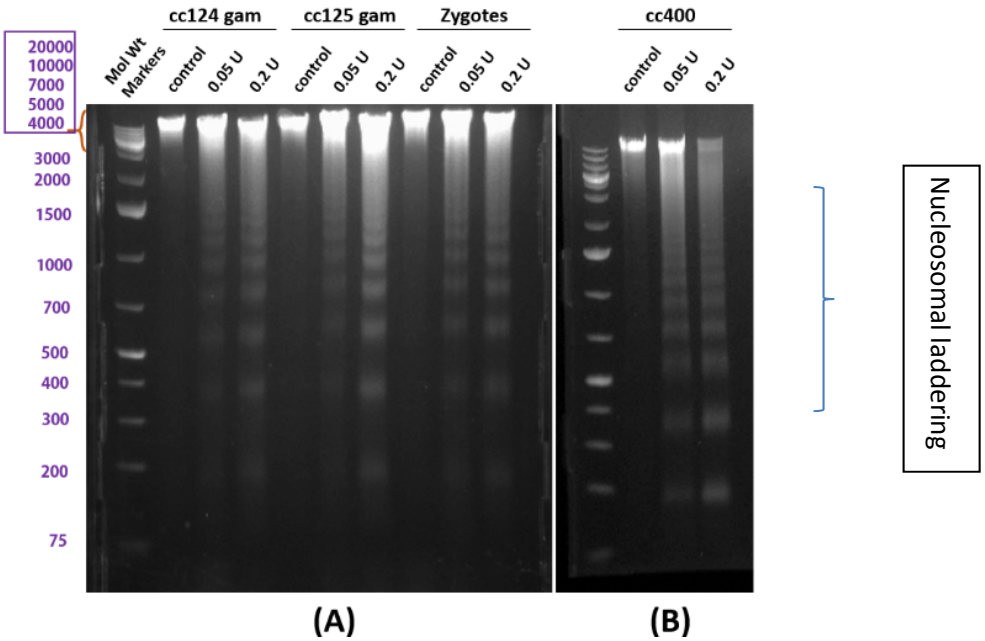


Figure 3: A quick-method using MNase to generate nucleosomal laddering patterns obtained in both cell wall plus (A) and cell wall minus (B) strains of Chlamydomonas.

Using both phenotypic and molecular assays to shuttle back and forth between the algal and mammalian model systems we propose to initiate discovery screens of epigenetically active compounds from indigenous plant based resources to not only increase the future repertoire of prognostic and treatment modalities, but also enhance our basic understanding of epigenetic pathways of gene expression.

Manu Lopus

Experimental Cancer Therapeutics and Chemical Biology Laboratory

Dr. Lopus's lab works on three key areas of cancer research, namely, development of potential anticancer drug molecules that do not induce neurotoxicity, molecular mechanisms and signaling pathways of cancer metastasis, and tubulin isotype-mediated drug resistance.

Project 1: Development of potential anticancer drug molecules that do not induce neurotoxicity

They have recently identified a potential anticancer drug molecule called beta sitosterol. Beta sitosterol, a phytosterol present in abundance in pomegranate, corn oil, avocado, and almonds, has been known for its health benefits and potential clinical uses. ß-SITO is orally bioavailable, and, as a constituent of edible natural products, devoid of undesired side effects. It has also been considered as a potent anticancer agent. However, the molecular mechanism of action of ß-SITO as a tubulin-binding anticancer agent and information on its biding site on tubulin remain poorly understood. Using a combination of biochemical analyses and molecular modeling, they investigated the molecular mechanism of action and potential binding site of this phytosterol. A polymer mass assay comparing the effect of ß-SITO with that of taxol and vinblastine on tubulin assembly in vitro, showed that the compound stabilized microtubule assembly. The compound perturbed the structural integrity of tubulin as evidenced by an 8-anilino-1-naphthalenesulfonic acid assay. Although ß-SITO did not show direct binding to the colchicine site on tubulin, it stabilized colchicine binding. Interestingly, as inferred from a DTNB assay, no sulfhydryl groups of tubulin were involved in the binding interaction of ß SITO with tubulin. Based on the insights from these biochemical assays, they modeled the binding interactions of ß SITO with tubulin. Using molecular docking followed by molecular dynamic simulation, it was found that ß SITO binds tubulin at a unique and novel site (named, "SITO-site") adjacent to colchicine and noscapine site. The data suggest that ß sitosterol is a potent anticancer compound that

interferes with microtubule assembly dynamics by binding to a novel site on tubulin. The paper was published in *European Journal of Pharmacology*. Their subsequent research on this compound indicated that it does not induce severe neurotoxicity. The lab currently focuses on a comprehensive preclinical pharmacological study of beta sitosterol as a potent drug against metastatic tumors using advanced cellular techniques such as three dimensional invasion assay, cell impedance analysis, in-cell western, etc.

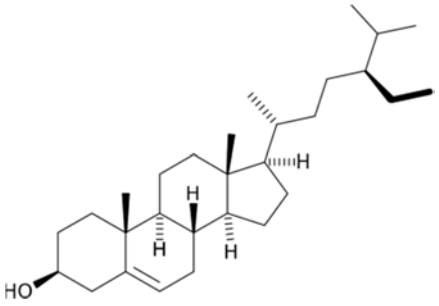
Project 2: Molecular mechanisms and signaling pathways of cancer metastasis

Another focus area of the lab is cancer metastasis. Metastasis (spreading of the cancer to different parts of the body) is the primary cause of mortality in cancer. Benign tumours are easy to treat, whereas once the cancer spreads, treatment becomes difficult. If the conversion of cells from the epithelial to mesenchymal phenotype can be prevented using therapeutics, metastasis could be prevented. The lab works on understanding the intricate pathways that convert epithelial (stationary type) cells to mesenchymal (highly mobile type) cells. Preliminary experiments have been started in this project which utilizes western blotting and SiRNA-mediated silencing of different target proteins to elucidate the pathways.

Project 3: Tubulin isotype-mediated drug resistance

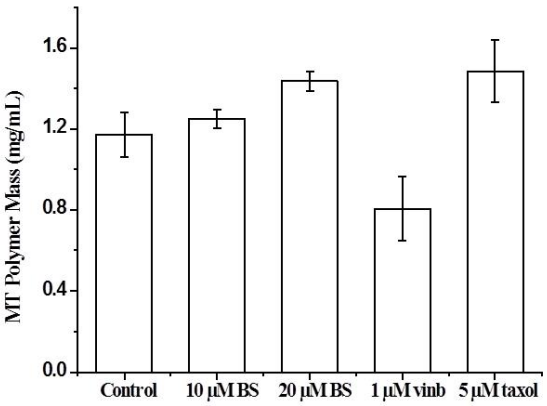
The third area of research involves studies aimed at understanding the mechanisms of tubulin isotype-mediated drug resistance. Here the lab investigates the protein-partners that assist tubulin isotypes in facilitating drug resistance. Their research in this area has also identified a potent molecule called Vin-Phe noscapine that preferentially binds to beta III isotype of tubulin, the isotype implicated in drug-resistance. Biophysical, cytological, and biochemical techniques have been employed to further understand potential clinical utility of this molecule.

Biochemical characterization of beta SITO as a tubulin-binding agent

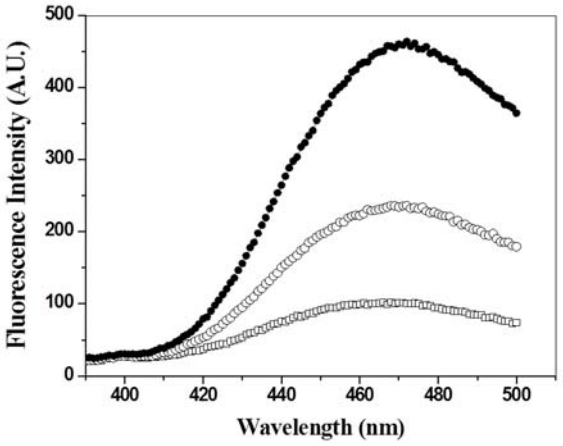


β-sitosterol ((3S,8S,9S,10R,13R,14S,17R)-17-[(2R,5R)-5-ethyl-6-methylheptan-2-yl]-10,13-dimethyl-2,3,4,7,8,9,11,12,14,15,16,17-dodecahydro-1H cyclopenta[a]phenanthren-3-ol)

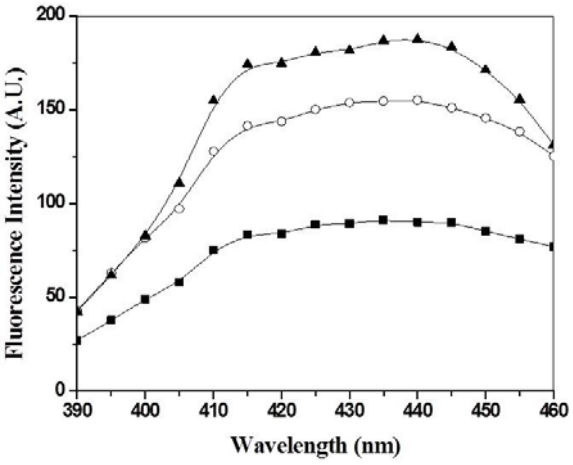
1.Beta SITO stabilized microtubules. Tubulin (15 μM) was assembled without or with β-SITO, vinblastine, or taxol, and the assembled polymers sedimented. Concentration of the polymers was determined using a Bradford assay. β-SITO enhanced the quantity of sedimented polymers, indicating potential stabilization of microtubule assembly. The experiment was repeated twice. Data represent mean ± SD.



2. **Direct binding of beta SITO to tubulin as evidenced by increased ANS fluorescence in beta SITO-treated tubulin**. Tubulin (2 μM) was incubated without (open squares) or with 30 μM (open circles), or 50 μM (solid circles) β-SITO, followed by another incubation with ANS (50 μM). The samples were excited at 380 nm and the emission spectra collected (390 nm – 500 nm). β-SITO showed a concentration-dependent increase in tubulin-ANS fluorescence, indicating its binding to tubulin. The graph is a representative of three independent experiments.



3. **Stabilization of colchicine binding to tubulin by β-SITO**. Tubulin (3 μM) was incubated without (solid squares), or with 30 μM (open circles) or 50 μM (sold triangles) β-SITO. Subsequently, the samples were incubated with colchicine (10 μM). Following the incubation, the samples were excited at 360 nm, and the emission spectra recorded (390 nm – 460 nm). β-SITO increased the tubulin-colchicine fluorescence, indicating the stabilization of colchicine binding to tubulin. The graph is a representative of three independent experiments.

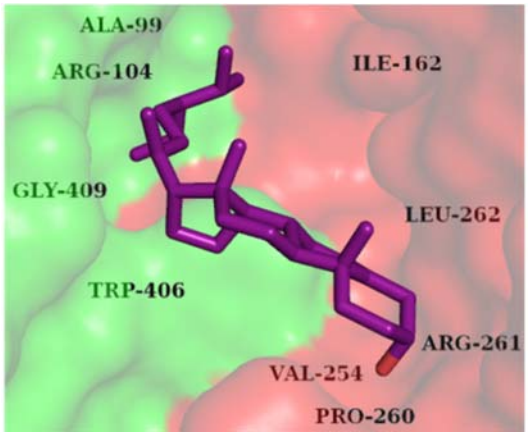


*4. β-**SITO – tubulin interaction does not involve sulfhydryl groups of tubulin.***

β-SITO (μM)	Number of Cys residues
0	15 ± 1
50	16 ± 1
75	17 ± 0.7

Tubulin (3 μM) was incubated with different concentrations of β-SITO (0 μM - 75 μM) followed by an incubation with DTNB (200 μM). Absorbance at 412 nm was measured at 0 min and after the 45 min of incubation. β-SITO did not modify cysteine residues of tubulin as indicated by a lack of reduction in the number of cysteine residues in the presence of different concentrations of β-SITO. Data represents mean ± SD of three independent experiments.

5. **Molecular docking and molecular dynamic simulations indicate presence of a novel binding site for beta SITO on tubulin**.



Three-dimensional representation of β-SITO-tubulin interaction. Only the residues that contribute binding free energy less than -0.5 kcal/mol are shown.

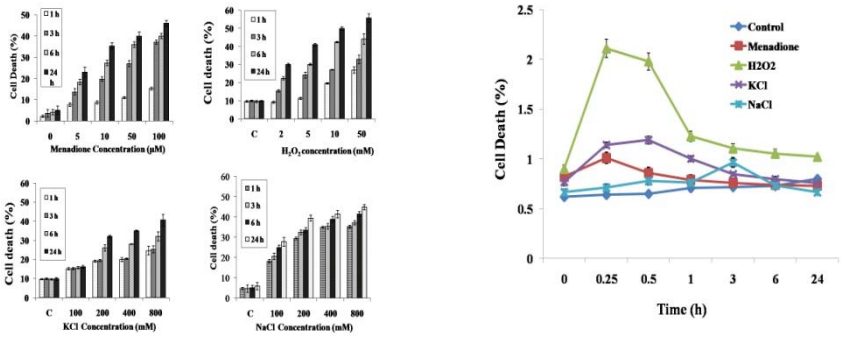
V. L. Sirisha

Environmental stresses are known to induce production of reactive oxygen species in cellular compartments thereby resulting in oxidative damage and apoptotic-like cell death. The study of cell death in higher plants and animals has revealed the existence of an active ('programmed') suicidal process and similarities in this machinery between plants and animals suggest an evolutionarily ancient origin. Genetic, molecular and biochemical approaches have begun to reveal interesting candidate regulators in plants that show both similar and new properties compared with their animal counterparts. In recent years, it has also been convincingly shown that a number of unicellular organisms possess the ability to undergo programmed death. In particular, the unicellular algal cells *Chlamydomonas reinhardtii and Dunaliella tertiolecta* die in a PCD-like manner in response to exposure to various stress agonists. Until date, there are two related issues that remain elusive in these

unicellular organisms are the key molecular players involved in the process and the precise physiological role of this cellular mechanism. A detailed study of PCD in unicellular photosynthetic organisms will likely provide important insight into intracellular and molecular cell death pathways which in multicellular organisms and tissues are difficult to investigate. In this present study, we investigate whether the unicellular green alga *Chlamydomonas reinhardtii* is capable of executing a programmed cell death (PCD) -like mechanism upon exposure to oxidative (5 μM menadione and 10 mM H_2O_2) and osmotic (200 mM KCl, 200 mM NaCl and 200 mM sorbitol) stress agents.

These stress agents caused a decreased cell survival (56 % and 48% for oxidative stress and 42% for osmotic stress) and biochemical analysis showed that oxidative stress caused a 2 fold increase in Reactive oxygen species production, while osmotic stress showed 1.5 fold increase. Some hallmarks of apoptosis like DNA fragmentation detected by the terminal deoxynucleotidyl transferase-mediated dUTP nick end-labeling (TUNEL) assay and oligonucleosomal DNA laddering assay was observed within 6 h for oxidative stress while it was observed at 24 h for osmotic stress. DNA laddering during these oxidative and osmotic stresses could be prevented by addition of Zn^{2+}. Moreover, alteration of mitochondrial membrane potential, increased Caspase-3-like activity, PARP-1 like cleavage was detected after menadione and H_2O_2, While with KCl and NaCl no significant caspase activity was observed. However, KCl stress induced the release of AIF inducing a caspase-independent PCD. These results clearly elucidated that different stress regimes induces different cell death paradigms in the same organism.

Abiotic stress induced programmed cell death in Chlamydomonas reinhardtii



Publications

8. Publications

1. **H.C. Pradhan**, Shirish Pathare, Saurabhee Huli, Madhura Nachane and Savita Ladage
   "Understanding thermal equilibrium through activities"
   Physics Education (UK),50(2),2015,p.146-158

2. **S. Kailas** and K. Mahata Pramana. J.
   "Charged particle induced nuclear fission reactions - progress and prospects"
   Physics 83,851 (2014) invited review article

3. A. Parihari**, S.Kailas** et al
   "Fission fragment angular distributions in 6,7Li +235,238U reactions"
   Phys. Rev. C90,014603 (2014)

4. S . Santra, **S. Kailas** et al
   "Effect of projectile breakup on fission fragment mass distributions in the 6,7Li + 238 U reactions"
   Phys. Rev. C 90, 064620 (2014)

5. J.P.Nair, **S. Kailas** et al
   "Track etched membranes in separation sciences from BARC-TIFR pelletron accelerator"
   Radio analytical and nuclear chemistry 302, 947 (2014)

6. **S. K. Tandel**
   "K isomers as probes of nuclear structure"
   American Institute of Physics Conf. Proc. 1609, 157 (2014)

7. S. Mukhopadhyay, D. C. Biswas, **S. K. Tandel,** L. S. Danu, B. N. Joshi, G. K. Prajapati, Somnath Nag, T. Trivedi, S. Saha, J. Sethi, R. Palit, P. K. Joshi
   "Coexisting shape- and high-K isomers in the shape transitional nucleus ^{188}Pt"
   Physics Letters B 739, 462 (2014)

8. S. S. Hota, P. Chowdhury, T. L. Khoo, M. P. Carpenter, R. V. F. Janssens, Y. Qiu, I. Ahmad, J. P. Greene, **S. K. Tandel,** D. Seweryniak, S. Zhu, P. F. Bertone, C. J. Chiara, A. Y. Deo, N. D'Olympia, S. Gros, C. J. Guess, T. Harrington, D. J. Hartley, G. Henning, C. R. Hoffman, E. G. Jackson, F. G.

Kondev, S. Lakshmi, T. Lauritsen, C. J. Lister, E. A. McCutchan, K. Moran, C. Nair, D. Peterson, U. Shirwadkar, I. Stefanescu
"N = 151 Pu, Cm, and Cf nuclei under rotational stress: Role of higher-order deformations"
Physics Letters B 739, 13 (2014)

9. J. T. Matta, U. Garg, W. Li, S. Frauendorf, A. D. Ayangeakaa, D. Patel, K. W. Schlax, R. Palit, S. Saha, J. Sethi, T. Trivedi, S. S. Ghugre, R. Raut, A. K. Sinha, R. V. F. Janssens, S. Zhu, M. P. Carpenter, T. Lauritsen, D. Seweryniak, C. J. Chiara, F. G. Kondev, D. J. Hartley, C. M. Petrache, S. Mukhopadhyay, D. Vijaya Lakshmi, M. Kumar Raju, P. V. Madhusudhana Rao, **S. K. Tandel**, S. Ray, F. Donau
"Transverse wobbling in ^{135}Pr"
Physical Review Letters 114, 082501 (2015)

10. Deepika Choudhury, R. Palit, P. Singh, J. Sethi, S. Saha, S. Biswas, H. C. Jain, V. Nanal, R. G. Pillay, R. Donthi, S.K. Jadhav, B.S. Naidu, B. Maheshwari, A. K. Jain, S. C. Pancholi, R. P. Singh, S. Mukhopadhyay, D. C. Biswas, L. S. Danu, **S. K. Tandel**, L. Chaturvedi, K. Rojeeta Devi, Sukhjeet Singh,
"Role of neutrons in the coexistence of magnetic and antimagnetic rotation bands in ^{107}Cd"
Physical Review C 91, 014318 (2015)

11. Joydeep Bagchi, M. Vivek, Vinu Vikram, **Ananda Hota,** et al.
"Megaparsec Relativistic Jets Launched from an Accreting Supermassive Black Hole in an Extreme Spiral Galaxy"
The Astrophysical Journal, Volume 788, Issue 2, article id. 174, 18 pp. (2014)

12. **M. Hemalatha**
"Elastic scattering of the halo nucleus ^{11}Be on ^{64}Zn,"
European Physical Journal, 66 (2014).

13. **M. Hemalatha**
"Double folding model analysis of elastic scattering of halo nucleus ^{11}Be from ^{64}Zn around Coulomb barrier"
Pramana, 82 (2014) 789.

14. **B. L. Khubchandani**
"Implications of Raman scattering and phase noise on multiple four-wave mixing processes in an optical fiber"

Optics Letters, 39, 4859 (2014)

15. A Puthucode, A Devaraj, S Nag, **S Bose**, P Ayyub, MJ Kaufman, R Banerjee
"De-vitrification of nanoscale phase-separated amorphous thin films in the immiscible copper–niobium system"
Philosophical Magazine, 94 (15), 1622 (2014)

16. **Sangita Bose**, Pushan Ayyub
"A review of finite size effects in quasi-zero dimensional superconductors"
Reports on Progress in Physics, 77 (11), 116503 (2014)

17. S Kumar, C Kumar, J Jesudasan, V Bagwe, P Parab, P Raychaudhuri, **S Bose**
"Origin of matching effect in anti-dot array of superconducting NbN thin films"
Superconductor Science and Technology 28 (5), 055007 (2015)

18. Shikha Misra, Sanjay K. Mishra, **P. Brijesh**,
"Coaxial propagation of Laguerre-Gaussian and Gaussian Beams in a Plasma"
Laser and Particle Beams, 33, p123–133, (2015)

19. P. K. Singh, G. Chatterjee, A. Adak, A. D. Lad, **P. Brijesh** and G. Ravindra Kumar,
"Ultrafast optics of sold-density plasma using multicolor probes"
Optics Express, 22, 19, p22320 (2014)

20. A. Adak, D. Blackman, G. Chatterjee, P. K. Singh, A. D. Lad, **P. Brijesh**, A. P. L. Robinson, J. Pasley and G. Ravindra Kumar
"Ultrafast dynamics of a near-solid density layer in an intense femtosecond laser-excited plasma"
Phys. Plasmas 21, 062704 (2014)

21. Anjan Kundu and **Tapan Naskar**
"Arbitrary bending of optical solitonic beam regulated by boundary excitations in a doped resonant medium"
Physica D: Nonlinear Phenomena, Volume 276, May 15, 2014

22. **Manojendu Choudhury,** Nilay Bhatt and Subir Bhattacharyya
"QPO states of 4U 1630-47",
Monthly Notices of Royal Astronomical Society 2015, Vol, 447

23. **Manojendu Choudhury, ,**
"Black hole and the Scientific Process"

Planex Newsletter 2015, Vol. 5, Issue 1, Pages 15-20.

24. F G Desforges, **B. S. Paradkar**, M Hansson, J Ju, L Senje, TL Audet, A Persson, S Dobosz-Dufrénoy, O Lundh, G Maynard, P Monot, J-L Vay, C-G Wahlström, B Cros,
"Dynamics of ionization-induced electron injection in the high density regime of laser wakefield acceleration",
Physics of Plasmas (Letter) ***21****, 120703 (2014)*

25. **B. S. Paradkar**, NE Andreev, B Cros, VE Baranov, P Mora, G Maynard,
"A comparative study of plasma channels for a 100 GeV electron accelerator using a multi-petawatt laser"
Plasma Physics and Controlled Fusion ***56 (8)****, 084008 (2014)*

26. J Ju, G Genoud, HE Ferrari, O Dadoun, **B Paradkar**, K Svensson, F Wojda, M Burza, A Persson, O Lundh, NE Andreev, C-G Wahlström, B Cros,
"Analysis of x-ray emission and electron dynamics in a capillary-guided laser wakefield accelerator"
Physical Review Special Topics-Accelerators and Beams ***17(5)****, 051302 (2014)*

27. Pushpa Mishra, Shobona Sharma and **Ramakrishna V. Hosur**
"Residue level description of In-vivo-self-association of *Plasmodium falciparum* P2"
J Biomol. Struct. Dyn. 32, 602-612 (2014)

28. **Mohanish Borana**, Pushpa Mishra, Raghuvir R. S. Pissurlenkar, **R. V. Hosur** and **Basir Ahmad**
"Curcumin and Kaempferol Prevent Lysozyme Fibril Formation by Modulating Aggregation Kinetic Parameters"
BBA –Proteins and Proteomics, 1844(3):670-80 (2014)

29. Jithender G. Reddy and **Ramakrishna V. Hosur**
"Complete Backbone and DENQ Side chain NMR Assignments in Proteins from a Single Experiment: Implications to Structure - Function studies"
J. Struct. Funct. Genom. 15(1):25-32 (2014)

30. Jithender G. Reddy, Dinesh Kumar and **Ramakrishna V. Hosur**
"Novel (3,2)D- reduced dimensionality experiments and their automated analysis: Implications to high-throughput structural studies on proteins"
Magn. Reson. Chem., 53(2):79-87 (2015)

31. Jithender G. Reddy and **Ramakrishna V. Hosur**
"A reduced dimensionality NMR pulse sequence and an efficient protocol for unambiguous assignment in intrinsically disordered proteins"
J. Biomol. NMR, 59, 199-210 (2014)

32. Pushpa Mishra, Sudarshan Rajgopal, Shobhona Sharma, **Ramakrishna V. Hosur**
"The C-terminal Domain of Eukaryotic Acidic Ribosomal P2 Protein is Intrinsically Disordered with conserved Structural Propensities"
Protein and Peptide Letters, 22, 212-218 (2015)

33. **Sonali M. Shiriskar, Neeraj Agarwal,** Raghuvir R. S. Pissurlenkar and **Basir Ahmad**
"Effects of 2-amino-8-hydroxyquinoline interaction on the conformation of physiological isomers of human serum albumin"
Eur Biophys J., DOI 0.1007/s00249-015-1014-0

34. **Dipti Lakhe, Karthika K. Jairaj, Madhura Pradhan, Uma Ladiwala** and **Neeraj Agarwal**
"Synthesis and photophysical studies of heteroaryl substituted-BODIPy derivatives for biological applications"
Tetrahedron Letters, 2014, 55, 7124-7129.

35. **Nivin Mothi, Shivani A. Muthu, Mohanish S. Borana** and **Basir Ahmad**
"The Molecular Mechanism of Inhibition and Acceleration of Protein Aggregation"
BioWorld-2014, Protein Structure and Function, IIT Delhi, 12th-14th December 2014

36. **Nivin Mothi, Basir Ahmad**
"A Mechanistic Model for Amorphous Protein Aggregation and its Prevention"
National Symposium on Biophysics & Golden Jubilee Meeting of Indian Biophysical Society, JMI, New Delhi, 14th-17th February 2015

37. Pushpa Mishra, **Sinjan Choudhary**, Sujoy Mukherjee, Disha Sengupta, Shobhona Sharma, **R.V. Hosur**,
"Molten globule nature of Plasmodium falciparum P2 homo-tetramer"
Biochemistry and Biophysics Reports1 (2015) 97-107.

38. Pushpa Mishra, **Sinjan Choudhary, Ramakrishna V. Hosur**
"Ribosomal Protein P2 from apicomplexan parasite, Toxoplasma gondii is intrinsically a molten globule"

Biophysical Chem. 200-201 (2015) 27-33

39. **V.L.Sirisha, Kanak K. Gawade, Mahuya Sinha and Jacinta D'Souza**
"Programmed cell death is induced by hydrogen peroxide but not by excessive ionic stress of sodium chloride in the unicellular green algae *Chlamydomonas reinhardtii*"
European Journal of Phycology 50 (4), 422-438

40. Ankita Jain, D. V. Rao, **V.L.Sirisha** and Amita Jain
"Preliminary secondary metabolite screening and GC-MS analysis of plant extracts of *Tridax procumbens*. "
International Journal of Applied, Natural and Social Sciences. 3(5): 9-26.

41. **V.L.Sirisha**, **Mahuya Sinha** and **Jacinta D'Souza**
"Menadione-induced caspase-dependetn programmed cell death in the green chlorophyte *Chlamydomonas reinhardtii*"
Journal of Phycology. 50: 587–601.

42. Amita Jain, Rashmi Ranade, Prem Pritam, Neelu Joshi, **Sirisha Lakshmi Vavilala**, Ankita Jain.
"A comparative study of antioxidant activity, total phenolic and flavanoid contents in different parts of *Helicteres isora*"
American Journal of Life Sciences. 2(5): 292-302.

43. Surekha Borkar, Assfhali Bankapur, **Madhura Pradhan,** Santosh Chidangil, Deepak Mathur, **Uma Ladiwala**
"Probing differentiation in cancel cel lines by Singal-Cell micro-Roman Spectroscopy"
Journal of Biomedical optics.

44. **Mahaddalkar T,** Suri C, Naik PK, and **Lopus M**
"Biochemical characterization and molecular dynamic simulation of β-sitosterol as a tubulin-binding anticancer agent"
Eur J Pharmacol. doi:10.1016/j.ejphar.2015.04.014

45. Mishra RC, Gundala SR, Karna P, **Lopus M**, Gupta KK, Nagaraju M, Hamelberg D, Tandon V, Panda D, Reid MD, and Aneja R
"Synthesis and biological evaluation of di-substituted noscapine analogs as potent and microtubule-targeted anticancer agents"
Bioorg Med Chem Lett. doi:10.1016/j.bmcl.2015.03.076

46. Santoshi S, Manchukonda NK, Suri C, Das SK, Hota SK, Joseph S, **Lopus M**, Kantevari S, and Naik PK
"Rational design of biphenyl pharmacophore substituted noscapine derivatives as potent tubulin binding anticancer compounds"
J Comput Aided Mol Des, 29, 249-70

47. **Lopus M** and Naik PK
"Taking aim at a dynamic target: Noscapinoids as microtubule-targeted cancer therapeutics"
Pharmacol Rep, 67, 56-62

48. Elvis A. F. Martis, Rakesh C. Chandarana, Mushtaque S. Shaikh, Premlata K. Ambre, Santosh R. Nandan, **Jacinta S. D'Souza**, Krishna R. Iyer, Evans C. Coutinho and Raghuvir R. S. Pissurlenkar
"Quantifying Ligand-Receptor Interactions for Gorge Spanning Acetylcholinesterase Inhibitors for the Treatment of Alzheimer's disease"
Journal of Biomolecular Structure and Dynamics 33: 1107-25.

49. Chakroborty S, **Mehta IS**, Kulashreshtha M and Rao BJ
"Quantitative analysis of chromosome localization in the nucleus"
Methods Mol Biol. 2015; 1228:223-33. doi: 10.1007/978-1-4939-1680-1_17

50. Bridger JM1, Arican-Gotkas HD, Foster HA, Godwin LS, Harvey A, Kill IR, Knight M, **Mehta IS**, Ahmed MH.
"The non-random repositioning of whole chromosomes and individual gene loci in interphase nuclei and its relevance in disease, infection, aging, and cancer"
Adv Exp Med Biol. 2014; 773:263-79. doi: 10.1007/978-1-4899-8032-8_12

51. Syed Rafi, **A. Bhagwat**, W. Haider and Y. K. Gambhir
"Nucleon Density Distributions in 9C"
Phys. Rev. C 89, 067601 (2014)

52. **A. Bhagwat**
"Simple Nuclear Mass Formula"
Phys. Rev. C 90, 064306 (2014)

53. J. P. Maharana, **A. Bhagwat** and Y. K. Gambhir,
"Microscopic Investigations of α Emitters Close to the N=Z Line"
Phys. Rev. C 91, 047301 (2015)

54. Kumari, D.; **Anjitha S. G.**; Pant, C. S.; **Patil M.**; Singh, H.; Banerjee, S.
"Synthetic approach to novel azido esters and their utility as energetic plasticizers"
RSC Adv. 2014, *4*, 39924

55. Yamajala, K. B. D.; **Patil M.**; Banerjee, S.
"Pd-catalyzed regioselective arylation on C-5 position of N-aryl 1,2,3-Triazoles"
J. Org. Chem. 2015, 80, 3003

56. Götze, J.; Karasulu B.; **Patil, M.** Thiel W.
"Vibrational relaxation as the driving force for wavelength conversion in the peridinin-chlorophyll a-protein"
BioChim. Biophys. Acta 2015, 12, 1509

Patent

Patent filed under the Patents Act 1970 (39 of 1970) & The Patents Rules, 2003 Provisional/Complete Specification (Section 10 and rule 13).
Title of Invention, 'Process for Synthesis of Nanoparticles using tryptone as a reducing agent'.
Authors of Invention, Mr. Saurabh Mehta**,** Dr. Muthurajan Harries & **Dr. D'Souza Jacinta Seraphina.**

Book Chapter

V. L. Sirisha and **Jacinta S. D'Souza** "Algal polysaccharides and their biological applications". **Invited chapter** for the book titled, 'Marine Algae Extracts: Processes, Products, and Applications". First Edition. Edited by Se-Kwon Kim and Katarzyna Chojnacka. © 2015 Wiley-VCH Verlag GmbH & Co. KGaA. Published 2015 by Wiley-VCH Verlag GmbH & Co. KGaA. Chapter 26, pages: 411-453.

H. C. Pradhan and V. D. Lale (Coordinating editors) *Kumar Vishwakosh – Jeevshastra and Paryavaran* (Junior Encyclopedia – Biology and Environment), Part II, December 2014 (Hard-bound edition), Maharashtra Rajya Vishwakosh Nirmitee Mandal.

Conferences, Invited talks and Lecture given outside CEBS

9. Conferences, Invited talks and Lecture given outside

R. V. Hosur

- Delivered lectures on "NMR Spectroscopy" at ICT- Mumbai, December 17-18, 2014.
- Attended the following conferences:
  - ICMRBS at Dallas, USA, August 19-23, 2014.
  - INDO-US workshop on Structural Biology at IIT-Roorkee, October 7-9, 2014.
  - Conference on Frontiers in Chemical and Material Sciences, Shivaji University, Kolhapur, January 16-17, 2015.
  - National Symposium on Molecular Medicine at JNU, New Delhi, February 13-14, 2015.
  - Indian Biophysical Society Meeting at Jamia Mila Islamia, New Delhi, February 14-17, 2015.
  - NMRS at Amritsar, March 6-9, 2015.
- Invited to give talk at the followings:
  - April 28, 2014: Pushing the Frontiers in Protein NMR, at ICGEB, New Delhi.
  - June 10, 2014: Surmounting speed, size and 'foldedness' barriers in Protein NMR, National Technological Institute, Singapore.
  - July 25, 2014: The Excitement in Science, Ruia College, Mumbai.
  - August 18, 2014: The Excitement in Science, at Dharwad.
  - September 12, 2014: The Excitement in Science, at Surat College.
  - October 8, 2014: Phase Cycling and Gradient enhanced NMR, Amritser.
  - October 8, 2014: Protein Structure, Dynamics, Folding And Function, Amritser.
  - September 26, 2014: The Plasmodium falciparum P2 story: NMR revelations, DCS, TIFR, Mumbai.
  - October 9, 2014: Evolution and Prospects of NMR based Structural Biology in India, INDO-US workshop on structural biology, IIT-Roorkee.
  - November 1, 2014: Pushing the NMR Frontiers, TIFR Founder's Day Lecture.
  - November 6, 2014: The Pleasure of Doing Science, SSPTM College, Vile Parle, Mumbai.
  - November 9, 2014: The Pleasure of Doing Science, KVPY workshop, IISc, Bangalore.
  - December 12, 2014: Pushing the Frontiers of Protein NMR, IIT New Delhi.
  - December 17-18, 2014: 4 lectures on 'NMR Spectroscopy' at ICT, Mumbai.
  - December 20, 2014: The Pleasure in Science, at 'Science outreach to Schools', Amaravati.
  - December 23, 2014: Pushing the Frontiers of Protein NMR, Mumbai University, Mumbai.

- December 28, 2014: The pleasure in Science, INSPIRE camp, Raipur.
- December 30, 2014: bio-Nano Materials Research by NMR, MU refresher course.
- January 5, 2015: Pushing the frontiers of Protein NMR, MU, Indian Science Congress 2015, New Biology Section.
- January 16, 2015: Insights into bio-molecular structure and function by NMR, Inaugural lecture at Conference on Frontiers in Chemical and Material Sciences, Shivaji University, Kolhapur.
- February 9, 2015; Inaugural lecture at NET-SET workshop at National college, Bandra.
- February 13, 2015; Lecture at JNU, National Symposium on Molecular Medicine.
- February 27, 2015; Nano Bio-Molecular Research by NMR, at Central Gujarat University, Gandhinagar.
- March 7, 2015; 'The Plasmodium falciparum P2 story', NMRS Symposium, Amritser.

S. M. Chitre

- Attended several lectures/meetings at the Institute of Astronomy, Cambridge May-June, 2015.

S. Kailas

- Invited to give talk at the followings:
  - Accelerator as a tool for science and technology, Refresher course at University of Mumbai.
  - Charged particle accelerators for science, technology and society, VECC, Kolkatta.
  - Atomic energy in national development, DST SERC school, Mumbai.
  - Atomic energy in national development, Rajiv Gandhi College, New Mumbai
  - Accelerator as a tool for science, technology and society, Foundations of Physics, Refresher course, IWSA, New Mumbai.
  - Atomic energy in national development, Foundations of Physics, Refresher course, IWSA, New Mumbai.
  - Nuclear data for science, technology and society, EXFOR nuclear data meeting, Bangalore University.
  - Summary talk of the conference on 75 years of nuclear fission-75 years of nuclear fission - perspectives and prospects.

- Following Meetings were organized:
  - Chairman, Basic Sciences Committee, BRNS.

- Chairman, Programme Review Committee, Nuclear Data Physics Centre of India.
- Organized the refresher course on Foundations of Physics at IWSA (along with Dr. L. J. Dhareshwar).

H. C. Pradhan

- Invited to give talks at the followings:
  - Introductory biostatistics, International Biology Olympiad Orientation-cum-Selection Camp 2014, June 8, 2014.
  - "Exciting Careers in Science", Workshop for National Science Talent Search Scholars, Nov 6, 2014.
  - "On the history of the concepts of inertia and gravity up to the scientific revolution", C.K.Mazumdar Summer School, Jointly organized by Indian Association of Physics Teachers and S.N. Bose institute of Physics, Kolkata, June 26, 2014.
  - "Axiomatic approach to thermodynamics", C.K.Mazumdar Summer School, Jointly organized by Indian Association of Physics Teachers and S.N. Bose institute of Physics, Kolkata, June 27, 2014.
  - "Relation between mathematics and physics", Workshop for post-graduate students in physics, IAPT Centre for Scientific Culture, Midnapore College, Midnapore, June 28, 2014.
  - "Mechanics of Rotational Motion", BASE Workshop for Physics Teachers, K.J. Somaiya College of Science, Mumbai, July 5, 2014.
  - "Science and mathematics education – Perspectives and prospects", Session on Challenges to Education in Modern India held at Nehru Centre, 102nd National Science Congress, University of Mumbai, Jan 6, 2015.
  - "Redefining quality in the context of higher education in India with focus on teaching and learning', Keynote address, Seminar on Quality Sustenance: Aspects and Initiatives, sponsored by National Assessment and Accreditation Council, Ramnarain Ruia College, Mumbai, Jan 10, 2015.
  - "History of the concept of gravity up to Newton", Students Seminar, Regional Institute of Education, NCERT, Bhopal, Feb 27, 2015.
  - "Students' alternative frameworks – Examples from physics", Inaugural Talk, National Science Day Seminar for Teachers (Western zone), Regional Institute of Education, NCERT, Bhopal, Feb 28, 2015.
- Popular Science Lectures:
  - "Opportunities for Research in Physics", Vocational Guidance Camp for Students, Joint Initiative of Daily Loksatta and Marathi Vidnyan Parishad, Chunabhatti, Mumbai, April 5, 2014 (in Marathi).

- *"What can we learn from Science Education in Israel?"* Address by the Chair, Seminar on Education in Israel, organized by the Consulate of Israel and Observer Research Foundation, Sathaye College, Parle, Mumbai, April 28, 2014.
- "Scientific temper" Keynote address, Intercollegiate Seminar on Scientific Temper, PVDT Polytechnic, Juhu, Mumbai, August 8, 2014.
- "Face to face with scientists", Question and answer session, National Children's Science Congress, Bengaluru, Dec 27, 2014.
- "Rise of the scientific method – Concept of gravity as an exemplar", National Science Day Seminar, Marathi Vidnyan Parishad, Thane, March 18, 2015 (in Marathi).

- Television and Radio Programmes:
  - A discussion on "*Kumar Vishwakosh*, in *Amrutvel*," A fortnightly programme (30 min) on new books (in Marathi), Sahyadri Vahini, Doordarshan, Mumbai, June 12, 2014 (with Vijaya Wad).
  - "Vidnyan–Tantradnyan ani Vikas", Mahacharcha, A live discussion programme (45 min) on current topics (in Marathi), Sahyadri Vahini, Doordarshan, Mumbai, Feb 19, 2015.
- Conferences attended and other relevant information:
  - Brain-storming Workshop for Preparation of Activity Guide for Projects at National Children's Science Congress 2014, organized by National Council for Science and Technology Communication, DST, Gov of India at Lycee' Francais, Pondicherry, May 1-4,2014.
  - Delivered Welcome and Valedictory addresses as President of the Association in National Convention of the Indian Association of Physics Teachers at Chandigarh, Oct 10-12, 2014.
  - Brain-storming Workshop on Setting up of a Centre for Excellence in School Education, Kusum Kothari Foundation, Nashik, Oct 16-18, 2014.
  - National Children's Science Congress 2014, SJB Institute, Kengeri, Bengaluru, Dec 26-31, 2014.
  - 102nd National Science Congress, University of Mumbai, Jan 3-7, 2015 (Along with Aniket Sule, he coordinated the session of the congress on "Challenges to Education in Modern India").
  - Learnet 3, the annual convention of NGOs (funded by Hemendra Kothari Foundation) working on educational projects in tribal schools in eco-sensitive zones, especially tiger-reserves, Panchmarhi, March 13-15, 2015.

R. Nagarajan

- Invited to give talk on "Superconductivity" and Demonstrations (with Shri K.V. Srinivasan and V. Arolkar of Low Temperature Facility of T.I.F.R., Mumbai)

using liquid nitrogen at INSPIRE 2014 camp of DST, Govt of India, organized by Guru Nanak Khalsa College of Arts, Science and Commerce, Matunga (East), Mumbai, November 26-30, 2014.

- Chintamani Pai, H. Muthurajan, **M. Shalini**, S. Radha, **R. Nagarajan**
  Poster presentation on "Software development for the study of nonlinear and magneto-optical effects in nanofluids" at 102nd Indian Science Congress 2015, University of Mumbai (January 3-7, 2015).

Sujit Tandel

- Delivered Lecture Series on "Conversion Electron Spectroscopy and Heavy Nuclei" DST-SERC School on Nuclear Structure, Tata Institute of Fundamental Research, October 5-25, 2014, Mumbai, India.
- Delivered Lecture Series on "Heavy Nuclei, Nuclear Isomers, and Nuclear Shapes" in the School on Nuclear Structure Physics at Inter-University Accelerator Centre, April 21-26, 2014, New Delhi, India.
- Invited to give talk at conferences:
  - "Octupole collectivity in heavy nuclei", International Conference on Frontiers in Gamma Spectroscopy – 2015 (FIG15), Variable Energy Cyclotron Centre, February 18-20, 2015, Kolkata, India.
  - "Spectroscopy of heavy fissionable nuclei", International Conference on 75 years of Nuclear Fission, Bhabha Atomic Research Centre, May 8-10, 2014, Mumbai, India.

Jacinta D'Souza

- Conference and Invited talks:
  - Presented 3 posters at the 16th International Conference on Cellular and Molecular Biology of *Chlamydomonas*, held since June 08-13, 2014 in Asilomar, California, USA.
  - Presented a poster at the one-day conclave of C-CAMP, NCEBS, Bangalore, India, titled, 'Identification of protein interactomes in the green alga, *Chlamydomonas reinhardtii*' on 14th November, 2014.
  - Attended the 102nd Indian Science Congress, held in University of Mumbai during January 3-7, 2015.
  - Invited to deliver a talk on 'Cellular macromolecules' April, 2014 for VIIIth and IXth standard school children at a 6-day workshop under the auspices of the Progressive Science Centre held at G. N. Khalsa College, Matunga.
  - Invited as a Resource person involving a talk on, 'Flagella: Cellular Movers and Sensors,' on November 23, 2014 at the Orientation *cum* Selection camp of

NIUS (Biology) 2014 held at the Homi Bhabha Centre for Science education (TIFR).

- Invited to deliver a talk on '*Chlamydomonas reinhardtii*, a model organism'. at Sophia College on the occasion of National Science Day, February 28, 2015.

Gargi Shaw

- Delivered lectures on "Galactic and Extra galactic astronomy" at Department of Physics, University of Mumbai (July- Nov, 2014).
- Given lectures and demonstrations along with CEBS students to the under privileged students organized by Nehru Planetarium.
- Invited to give a talk and poster presentation at the ASI-2015 meeting held in February 2015 at NCRA.
- Volunteered for the "Megaprojects in Astronomy Session" in 102 ISCA held at Mumbai University in January 2015.

Basir Ahmad

- Conference and Invited talks
  - Nivin Mothi, Shivani A. Muthu, Mohanish S. Borana and **Basir Ahmad** The Molecular Mechanism of Inhibition and Acceleration of Protein Aggregation. BioWorld-2014, Protein Structure and Function, IIT Delhi, December 12-14, 2014
  - **Nivin Mothi, Basir Ahmad** A Mechanistic Model for Amorphous Protein Aggregation and its Prevention. National Symposium on Biophysics & Golden Jublee Meeting of Indian Biophysical Society, JMI, New Delhi, February 14-17, 2015
  - Muthu SA, Ratnaparkhi A, Shiriskar SM, Pissurlenkar RR, Choudhary S, **Basir Ahmad* (**corresponding Author). Effects of hesperidin, a flavanone glycoside interaction on the conformation,stability, and aggregation of lysozyme: multispectroscopic and molecular dynamic simulation studies. The Second International Symposium on Protein Folding and Dynamics, NCBS, Bangalore, November 05-07, 2014
  - Nivin Mothi, **Basir Ahmad,** Shivani A. Muthu Curcumin induces conversion of amorphous Aggregation into fibrillar aggregation of human serum albumin, The Second International Symposium on Protein Folding and Dynamics, NCBS, Bangalore, November 05-07, 2014

Ananda Hota

- Delivered a talk at Institute of Physics, Bhubaneswar on June26, 2014, titled "*Any BSc/BE Can Do Research using GMRT via RAD@home (#RADathomeindia*

#*ABCDresearch)*"

- Co-authored a poster paper titled "Tracking cosmological accretion onto clusters of galaxies by semi-expert e-astronomers of RAD@home collaboratory."presented in the International Centre for Theoretical Physics (ICTP, Italy) during Summer School on Cosmology (August 4-15, 2014).
- Presented a poster paper in the annual meeting of the Astronomical Society of India hosted by NCRA-TIFR (Pune), from February 17-20, 2015. Title of the poster paper "Progress Report on RAD@home Astronomy Collaboratory, India (#RADathomeindia #ABCDresearch).
- Invited to give a talk in the P.G. Department of Physics, Sambalpur University (Odisha) titled "Discovery of the exotic black hole-galaxy system Speca" on the National Science day (February 28, 2015).

Sangita Bose

- Delivered following lectures:
  - "Origin of Matching Effects in Anti-dot Array of Superconducting Thin Films" at the Physics Department of the University of Lisboa, Portugal in June, 2014.
  - "Study of Matching Effects in Anti-dot Array of Superconducting Thin Films" in Max Planck Institute for Solid State Research, Stuttgart, Germany in the group of Prof. K. Kern in August, 2014.
- Conference and Invited talks:
  - "Study of Matching Effects in Anti-dot Array of Superconducting Thin Films" at the International conference on "Multi-Condensate Superconductivity and Superfluidity in solids and ultra-cold gases" at Camerino, Italy in June 2014.

M. Hemalatha

- Conferences:
  - VI International Conference FUSION14, New Delhi, April 24-28, 2014.
  - 75 years of Nuclear Fission: Present status and future perspectives, Mumbai, May 8-10, 2014.
  - International Nuclear Physics Conference (INPC2013), Firenze, Italy, June 2-7, 2013.
- Invited talks:
  - Invited to give a talk on "Nuclear Transmutation Strategies for Management of Long Lived Fission Products" , Proc. 75 years of Nuclear Fission: Present status and future perspectives, May 10, 2014.

Manojendu Choudhury

- Delivered lectures at the Dept. of Physics, University of Mumbai, for the M.Sc final year students, on the units of high energy astronomy and astrophysics.
- Delivered Lectures on various topics of physics, astronomy and astrophysics at the Orientation and selection camp for the Astronomy Olympiads at the HBCSE, May-June 2014.
- Delivered Lectures on various topics of physics, astronomy and astrophysics at the Astronomy Olympiad Exposure Camp to the school and college teachers, November 2014.
- Conference and Invited talks:
  - Public talk organized by the Physical Society, SIES college, titled "The Universe In Different Colours", held in the college premises, on August 23, 2014.
  - Participated in the ISSAC 2014 (International Summer School on Astrocomputing) on Nuetrino and Nuclear Astrophyiscs, at University of California San Diego, organized by University of California High Performance Computing Centre (UC-HiPACC) and San Diego Supercomputing Center (SDSC), during July 21 – August 01, 2014.
  - Presented a poster titled "Low Frequency Radio Detection of Unidentified Gamma-ray Source" at 33 rd Astronomical Society of India Meeting held at NCRA-TIFR, Pune, during February 17-20, 2015.

Avinash Kale

- Lectures:
  - Taught various topics (X-ray crystallography, NMR, SAXS, CD, Fluorescence, Molecular dynamics, and Monte Carlo simulation) at workshop organized by Haffkine Institute for Training Research and Testing (HITRT) on Bioinformatics Applications and Interdisciplinary Technologies (BAIT) from Jun 9, 2014 until July 4, 2014.
  - Involved in teaching "Bio Crystallography & Magnetic Resonance Techniques (course code PSBP302)" to semester III MSc Biophysics students.
  - Involved in teaching "Elements of Bioinformatics & Chemoinformatics (Course code PSBP403)" to semester IV MSc Biophysics students.

Alkendra Pratap Singh

- Lectures:
  - Effect of shear on nonlinear dynamo in partially ionized solar atmosphere, AOGS 2014, Sapporo, Japan, July 2014.

- On multiple plasma ejections and intermittent nature of magnetic reconnection in solar chromospheric anemone jets, AOGS 2014, Sapporo, Japan, July 2014.
- Taught course on "Astrophysics and Space Science" to post graduate students of Mumbai University.

- Conference and Invited talks:
  - Oral presentations at Asia Oceania GeoSciences Society (AOGS) 2014- 11th Annual Meeting, Sapporo, Japan, July 2014.
  - Poster presentation at Joint ICTP-IAEA College on Advanced Plasma Physics, ICTP, Trieste, August 2014.
  - Poster presentation at International Conference on Coupling and Dynamics of the Solar Atmosphere, IUCAA, Pune, November 2014.

Subhojit Sen

- Attended Meeting of Society of Biological Chemists India, Mumbai Chapter on "Tracking epigenetic memories from Stem cells to Cancer: a path paved by Bivalent Nucleosomes".
- Presented poster at **ENCODE 2015: Research Applications and Users Meeting,** National Human Genome Research Institute (NHGRI) at the Bolger Center in Potomac, MD USA on "Genome-wide positioning of bivalent mononucleosomes" Subhojit Sen, Kirsten F. Block, Alice Passini, Stephen B. Baylin, Hariharan Easwaran.

Manu Lopus

- Conference and Invited Talks:
  - Invited to give a talk on "Antibody-conjugated agents in cancer chemotherapy", St. Xavier's College, Mumbai (Jan 10, 2015).
  - Invited to Give talk on "Advances in cancer chemotherapeutics research", National Conference on Advances in Biosciences, University of Mumbai (Dec 23, 2014).

Shameek Paul

- Participated in the ATM Workshop on 'Lattices: Geometry and Dynamics' held during December 17-22, 2014 at IISER, Mohali.
- Attended a conference on 'Commutative Algebra and Algebraic Geometry' held during February 5-9, 2015 at IIT, Guwahati.

P. Brijesh

- Conference and Invited Talks:
  Posters in the International Conference on Ultrahigh Intensity Lasers (ICUIL-2014), Goa – India
  - **P. Brijesh**, S.Samant, S.Krishnagopal
    "Hollow Electron Beams from Laser Wakefield Accelerators",
  - S. Krishnagopal, **P. Brijesh**, S. Samant

    "High Brightness, High Energy Electron Beam from Density Transition And Subsequent Acceleration in a Plasma Channel"

  - S.Samant, **P. Brijesh**, S. Krishnagopal.
    "Electron Injection Dynamics in the Sharp Density Transition Regime of Laser Wakefield Acceleration"

Ishita Mehta

- Conference and Invited talks:
  - Presented poster in the conference on "5th Asian chromatin Meeting" – Organized at JNCASR, Bangalore (January 15-18, 2015)
  - Invited to give talk in the conference on "Genome Architecture and Cell Fate Regulation" – Organized at University of Hyderabad (December 01-04, 2014)

V. L. Sirisha

- Presented poster: V. L.Sirisha, Mahuya Sinha, Jacinta S. D'Souza.
  On "Abiotic stress induced programmed cell death in Chlamydomonas reinhardtii" at 16th international conference on cell and molecular biology of Chlamydomonas, pacific Grove, California, (June 8-13, 2014).
- **Participated at 102nd Indian Science Congress** at University of Mumbai, Kalina Campus, during (January 3-7, 2015)

Mahendra Patil

- Attended 102nd edition of Indian Science Congress, Mumbai January 3, 2015 to January 7, 2015.

Collaboration

Collaboration of CEBS Faculty with other departments, organizations and countries

National:

- Advanced Centre for Treatment, Research and Education in Cancer (ACTREC), Mumbai
- Andhra University, Vishakapatnam
- Bhabha Atomic Research Centre (BARC), Mumbai
- Bombay College of Pharmacy, Mumbai
- Department of Atomic and Molecular Physics, Manipal University, Manipal
- Department of Atomic and Molecular Physics, Tata Institute of Fundamental Research (TIFR), Mumbai
- Department of Biotechnology, University of Mumbai
- Department of Chemistry, University of Mumbai
- Department of Physics, Aligarh Muslim University, Aligarh
- Department of Physics, IIT-Bombay, Mumbai
- Department of Physics, University of Mumbai
- Guru Ghasidas Central University, Chhattisgarh
- Haffkine Institute, Mumbai
- Indian Institute of Chemical Biology, Hyderabad
- Indian Institute of Technology (IIT-B), Mumbai
- Institute for Plasma Research (IPR), Gandhinagar
- Institute of Minerals and Materials Technology, Bhubaneswar
- Inter-University Accelerator Centre, New Delhi
- Manipal University, Manipal
- Mata Amrithanandamayi University, Coimbatore
- National Institute of Research for Reproductive Health (NIRRH), Mumbai.
- National Physical Laboratory, New Delhi
- Padmashrree Dr. D. Y. Patil University, Navi Mumbai
- S. N. Bose National Centre for Basic Sciences, Kolkata
- Tata Institute of Fundamental Research (TIFR), Mumbai
- The Inter-University Centre for Astronomy and Astrophysics (IUCAA) Pune

International

- Antwerp University, Belgium
- Argonne National Laboratory, USA
- German Cancer Research Centre, Heidelberg
- Greenwood Genetic Centre, USA
- Institut de Biotechnologie des Plantes, Université Paris-Sud, France.
- Instituto Superior Tecnico, Lisbon
- IPN Orsay, France
- John Hopkins University, USA
- Johns Hopkins University, MD, USA
- KTH, Stockholm, Sweden
- Marquette University, USA
- Michigan State University, USA
- Pukyong National University, South Korea.
- University of Alberta, Canada
- University of Barcelona, Spain
- University of Cambridge , UK
- University of Castilla-La Mancha, Spain
- University of Georgia, USA
- University of Kentucky, USA
- University of Massachusetts Lowell, USA
- University of Mississippi, USA
- University of North Texas, US
- University of Notre Dame. Notre Dame, IN, USA
- University of Ulm, Germany
- Weizmann Institute of Science, Israel

Externally funded Research Projects

11. Externally funded Research Projects:

Name of the Principal Investigator	Title of the Project	Funding Agency	Duration	Total Project Amount
Dr. Jacinta D'Souza	Spectroscopic analyses of flagellar proteins from chlamydomonas reinhardti and homologous ciliary proteins from human	Ministry of Science & Technology, Department of Biotechnology (DBT)	3 years from August, 2012	61,61,600/-
Dr. Ameeya Bhagwat	Microscopic global nuclear mass formula	Department of Science and Technology (DST)	3 years from June, 2011	21,50,000/-
Dr. Neeraj Agarwal	New Bodipy derivatives and their anthracene-fused-porphyrin composites for the up-conversion of energy	Department of Science and Technology (DST)	3 years from January, 2012	21,00,000/-
Dr. Gargi Shaw	Numerical simulations of molecular astrophysics and their spectra applications to star forming regions from local high redshift universe	Science and Engineering Research Board (SERB)	3 years from July, 2012	12,84,000/-
Dr. Sangita Bose	Superconductivity in Engineered Granular Thin Films	Indian National Science Academy (INSA)	3 years from January, 2013	5,00,000/-
Dr. Sangita Bose	Tunneling studies in novel supercoductors and nanocomposites	Science and Engineering Research Board (SERB)	3 years from July, 2012	26,00,000/-

Dr. Sangita Bose	Vortex matching studies in anti-dot arrays of dis-ordered superconducting NbN	Science and Engineering Research Board (SERB)	3 years	18,00,000/-
Dr. M. Hemalatha	Laser Spectroscopy of nuclei away from stability	Board of Research in Nuclear Sciences (BRNS) for Yong Scientist Research Award-2012	3 years from October, 2012	17,00,000/-
Dr. Subhojit Sen (Ramalingaswami Fellowship)	Epigenetic Study of Environmental influence of Quality of Life	Ministry of Science & Technology, Department of Biotechnology (DBT)	5 years from September, 2013	82,00,000/-
Dr. Tripti Bameta	INSPIRE Faculty Award	Department of Science and Technology (DST)	Maximum 5 years from August, 2013	19,00,000/- (For First Year)
Dr. Prachi Chandrachud	Dr. D.S. Kothari Postdoctoral Fellowship	University Grant Commission (UGC)	Maximum 3 years from September, 2013	3,93,000/-
Dr. Ishita Mehta	INSPIRE Faculty Award	Department of Science and Technology (DST)	Maximum 5 years from September, 2013	19,00,000/- (For First Year)
Dr. Mahendra Patil	Computational Studies of Synergistic Catalysis: Reactivity, Mechanism, Stereoselectivity and Catalyst Screening.	Department of Science and Technology (DST)	3 years from March, 2014	23,00,000/-

	(DST-Fast Track Project for Young Scientist)			

External UGC Grants:

Name of the Faculty	Title	Funding Agency	Duration	Amount in Rs.
Dr. Sujit Tandel	UGC Associate Professor	University Grant Commission (UGC)	June 2014 To March 31 2015	11,00,000/- + 6,00,000/- (startup grant)
Dr. Ananda Hota	UGC Assistant Professor	University Grant Commission (UGC)	June 2014 To March 31 2015	11,00,000/- + 6,00,000/- (startup grant)
Dr. Basir Ahmad	UGC Assistant Professor	University Grant Commission (UGC)	June 2014 To March 31 2015	11,00,000/- + 6,00,000/- (startup grant)

Colloquia

12. Colloquia

CEBS organises colloquia on Tuesdays at 3.45p.m. on topics of academic interest by reputed speakers, researchers, scientist etc. to facilitate exchange of ideas. The list of such colloquia held during 2014-15 is reproduced below:

- April 08, 2014: **Dr. Pushpa M. Bhargava**, CCMB, Hyderabad *"Two Faces of Beauty: Science and Art".*

- April 15, 2014: **Prof. M.V. Hosur,** ACTREC, Mumbai *"Crystallographic investigations into catalytic and drug-resistance mechanisms in HIV-1 protease".*

- September 16, 2014: **Prof. Sabyasachi Bhattacharya,** Tata Institute for Fundamental Research (TIFR) Mumbai, *"Dynamics of soft interfaces, real and imagined".*

- Oct 7, 2014: **Dr. Supreet Saini**, Department of Chemical Engineering, IIT-Bombay *"Revisiting Demand* Rules *for Gene Regulation*".

- October 28, 2014 : **Prof. Lokesh C. Tribedi,** Tata Institute for Fundamental Research (TIFR) Mumbai *"Atomic collisions and Inter disciplinary science".*

- November 04, 2014 : **Prof. Mohan Phadnis**, Retd. Sr. Scientist, BARC, *"Regression of Moore's law to Development of Technology through the Ages – The Science and Technology Synergy Syndrome".*

- November 11, 2014: **Prof. Seyed E. Hasnain**, IIT-Delhi, *"TB, the world's deadliest infectious bacterial disease, caused by Mycobacterium tuberculosis, continues to be a grand challenge".*

- February 03, 2015: **Prof. Mayank Vahia**, Tata Institute for Fundamental Research (TIFR) Mumbai *"India in Space".*

- February24, 2015: **Prof. N.R. Jagannathan**, AIIMS-Delhi, NMR in *Medicine: Role of Magnetic Resonance Imaging (MRI) and MR Spectroscopy (MRS)*

- March 17, 2015.: **Dr. Ashutosh Kumar**, IIT Bombay, *"NMR of insoluble Bio-molecule".*

- March 24, 2015: **Dr. Sarath Chandra Dantu**, Max Planck Institute for Biophysical Chemistry, Gottingen, Germany, *"Understanding protein dynamics using MD simulations"*.

- March 31, 2015: **Prof. T.P. Singh**, All India Institute of Medical Sciences (AIIMS), New Delhi, *"Structural basis of the Antibiotic action of Innate Immunity Proteins and their therapeutic applications as Protein antibiotics"*.

Events

13. Events: 2014-2015

13.1 Meetings held at the Centre

During the year 2014-2015, the following meetings were conducted:

Total nine Faculty Meetings were held during 2014-2015

20th Meeting of the Governing Council : April 17, 2014

12th Meeting of the Academic Board : April 12, 2015

13.2 Second Graduation Ceremony

The second batch of 11 students and third batch of 21 students of CEBS graduated the Five Year Integrated M.Sc. Programme in July 2013 and 2014 respectively. The second graduation ceremony of the UM-DAE Centre for Excellence in Basics Sciences (CEBS) was held on April 20, 2015. The students received the B.Sc. degree certificates at the hands of Dr. R. K. Sinha, Chairman of the Atomic Energy Commission and Chairperson, Governing Council of CEBS and M. Sc. degree certificates were given at the hands of Dr. Rajan Welukar, Vice Chancellor of the University of Mumbai and Co-Chairperson of Governing Council of CEBS. Dr. Naresh Chandra, Pro Vice Chancellor of University of Mumbai, Dr. Rajpal Hande, Director Board of College and University Development (BCUD), Prof R. V. Hosur, Director CEBS and Prof. S.M. Chitre, Chairman Academic Board of CEBS graced the occasion.

In the batch of 2008, the Gold Medal was awarded to Mr. Dhruv Ringe (Physics) and in the batch of 2009 the Gold and Silver medals were awarded to Mr. Mohanish Borana (Chemistry) and Ms. Angana Mondal (Physics) respectively for topping in the batch.

13.3 Foundation Day Celebrations

The 8th CEBS Foundation Day Program was held on 18th September in the Alkesh Dinesh Mody Auditorium, University of Mumbai, Kalina. The

programme began at with a dance recital by the renowned danseuse Ms. Deepika Potdar and was followed by performances of students of CEBS.

13.4 Jigyasa

"JIGYASA" is an annual inter college science quiz conducted by the students of UM DAE CEBS. It challenges the students' understanding of basic concepts in science at a deeper level. This year our students took it a step further by opening up centres across Mumbai and Pune to increase participation. The quiz was conducted in two phases, the preliminary phase was conducted in various centres across Mumbai and Pune on January 18, 2015. The second phase was held on February 01, 2015 at UM-DAE CEBS. Top ten teams from the first phase moved on to the second phase. The winners were given prizes.

13.5 Students' Science Blog

CEBS students have started a science blog for creating a platform where everybody can put his or her ideas, experiences about his/her research projects or any educational matter. This will help in creating awareness about opportunities available for a wider segment of society. By sharing personal experiences, readers can get information normally not available on any web page. This way a lot of possibilities will be open to everyone.

The blog also covers various other information such as details of Wednesday Sciences talks, important events, interesting posts, comments etc. The address of the blog is philomaths.blogspot.in.

13.6 Dhwani Programme

Dhwani is the annual musical event where students of CEBS, faculty members and guest artists are performing in the campus of University of Mumbai. The aim of this musical event is to enrich the academic ambiance of CEBS with music.

This year Dhwani programme was held on February 17, 2015 in the D. N. Marshall Hall, J N. Library, University of Mumbai. Ms. Nupur Joshi was invited as the main artist on this event. She is trained in Hindustani Classical music and Carnatic

classical music. She performed Hindustani and Carnatic classical music recitals and was followed by performances by students of CEBS.

13.7 Blood Donation Camp

CEBS students had initiated holding of a blood donation camp in 2013, which was also held in this year. The camp was organized by CEBS Health Club and conducted by Lokmanya Tilak Municipal General Hospital (Sion Hospital). Approximately 100 students, staff and faculty members of Centre and other departments of university participated in the events. All the blood donors were given certificates and voluntary blood donation cards.

13.8 ORIS – 2015

ORIS is the annual cultural event of CEBS. Like other events, this too is managed by students with support from CEBS Administration. The main events comprised painting, photographic exhibition and bouquet making. Prof. R. Nagarajan arranged a session on Origami, the art of paper folding. The event concluded with a small ceremony where singers from outside the CEBS community, together with a group of students gave a performance.

13.9 Ragnarok 2015

Ragnarok is the annual sports event of CEBS and is organised by the students themselves with active support from CEBS. Every year, one or two batches of students assume responsibility for the overall coordination of the events. The event was organised in January 2014 and comprised eight sporting events – both outdoor and indoor. The events organised were cricket, volleyball, football, basketball, badminton, table tenis, chess & carrom. In addition to these, games played on computer consoles were also organised which was a great success.


CBS
CBS


CBS

Nurturing talent...promoting excellence

मौलिक विज्ञान प्रकर्ष केन्द्र

UM-DAE CEBS

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