University of Mumbai

Nurturing talent...promoting excellence

मौलिक विज्ञान प्रकर्ष केन्द्र

राष्ट्र की सेवा में परमाणु

प ऊ वि DAE

ATOMS IN THE SERVICE OF THE NATION

University of Mumbai – Department of Atomic Energy

Centre for Excellence in Basic Sciences

Annual Report

2017 - 2018

University of Mumbai

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ATOMS IN THE SERVICE OF THE NATION

UM-DAE CEBS

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

Centre for Excellence in Basic Sciences (CEBS)

Annual Report

(2017 – 2018)

Director's message

I am happy to present the 2017-2018 Annual Report of the University of Mumbai-Department of Atomic Energy - Centre for Excellence in Basic Sciences (UM-DAE-CEBS) which I joined in October 2017. The Academic Board of the Center was of the view that the Academic Year rather than Financial or Calendar year, be taken for preparation of the Annual Report of an educational center. Accordingly, this report covers the activities of the Center for the period August -2017 to July 2018 and also includes activities of the preceding few months (April-July 2017) of this report.

The report period was, indeed, transformational for UM-DAE-CEBS. Although the Center was recognized as the DAE aided institute on 1 January 2016, regular core Faculty members (12 in number) and Director were appointed during this period. The Office of the Dean, Academic Affairs as well as the four Schools, *viz*. School of Chemical Sciences, School of Biological Sciences, School of Physical Sciences and School of Mathematical Sciences, were created. Distinguished Professors in each discipline were also inducted for mentoring and motivating students and for shaping-up the teaching and research programs of the Center. The year 2018 will mark a major step as the Center started receiving generous financial aid from DAE w. e. f. 1st April 2018. From the current academic year CEBS will start Ph. D. program in four principal areas of basic sciences, namely Chemistry, Physics, Biology and Mathematics.

Collaboration is vital in today's research environment. It is heartening to note that the Faculty members of the Centre have been collaborating with premier institutions like BARC, HBCSE, TIFR, IIT(B), ICT. This brings additional intellectual resources for further strengthening science education and research at the Center. CEBS has also developed close linkages with Departments of University of Mumbai and its affiliated Colleges. We are glad to note that this partnership with the University has been a mutually successful journey. CEBS Faculty members are making sincere efforts, despite several odds, in high quality research, manifested in the form of several publications in peer reviewed international journals, participation in national and international conferences and delivering invited lectures at various forums. They have been able to network with a number of the finest science and technology groups around the world and have also been successful in securing grants from external sources both from the Government and the industry.

Starting with a very modest scale of 20 students in the first batch in 2007, CEBS has currently about 180 students who are pursuing their Integrated M.Sc. programme. Student intake to the Centre is based on merit-rank obtained in the National Entrance Screening Test (NEST) which was conducted at more than 150 centers (in 80 cities) spread over in different parts of the Country. The popularity of this can be gauged from the number of students who appeared for the test: in the first year it was around 3500, this year it was nearly 68,000! An exponential jump which shows how keenly competitive the test has become over the years. So far seven batches of students (157 M.Sc. and 12 B.Sc.) have graduated. It is heartening to note that a very large number of our students who graduated from CEBS are pursuing their graduate studies in science and have enrolled for Ph.D. degrees in reputed institutes in India and abroad and a number of them have completed their Ph.D. degree while a quite a few of them have also joined DAE organizations like BARC, NPCIL.

Apart from regular classroom teaching, lab instruction and research activities through project, CEBS also arranges Colloquia, Public Lectures, Workshops, Seminars, etc. This enables students to know about the latest advances in different disciplines of science, and encourages inter-disciplinary approach in unravelling nature's secrets. Other non-curricular activities such as sports, cultural activities, literary activities, etc. are encouraged by the Centre and this has helped students to develop an overall well-rounded personality and leadership qualities.

This report gives glimpses of different activities of the Centre. I sincerely thank Publications Committee, academic and non-academic staff of the Centre for their efforts in preparing this report and pledge to continue to nourish scientific talent in the country.

Vimal K. Jain
Director

Contents

1. Governing Council and Academic Board of the Centre

Governing Council of the Centre

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

Dr. Sekhar Basu 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. Suhas Pednekar Vice – Chancellor University of Mumbai Fort Campus Mumbai – 400 032	Co-Chairperson (From April 27, 2018)
Dr. Anil Kakodkar Former Chairman Atomic Energy Commission	Member
Dr. Vijay Khole Vice-Chancellor Amity University Navi Mumbai – 410 206	Member
Shri. K. N. Vyas Director Bhabha Atomic Research Centre Trombay, Mumbai – 400 085	Member
Dr. Sandip P. Trivedi 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
Pro Vice Chancellor University of Mumbai Fort Campus Mumbai – 400 032	Member

Finance & Accounts Officer University of Mumbai Fort Campus, Mumbai – 400 032	Member
Joint Secretary (A&A) Department of Atomic Energy Anushakti Bhavan, C.S.M. Marg Mumbai – 400 001	Member
Joint Secretary (Finance) Department of Atomic Energy Anushakti Bhavan, C.S.M. Marg Mumbai – 400 001	Member
Dr. Vimal K. Jain Director, UM-DAE CEBS University of Mumbai Kalina Campus, Mumbai – 400 098	Member Secretary (From October 18, 2017)
Shri. K. P. Balakrishnan Registrar, UM-DAE CEBS University of Mumbai Kalina Campus, Mumbai – 400 098	Non-member Secretary

The below members term as Govening Council member is mentioned against each name:

1. Prof. R. V. Hosur, Member Secreatary (Till October 18, 2017)
2. Dr. Devanand Shinde, Acting Vice Chancellor – University of Mumbai, Co-Chairperson (From October 28, 2017 till April 26, 2018)
3. Dr. Sanjay Deshmukh, Vice Chancellor – University of Mumbai, Co-Chairperson (Till October 27, 2017)

Academic Board of the Centre

The academic activities of the Centre are designed and overseen by the Academic Board of the Centre which has been reconstituted with the approval of the Governing Council for the period May 2018 to April 2021. Following are the member of the Board:

Prof. J. P. Mittal* FNASc, FASc, FNA, FTWAS Ex-DAE Raja Ramanna Fellow of BARC Distinguished Professor, UM-DAE CEBS University of Mumbai Kalina Campus, Mumbai – 400 098	Chairperson (From June 01, 2018)
Prof. M. S. Raghunathan** FNASc, FASc, FNA, FTWAS, FRS (UK) Fellow of the American Mathematical Society Former IIT B- Chair, Academic Board Indian Institute of Technology – Bombay Powai, Mumbai – 400 076	Chairperson (Till April 30, 2018)
Prof. S. M. Chitre** FNASc, FASc,FNA, FTWAS FRAS (Fellow of the Royal Astronomical Society) Distinguished Professor UM-DAE CEBS University of Mumbai Kalina Campus, Mumbai – 400 098	Member
Prof. R. V. Hosur* FNASc, FASc,FNA, FTWAS Ex Director, UM-DAE CEBS Senior Professor Tata Institute of Fundamental Research Homi Bhabha Road Mumbai – 400 005	
Prof. S. G. Dani FNASc, FASc, FNA, FTWAS Distinguished Professor UM-DAE CEBS University of Mumbai Kalina Campus, Mumbai – 400 098	Member
Dr. S. K. Apte FNA, FASc, FNASc, FNAAS, FMASc Ex DAE Raja Ramanna Fellow Former Director Bio-Medical Group Molecular Biology Division Bhabha Atomic Research Centre Trombay, Mumbai - 400 085	Member

Prof. Arvind Kumar* FNASC Formerly, Homi Bhabha Centre for Science Education (HBCSE), V. N. Purav Marg Mankhurd, Mumbai – 400 088	Member
Dr. Swapan Ghosh FNASc, FASc, FNA, FTWAS Ex DAE Raja Ramanna Fellow Distinguished Professor UM-DAE CEBS University of Mumbai Kalina Campus, Mumbai – 400 098	Member
Prof. Dipan Kumar Ghosh Formerly, Indian Institute of Technology – Bombay Powai, Mumbai – 400 076	Member
Prof. P. Dongre Department of Biotechnology University of Mumbai Kalina Campus, Mumbai – 400 098	Member
Prof. Anil Karnik Department of Chemistry University of Mumbai Kalina Campus, Mumbai – 400 098	Member
Prof. A. K. Srivastava Department of Chemistry University of Mumbai Kalina Campus, Mumbai – 400 098	Member
Prof. Anuradha Mishra Department of Physics University of Mumbai Kalina Campus, Mumbai – 400 098	Member
Prof. B. N. Jagtap Former Director Chemistry Group, BARC Department of Physics Indian Institute of Technology- Bombay Powai, Mumbai – 400 076	Member (From May 01, 2018)
Dr. K. Subramaniam Centre Director Homi Bhabha Centre for Science Education Tata Institute of Fundamental Research V. N. Purav Marg, Mankhurd Mumbai - 400088	Member (From May 01, 2018)

Dr. S. V. Chiplunkar Director Advanced Centre for Treatment Research and Education in Cancer (ACTREC) Tata Memorial Centre (TMC) Sector-22, Kharghar Navi Mumbai, 410 210	Member (From May 01, 2018)
Dr. Smita Mahale FNASC, FNA Director National Institute for Research in Reproductive Health Jehangir Merwanji Street Parel, Mumbai 400012	Member (From May 01, 2018)
Dr. Vimal K. Jain F.N.A.Sc. FRSC Director UM-DAE CEBS University of Mumbai Kalina Campus, Mumbai – 400 098	Member - Secretary (From October 18, 2017)
Shri. K. P. Balakrishnan Registrar, UM-DAE CEBS University of Mumbai Kalina Campus, Mumbai – 400 098	Non-member Secretary

*Receipent of Padma Shri from Government of India
** Receipent of Padma Bhushan from Government of India

The below members term as Academic Board member is mentioned against each name:

1. Dr. R. V. Hosur, Member - Secretary (Upto October 18, 2017)
2. Prof. J. Maharana, Member (Upto April 30, 2018)
3. Prof. N. Mukunda, Member (Upto April 30, 2018)
4. Prof. R. R. Puri, Member (Upto April 30, 2018)
5. Prof. G. D. Yada, Member (Upto April 30, 2018)
6. Prof. Deepak Dhar, Member (Upto April 30, 2018)

2. Faculty

2.1 Core Faculty

SCHOOL OF BIOLOGICAL SCIENCES		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2017-2018)**
Prof. Jacinta D'Souza	Professor	Biology - I (B 101) Biology - II (B 201) Advanced Techniques in Biology (BE 1002)
Dr. Manu Lopus	Reader	Cell Biology - I (CB 305) Cell Biology - II (B 502) Animal Physiology (B 602) Biology Laboratory (BL 601) Advanced Techniques in Biology (BE 1002)
Dr. Sirisha L. Vavilala	Assistant Professor	Biology Laboratory (BL 601, BL 701) Plant Physiology (B 603)
Dr. Siddhesh Ghag	DST Inspire Faculty	Biology - I (B 101) Biology –II (B 201) Biotechnology - I (B 701) Biotechnology - II (B 804) Biology Laboratory (BL 801)
Dr. Subhojit Sen	Ramalingaswami Fellow	Biology Laboratory Coordinator (BL 101, BL 201, BL 601, BL 701) Molecular Biology (B 401) Advanced Techniques in Biology (BE 1002)
Dr. Shraddha Mehta	Research Associate - I	Biology - I (B 101) Biology –II (B201) Virology (B 801)
Dr. Grace Nirmala	Research Associate - I	-
Dr. Prachi Verma	Research Associate - I	-

SCHOOL OF CHEMICAL SCIENCES		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2017-2018)**
Prof. Swapan Ghosh	Distinguished Professor	Chemistry - II (C 201) Quantum Chemistry (C 501) Physical Chemistry –I (CB 403) Group Theory (C 401)

		Mathematics - III (CB 301) Computational Chemistry (C804) Advanced Theoretical Chemistry (CE 1003)
Prof. R. V. Hosur	Ex-Director, UM-DAE CEBS	Advanced NMR Spectroscopy (CE 801)
Dr. D.K. Palit	Emeritus Professor	Introduction to Spectroscopy (PCB 401) Photochemistry (C701) Lasers in Chemistry and Spectroscopy (C704) Introduction to Spectroscopy (CB 401)
Prof. Neeraj Agarwal	Associate Professor	Chemistry Laboratory (CL 101, CL 201) Analytical Chemistry (CB 501) Inorganic Chemistry II (C 502) Inorganic Chemistry III (C601)
Dr. Avinash Kale	Reader	Biophysical Chemistry (CB 601) Chemistry Laboratory (CL 301) Group Theory (C 401) Chemistry Laboratory (CL 601)
Dr. Mahendra Patil	Reader	Organic Chemistry - I (CB 303) Organic Chemistry - III (C 603) Chemistry Laboratory (CL 401) Chemistry Laboratory (CL 501) Chemistry Laboratory (CL 701)
Dr. Basir Ahmad	UGC Assistant Professor	Biochemistry - I (CB 302) Biophysical Chemistry (CB 601) Chemistry Laboratory (CL 601) Advance Chemistry Laboratory (CL 801)
Dr. Sinjan Choudhury	Assistant Professor	Chemistry Laboratory (CL 101) Chemistry Laboratory (CL 601) Biophysical Chemistry (CB 601) Chemistry Laboratory (CL 801)
Dr. Sunita Patel	Visiting Scientist – II	Chemistry Laboratory (CL 301) Numeracal Methods Laboratory (GL 401) Protein Chemistry and Conform Disease (CE 1004) Protein Folding and Conformational diseases (BE 1005) Chemistry Laboratory (CL 801)
Dr. Veera Mohana Rao	SERB Post-doctoral Fellow	Mathematical - III (CB 301) NMR Spectroscopy Laboratory (CL 801)

Dr. Kavitha Rachineni	SERB Post-doctoral Fellow	Introductory Spectroscopy (CBP 401) Chemistry Laboratory (CL 501) Chemistry Laboratory (CL 701)
Dr. Rahul Chavan	Research Assiciate –I	-
Dr. Gonna Somu Naidu	Research Assiciate –I	-
Dr. Animesh Patra	Research Assiciate –I	-

SCHOOL OF MATHEMATICAL SCIENCES		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2017-2018)**
Prof. S. G. Dani	Distinguished Professor	Topology II (M 503) Differential Topology (M 804)
Prof. Balwant Singh	Emeritus Professor	Commutative Algebra (M 702) Advanced Commutative Algebra and Applications (ME 1002) Advanced Commutative Algebra and Applications (ME 1005)
Dr. Saradha Natarajan	INSA Senior Scientist	Analysis I (M 302) Algebric Number Theory (M 802)
Dr. Swagata Sarkar	Assistant Professor	Mathematics – I (M 101) Mathematics – II (M 201) Algebraic Topology (M 803)
Dr. Anuradha Nebhani	SERB Post-doctoral Fellow	-

SCHOOL OF PHYSICAL SCIENCES		
Name of the faculty	**Designation**	**Courses taught in the Academic Year (2017-2018)**
Prof. S. M. Chitre	Distinguished Professor	Fluid Mechanics (P 701) Astronomy and Astrophysics (P 801)
Prof. R. Nagarajan	Emeritus Professor	Physics Laboratory (PL 201) Physics Laboratory (PL 501, 502) Physics Laboratory (PL 601, 602) Electronics and Instrumentation Laboaratory (GL 201, GL 301)
Prof. P. C. Agrawal	Emeritus Professor	Advanced Physics Laboratory (PL 801)
Prof. Gopal Krishna	NASI Senior Scientist	-
Prof. Vijay Singh	Raja Ramanna Fellow	Physics – I (P 101) Physics - II (P 201) Statistical Mechanics –II (P703)

Prof. Manohar Nyayate	Emeritus Professor	Physics Laboratory (PL 101, PL 201, PL 301-302, PL 401-402, PL 501-502, PL 601) Physics - II (P201)
Prof. Sujit Tandel	UGC Associate Professor	Statistical Techniques and Applications (G 401) Nuclear Physics (P 601) Advanced Physics Laboratory (PL 701) Advanced Chemistry Laboratory (CL 801)
Prof. Ameeya Bhagwat	Associate Professor	Waves and Oscillations (P 304) Mathematical Physics – I (P 301) Numerical Analysis (PM 501) Numerical Methods Laboratory (PML 501) Mathematical Physics (P-301) Special Functions and Applications (PM 601)
Dr. Sangita Bose	Associate Professor	Thermal & Statistical Physics (P 503) Condensed Matter Physics - I (P 602) Advance Physics Laboratory (PL 701) Advanced Chemistry Laboratory (CL801)
Dr. Padmnabh Rai	Reader	-
Dr. Ananda Hota	UGC Assistant Professor	Astronomy and Astrophysics (P 801)
Dr. Bhooshan Paradkar	Assistant Professor	Classical Mechanics (P 302) Fluid Mechanics (P 701) Plasma Physics (PE 1014)
Dr. Manojendu Choudhury	Assistant Professor	Computer Basics (G 101) Computer Laboratory (GL 101) Statistical Techniques and Applications (G 401) Numerical Analysis (PM 501) Numerical Methods Laboratory (PML 501) Advanced Physics Laboratory (PL 801)
Dr. P. Brijesh	Assistant Professor	Physics Laboratory (PL 301, PL 401) Mathematical Physics (P 304) Optics (P 404) Plasma Physics (PE 1014)
Dr. Neelam Upadhyay	PI-DST Project	Mathematics – I (M 101)
Dr. Tripti Bameta	DST Inspire Faculty	Computer Basics (G 101) Computer Laboratory (GL 101)

		Glimpses of Contemporary Sciences (P 303) Mathematical Physics – II (P 401) Numerical methods Laboratory (GL 401)
Dr. Sanved Kolekar	DST Inspire Faculty	General Relativity and Cosmology Electrodynamics II
Dr. Sreemoyee Sarkar	DST Inspire Faculty	Physics – II (P 201) Astronomy and Astrophysics (P801)
Dr. Abhishek Pathak	Post-Doctoral Fellow	-
Dr. Vinita Navalkar	Post-Doctoral Fellow	-

2.2 Distinguished Guest Faculty

Name of the faculty	Affiliation	Stream	Courses taught in the Academic Year (2017-2018)
Prof. S. S. Jha	*Formerly* TIFR, Mumbai	Physics	Quantum Mechanics – II (P 502)

2.3 Visiting Faculty

BIOLOGY STREAM		
Name of the faculty	**Affiliation**	**Courses taught in CEBS Academic Year (2017-2018)**
Dr. Aditya Akerkar	SIES College, Mumbai	Biodiversity (B 503)
Dr. Aparna Kotekar	iGenetic Diagnostics Pvt Ltd	Molecular Biology (B 401)
Dr. Aruna Mahesh	ICT, Matunga	Biotechnology II (B 804)
Dr. Bhaskar Saha	St. Xaviers College, Mumbai	Animal Physiology (B 602) Developmental Biology (B 703)
Dr. Deepak Modi	National Institute of Research in Reproductive Health, (NIRRH), Mumbai	Cell Biology – II (B 502)
Dr. Devashish Rath	Bhabha Atomic Research Centre (BARC), Mumbai	Bioinformatics (B 803)
Dr. Champakali Ayyub	Tata Institute of Fundamental Research (TIFR), Mumbai	Biology Laboratory (BL 501)
Dr. Fatema Moiz Bhinderwala	Sophia College, Mumbai	Biology Laboratory (BL 701) Neurobiology (B 802)
Dr. G. K. Rao	*Formerly,* Central Institute of Fisheiry Education, Mumbai	Biostatistics (B 402)

Dr. Girish Maru	Tata Memorial Centre (ACTREC), Mumbai	Cancer Biology (BE 1005)
Dr. Malini Krishna	Formerly, BARC, Mumbai	Neurobiology (B 802)
Dr. Ujwala Bapat	Formerly, St. Xavier's College, Mumbai	Plant Physiology (B 603)
Dr. Mahesh Subramanian	Bhabha Atomic Research Centre (BARC), Mumbai	Biochemistry – II (CB 402) Molecular Biology (B 401)
Dr. Mandar Karkhanis	Swami Vivekananda College	Microbiology (B 604) Genetics (B 501)
Dr. Muktikanta Ray	Bhabha Atomic Research Centre (BARC), Mumbai	Bioinformatics (B 803)
Dr. Nabila Sorathia	Sophia College	Biology Laboratory (BL 701, BL 801)
Dr. Piyaltaru Dasgupta	Tata Institute of Fundamental Research, Mumabi	Advanced Genetics (BE 1007)
Dr. Pradnya Rao	Institute of Forensic Science, Mumbai	Forensic Science (BE 1008)
Dr. Rajendra Shinde	St Xavier's College, Mumbai	Biodiversity (B 503)
Dr. Rahul Chaudhari	Indian Institute of Technology (IIT-B), Mumbai	Biotechnology - I (B 701) Cell Biology I (B 301)
Dr. Radiya Gupta	*Formerly,* St. Xavier's College, Mumbai	Develomental Biology (B703)
Dr. Radhika Tendulkar	St Xavier's College, Mumbai	Develomental Biology (B703)
Prof. S. Sivakami	*Formerly,* University of Mumbai	Biochemistry - II (CB 302) Biochemistry - II (CB 402)
Dr. Sandeepan Mukherjee	Haffkine Institute, Mumbai	Virology (B 801)
Dr. Shatrupa Sinha	-	Imaging technology in biological research (B 704)
Dr. Vainav Patel	National Institute of Research in Reproductive Health, (NIRRH), Mumbai	Immunology - I (B 601) Immunology - II (B 702)

CHEMISTRY STREAM		
Name of the faculty	**Affiliation**	**Courses taught in CEBS Academic Year (2017-2018)**
Dr. Alok Samanta	Bhabha Atomic Research Centre (BARC), Mumbai	Chemistry –I (C 101) Atomic and Molecular Spectroscopy (C 601) Organometallics & Bio-Inorganic

		Chemistry (C703)
Dr. Gail Carneiro	Sophia College, Mumbai	Chemistry – I (C 101)
Dr. Gomati Sridhar	KVS Menon College, Mumbai	Organic Chemistry – I (CB 303) Organic Chemistry - III (C 602)
Dr. KRS Chandrakumar	Bhabha Atomic Research Centre (BARC), Mumbai	Macro and Supramolecular Chemistry (C802) Computational Chemistry (C 804)
Prof. M. Sudarsanam	*Formerly*, University of Mumbai	Analytical Chemistry (CB 501) Chemistry Laboratory (CL501)
Dr. Padmakar Sathe	-	Analytical Chemistry (CB 501)
Dr. P. A. Hassan	Bhabha Atomic Research Centre (BARC), Mumbai	Macro and Supramolecular Chemistry(C802)
Dr. R. K. Vatsa	Bhabha Atomic Research Centre (BARC), Mumbai	Physical Chemistry – I (CB 403)
Dr. Rahul Tripathi	Bhabha Atomic Research Centre (BARC), Mumbai	Nuclear Chemistry (C 604)
Dr. Sandip Nigam	Bhabha Atomic Research Centre (BARC), Mumbai	Chemistry of Materials (C801)
Dr. S. Kannan	Bhabha Atomic Research Centre (BARC), Mumbai	Inorganic Chemistry - II (C 502) Inorganic Chemistry - III (C 602)
Dr. S. K. Kulshreshtha	*Formerly* Bhabha Atomic Research Centre (BARC), Mumbai	Inorganic Chemistry – I (C 301)
Dr. Mainak Roy	Bhabha Atomic Research Centre (BARC), Mumbai	Inorganic Chemistry – I (C 301)
Dr. Sunil Ghosh	Bhabha Atomic Research Centre (BARC), Mumbai	Physical Organic Chemistry (C 704) Organometallics & Bio-Inorganic Chemistry (C 703)
Dr. Tanuja Parulekar	SIES College	Organic Chemistry – I (CB 303) Organic Chemistry – III (C 603)
Dr. V. Sudarsan	Bhabha Atomic Research Centre (BARC), Mumbai	Chemistry of Materials (C801)
Dr. R. V. Hosur	TIFR, Colaba, Mumbai	Advanced NMR Spectroscopy (E801)

MATHEMATICS STREAM		
Name of the faculty	**Affiliation**	**Courses taught in CEBS Academic Year (2017-2018)**
Dr. Aniket Sule	Homi Bhabha Centre for Science Education (HBCSE),	Mathematics – I (M 100) Mathematics –II (M200)

	Mumbai	
Prof. Ajit Kumar	Institute of Chemical Technology (ICT), Mumbai	Computational Mathematics - II I(M 805)
Prof. A. J. Parameswaran	Tata Institute of Fundamental Research, Mumbai	Projective Geometry (ME 1004)
Prof. Amitava Bhattacharya	Tata Institute of Fundamental Research, Mumbai	Combinatory and Enumeration (ME 1002)
Prof. C. S. Rajan	Tata Institute of Fundamental Research, Mumbai	Rep Theory of Finite Groups (M705)
Dr. Chaitanya Senapati	Formerly, CEBS	Differential Geometry & Application (M 603) Foundations (M 301)
Prof. Jyotsna Dani	*Formerly*, University of Mumbai	Algebra II (M 402) Elementary Number Theory (M 403)
Dr. Kiran Kolwankar	R. J. College, Ghatkopar	Differential Equations and Dynamic Systems (M 604)
Prof. M. G. Nadkarni	University of Mumbai	Probability Theory (M 605) Stochastic Analysis (M703)
Prof. M. S. Raghunathan	*CEBS*	Functional Analysis (M701)
Dr. Mangala Gurjar	*Formally*, St Xavier's College, Mumbai	Topology I (M 404)
Prof. Mahadeo Bakre	*Formerly*, University of Mumbai	Analysis III (M 501) Fourier Analysis (M 801)
Prof. Narasimhan Chari	D.J. Sanghvi College	Graph Theory (M 504)
Prof. Parvati Shastri	Indian Institute of Technology (IIT-B), Mumbai	Algebra IV (M 602) Algebra –III (M502)
Prof. Ravi Aithal	*Formerly*, University of Mumbai	Analysis II (M401)
Prof. R. C. Cowsik	*Formerly*, University of Mumbai	Complex Analysis (M 405 & M601) Algebra –I (M 303)
Dr. Sanjeevani Gharge	Ruia College, *Mumbai*	Discrete Mathematcis (M 403) Graph Theory (M 504)
Dr. Shameek Paul	*Formerly, CEBS*	Partial Differential Equations (M 704)

PHYSICS STREAM		
Name of the faculty	**Affiliation**	**Courses taught in CEBS Academic Year (2017-2018)**
Prof. A. K. Raina	*Formerly,* CEBS & Tata Institute of Fundamental Research (TIFR), Mumbai	Mathematical Physics - II (P 401)
Dr. Aparna Shastry	Bhabha Atomic Research Centre (BARC), Mumbai	Atomic and Molecular Physics (P 603)
Prof. Anuradha Misra	University of Mumabi	Partical Physics (P 804)
Dr. Anwesh Majumdar	Homi Bhabha Centre for Science Education (HBCSE), Mumbai	Classical Mechanics (P403) Classical Mechanics (P502)
Prof. Arvind Kumar	*Formerly,* Homi Bhabha Centre for Science Education (HBCSE), Mumbai	Quantum Mechanics - III (P 702) General Relativity & Cosmology (PE 1004)
Prof. Dipan Ghosh	Indian Institute of Technology (IIT-B), Mumbai	Electromagnetism (P 303) Quantum Computing & Information (PE 1007) Quantum Mechanics –I (P 402)
Dr. Debabrata Biswas	Bhabha Atomic Research Centre (BARC), Mumbai	Non-Linear Dynamics (P704)
Prof. G. Ravindrakuam	Tata Institute of Fundamental Research (TIFR), Mumbai	Nonlinear Optics (PE 1013)
Dr. Karthik Subbu	Mithibhai College	Applied Electronics Laboratory (GL 301)
Dr. Kartik Patel	Bhabha Atomic Research Centre (BARC), Mumbai	Computational Electrodynamics (PE 1010)
Prof. Laxmi Natarajan	*Formerly,* University of Mumbai	Atomic and Molecular Physics (P 603)
Prof. P. Shashidhran	*Formerly,* Vertak College, Mumbai	Electronics and Instrumentation (G 201, GL 201) Applied Electronics Laboratory (GL 301)
Dr. Praveen Pathak	Homi Bhabha Centre for Science Education (HBCSE), Mumbai	Physics –I (P 101)
Dr. Pritesh Randave	Homi Bhabha Centre for Science Education (HBCSE), Mumbai	Classical Mechanics –II (P502)

Prof. Rajan Chitalay	*Formerly,* Mithibai College, Vile Parle	Electronics and Instrumentation (G 201, GL 201) Applied Electronics Laboratory (GL 301)
Dr. S. K. Singh	Bhabha Atomic Research Centre (BARC), Mumbai	Reactor Physics and Radiation Sciences (P 704)
Dr. Srinivas Krishnagopal	Bhabha Atomic Research Centre (BARC), Mumbai	Accelerator Physics (P 802)
Dr. Sudhir Jain	Bhabha Atomic Research Centre (BARC), Mumbai	Waves and Oscillations (P 304) Mathematical Physics –I (P 301) Post Modern Quantum Mechanics (PE 1003)
Dr. Tushima Basak	Mithibai College, Vile Parle	Physics Laboratory (PL 301) Classical Electrodynamics (P 604)
Dr. Wendrich Soars	Vedanta College, Vitthalwadi	Physics Laboratory (PL 101) Applied Electronics Laboratory (GL 301)

General subjects etc.		
Name of the faculty	**Affiliation**	**Courses taught in CEBS Academic Year (2017-2018)**
Prof. Nilufer Bharucha	*Formerly,* University of Mumbai	Communication Skills (H 101, H 201) World Literature (H 401)
Prof. Sridhar Rajeswaran	Centre for Advance Studies in India	Communication Skills (H 101, H 201) World Literature (H 401)
Dr. Kurush Dalal	University of Mumbai	Archaelogy (G502)
Dr. Sudhir Panse	ICT, Matunga	Ethics of Science and Intellectual Property Right (H 601)
Dr. S. K. Arora	Bhabha Atomic Research Centre (BARC), Mumbai	Earth Science (P 605)
Prof H. C. Pradhan	Formerly, CEBS, Mumbai	History and Philosophy of Science (H 301)

3.1 Administration

Director	Dr. Vimal K. Jain (w.e.f. October 18, 2017) Dr. R. V. Hosur (upto October 18, 2017)
Registrar	Mr. K. P. Balakrishnan
Wardens	Dr. Avinash Kale (Boys) Dr. Sinjan Chaudhary (Girls) Dr. Vaibhav Kumar Shukla –Co-warden (Boys) Dr. Swagata Sarkar- Co-warden (Girls)
Senior staff	Dr. Jayant Kayarkar (OSD - Administration) Mr. Kishore Menon (PR & Students Matter) Mr. Deepak P Hate (Purchase) Mr. B. P. Srivastava (Site-Suparvisor)
Medical Advisor	Dr. Rajendra Agarkar Dr. Archana Shukla
Office Superintendent	Ms. Swati V. Kolekar (Admin) Ms. Vaishali M. Kedar (Admin) Ms. Rupali Shringare (Finance) Ms. Neha Dandekar (Finance)
Assistants	Ms. Veena Naik (Purchase & Store) Ms. Nikita Shetkar (Multi Skill) Mr. Maharajan Thevar (Infrastructure) Mr. Dilip Gurav (Hostel Assistant-Boys) Ms. Vaishali Gurav ((Hostel Assistant-Girls)
System Administrator	Mr. P. V. Deshpande
Systems Assistant	Mr. Prashant Gurav
Technician	Mr. Tushar Bandkar (Electrical)
Library Attendant	Mr. Amit Shetkar
Office Attendant	Mr. Maruti Khot Mr. Bhushan Deshpande

3.2 Laboratory Staff

Scientific Assistants	Mr. Kanak Gawde (Biology) Ms. Sonali Shiriskar (Chemistry) Mr. Ajayweer Gautam (Biology)
Laboratory Attendants	Mr. Ram M. Soure (Physics) Mr. Dinesh B. Desai (Physics) Mr. Santosh Sood (Biology) Ms. Rupesh Kamtekar (Chemistry) Mr. Abhay Bakalkar (Physics & Computer) Mr. Harish Hira Singh (Biology) Mr. Abhijit Ghag (Chemistry) Mr. Sandesh Kolambe (Chemistry)

3.3 Laboratory staff engaged in research

Junior Research Fellow (JRF)	Mr. S. Gholam Wahid (Physics) Ms. Poulomi Roy (Physics) Mr. Saket Suman (Physics) Mr. Plawan Das (Mathematics) Ms. Krishna Thakkar (Chemistry)
Sunior Research Fellow (SRF)	Mr. Yogesha M (Biology)
Senior Project Assistant (SPA)	Ms. Marilyn Sequeira (Biology) Ms. Pradnya G. Parab (Physics) Mr. Domnic Colvin (Chemistry) Ms. Samridhi Phatak (Chemistry)
Junior Project Assistant (JPA)	Mr. Snehal Kaginkar (Biology) Ms. Pooja Potdar (Biology) Ms. Prabhjyot Bhui (Physics) Ms. Swati Dixit (Chemistry) Ms. Nayana Nambiar (Biology) Ms. Shivani Muthu (Chemistry) Ms. Sampada Parab (Chemistry) Ms. Tinku (Chemistry) Mr. Ankur Aswasthi (Chemistry) Ms. Ankita Rane (Chemistry) Ms. Vrunda Malvade (Chemistry) Ms. Jyoti Vishwakarma (Biology) Mr. Percival D'Gama (Biology) Ms. Vartika Gurdaswani (Biology)

4. Students

4.1 Student intake

The intake of students is based on the nation-level entrance test, called the National Entrance Screening Test (NEST) that is held in several Centres all over India. Students who have passed their 12th standard or equivalent examination from any board in India are eligible to enroll for the test. This year, the test was conducted in 120 centres all over India.

National Entrance Screening Test (NEST)

Year	No. of Students enrolled for the NEST	No. of Students appeared for the NEST	No. of students admitted in CEBS	No. of students remained in Semester I
2007	5,600	3,300	21	19
2008	8,200	7,000	20	11
2009	14,105	12,036	25	21
2010	16,686	9,453	30	25
2011	14,500	9,691	35	28
2012	15,099	10,775	35	34
2013	24,543	19,436	35	23
2014	45,519	29,645	35	33
2015	46,615	31,076	45	40
2016	54,511	37,662	47	39
2017	**68,458**	**49,870**	**47**	**38**

4.2 Students admitted in the academic year 2017-18:

Sr. No.	M/F	Name of the Student	State of Origin
1	M	Aditya Kishore Deshmukh	Maharashtra
2	M	Agnibha Nandi	West Bengal
3	M	Akshat Kumar	Jharkhand
4	F	Aparna C	Kerala
5	M	Ashutosh Bhuyan	Odisha
6	M	Biki Kumar Behera	Odisha

7	M	Chandrashekar Hariharan Iyer	Tamilnadu
8	M	Chayansudha Biswas	Tripura
9	F	Durgeshwari Rathore	Rajasthan
10	M	Jay Madhav Sonekar	Maharashtra
11	M	John C. Sunil	Kerala
12	M	Kevin K. Alex	Kerala
13	M	Kiran S. Ramesh	Maharashtra
14	M	Krishnamohan Nandakumar	Kerala
15	M	Kumar Priyank	New Delhi
16	M	Manender Yadav	Haryana
17	M	Mitul N. Bhalerao	Maharashtra
18	M	Mohit Virdi	Punjab
19	F	Neelima P.V.	Kerala
20	M	Prasad Kumar Mohite	Maharashtra
21	M	Prithwitosh Dey	West Bengal
22	M	Rahul Mahapatra	Odisha
23	M	Rishabh Verma	Uttar Pradesh
24	M	Rushikesh Kale	Maharashtra
25	F	Salony Mandloi	Madhya Pradesh
26	F	Sanskruti Karnawat	Chattisgarh
27	M	Seeli Haswanth	Andra Pradesh
28	F	Shefali Gedam	Maharashtra
29	M	Shivam Sharma	Rajasthan
30	M	Shyam Nair	Kerala
31	M	Sougandh K.M.	Kerala
32	M	Subhajit Roy	West Bengal
33	F	Sunita Mewal	Rajasthan
34	M	Tanveer Habib Tadavi	Maharashtra
35	M	Vatsal Trivedi	Uttarpradesh
36	M	Vishal Prakash Singh	Madhyapradesh
37	M	Vishwas Singh	Uttarpradesh
38	M	Yash Raj	Bihar

Maharashtra (8), Kerala (7), Odisha (3), Uttarpradesh (3), West Bengal (3), Rajasthan (3), Madhya Pradesh (2), and one each from Andhra Pradesh, Bihar, Chhattisgarh, New Delhi, Haryana, Jharkhand, Punjab, TamilNadu and Tripura.

4.3 Students graduated (M.Sc. Five Year Integrated) in the year 2018 and their placements:

Roll No.	Name of the student	Specialization	Current Placements
B 013702	Mr. Akshay Kumar Hotkar	Biology	Information not available
B 013705	Ms. Bhavya Venkatesh	Biology	Ph. D. University of Vancour, Cananda
B 013706	Mr. Chetan N	Biology	Information not available
B 013714	Ms. Pinki	Biology	Information not available
B 013726	Mr. Upnishad Sharma	Biology	Project in EMBL, Monterotond, Itly
M 013704	Mr. Aron G	Mathematics	Information not available
M 013712	Mr. Maradana Siva Kumar	Mathematics	Information not available
M 013727	Mr. Vijay Kumar Sharma	Mathematics	Information not available
P 013701	Mr. Adarsh S	Physics	Information not available
P 013703	Mr. Aniruddha T. Venkata	Physics	Ph. D. in USA
P 013707	Mr. Siddharth Dhanpal	Physics	Ph. D. at TIFR, Mumbai
P 013708	Mr. Ikshul J	Physics	Information not available
P 013709	Mr. Kartikeya Sharma	Physics	Ph. D at University of Lowell,
P 013713	Mr. Pawan Kumar Gupta	Physics	Ph. D. at Nikhem, Amsterdam
P 013715	Mr. Praphull Kumar	Physics	Information not available
P 013718	Mr. Samvit Mahapatra	Physics	Information not available
P 013719	Ms. Sanwardhini Pantawane	Physics	Ph. D at University of Bayreuth, Germany
P 013721	Ms. Shraddha Agrawal	Physics	Ph. D. in USA
P 013723	Mr. Soumek Pattnaik	Physics	Information not available
P 013724	Ms. Swati Guddolian	Physics	Persuing MBA at IIM, Ranchi
P 013728	Mr. Vikas Shridhar Bothe	Physics	Ph.D. Maxplanck Institute for Nucler Physics, Heidelberg
P 013729	Mr. Viswajith.E. S	Physics	Information not available

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

Roll No.	Name of the Student	Guide	Brief Title
B 013702	Mr. Akshay Kumar Hotkar	Dr. Devashish Rath (BARC, Mumbai)	In-silico analysis of targets of eubacterial CRISPR spacers and nanoparticle mediated delivery of CRISPR Cas9 system

B 013705	Ms. Bhavya Venkatesh	Dr. Guy Tanentzapf (University of British Columbia, Vancouver)	Analysis of integrin-mediated adhesion in the Drosophila hematopoietic niche
B 013706	Mr. Chetan N	Prof. Jacinta D'Souza and Dr. Shraddha Mehta (CEBS)	Towards the axoneme proteome comparison of three Chlamydomonas reinhardtii strains: An Electrophoretic approach
B 013714	Ms. Pinki	Dr Rakesh Mishra and Mr. A. Sirinivasan (CCMB, Hyderabad)	Analysis of Ultrabithorax regulatory regions to identify conserved sequence motifs and their role in differential expression among insects
B 013726	Mr. Upnishad Sharma	Dr. James Hackett (Mouse Biology Unit, Monterotondo, Italy)	Understanding the role of DNA demethylation resistance during epigenetic reprogramming
M 013704	Mr. Aron G	Prof. Utpal Garain (ISI Kolkata)	Gesture Recognition using ChaLearn LAP
M 013712	Mr. Maradana Siva Kumar	Prof. Ravi Aithal (UoM)	Riemannian Geometry
M 013727	Mr. Vijay Kumar Sharma	Dr. Shameek Paul (ex-CEBS)	Riemann-Roch for Elliptic Curves
P 013701	Mr. Adarsh S	Dr. Praveen Pathak (HBCSE-TIFR)	Minimum distance from the maximally mixed state for any Werner state to be PPT and k-distillable
P 013703	Mr. Aniruddha T. Venkata	Prof. Aninda Sinha (IISc)	Numerical Studies of a Conformal Field Theory:Determining scaling dimensions as a test of Bootstrap
P 013707	Mr. Siddharth Dhanpal	Prof. Ajith Parameshwaran (ICTS-TIFR)	Testing general relativity using higher order multipoles of gravitational radiation
P 013708	Mr. Ikshul J	Prof. Sai Vinjanampathy (IITB)	No-markovianity and initial system environment correlations in open quantum systems
P 013709	Mr. Kartikeya Sharma	Prof. Sujit Tandel (CEBS)	Rotational bands and K isomer in 173W

P 013713	Mr. Pawan Kumar Gupta	Prof. Sukanta Bose (IUCAA)	Constraining the EOS of neutron star using X-ray and GW
P 013715	Mr. Praphull Kumar	Dr. Dhrubaditya Mitra (NORDITA)	Magneto-Seismology
P 013718	Mr. Samvit Mahapatra	Prof. Mustansir Burma (TCIS-Hyd)	Analytical studies in the theory of Sedimenting Lattices
P 013719	Ms. Sanwardhini Pantawane	Dr. Stefan Gekhle (Bayreuth Univ.)	Morphological variation in semi-flexible polymer chains: Collapse, folding and aggregation
P 013721	Ms. Shraddha Agrawal	Prof. Mandar Deshmukh (TIFR)	A study of graphene devices
P 013723	Mr. Soumek Pattnaik	Prof. P C Agrawal (CEBS)	Timing and spectral analysis of Cir X-1
P 013724	Ms. Swati Guddolian	Prof. Arnab Bhattacharya (TIFR)	Characterization of single crystal of beta-Ga2O3
P 013728	Mr. Vikas Shridhar Bothe	Prof. R. Palit (TIFR)	Performance of hybrid array consisting of LaBr3(Ce) and HPGe detectors
P 013729	Mr. Viswajith.E. S	Prof. Shiraz Minwalla (TIFR)	Membrane stress tensor for large D black holes to the second order

4.7 Ph. D. Programme

The following CEBS students are registered for their Ph.D from University of Mumbai. Since Ph.D. Programme not formally approved at CEBS, the students are registered with Faculty member of University of Mumbai, but their research work is carried out at CEBS under the guidance of a CEBS Faculty member. It is hoped that this program, together with other academic programs, will start soon.

Name of the student	Guide in CEBS	Guide under whom registered
Ms. Pradnya Parab	Dr. Sangita Bose	Under process
Mr. S. Gholam Wahid	Prof. Sujit Tandel	Prof. Sujit Tandel
Ms. Poulomi Roy	Prof. Sujit Tandel	Prof. Sujit Tandel
Mr. Plawan Das	Prof. Balwant Singh	Under process
Mr. Dominic Colvin	Dr. Avinash Kale	Under process
Ms. Samridhi Pathak	Dr. Avinash Kale	Under process

5. Awards & Honors

Ananda Hota

- "Samanta Chandrasekhar Jyotirbigyani Sanmana" has been conferred on Dr. Ananda Hota by Samanta Chandrasekhar Amateur Astronomers Association in a gala function at the Institute of Physics, Bhubaneswar, Odisha on 28th February 2018." The award has been given to him in recognition of his contribution to Astronomy and Science Education.

Avinash Kale

- A grant of INR 40,00,000/- has been sanctioned for the project entitled "Organelle dynamics and cellular ageing in yeast" from DBT under Twinning Program 2015-16. The duration of the project is for three years.
- An MoU has been signed between CEBS and M/s. Abhitech Energycon Limited for carrying out a joint project to work on "Technology Development for the Sugar Industrial Waste Management using Thermophilic Bacteria". A grant of INR 60,00,000/- has been sanctioned for the duration of three years.

Vimal K. Jain

- Conferred 'Vigyan Ratan Award' of Gyan Sagar Science Foundation (2017).

5.1 Other recognition like travel award, memberships of committees, Societies etc.

Ameeya Bhagwat

- Organising committee – LC 2017: Frontiers in Light Front Hadron Physics: Theory & Experiment, held at University of Mumbai during S18-22 September, 2017.
- Editor of Physics News (Published by Indian Physics Association).
- Member of the Board of Studies, Department of Physics, SIES College, Mumbai 400022, as the subject expert.

Ananda Hota

- Elected member of a Cenruary old International Astronomical Union (www.iau.org).
- Reviewer of the Giant Meterwave Radio Telescope (GMRT) Time Allocation Committee.
- Reviewer of the ASTROSAT Telescope Time Allocation Committee.

- Reviewer of the Devasthal Optical Telescope Radio Telescope Time Allocation Committee.

Avinash Kale

- Member, Advisory Board of Hon. Shri. Babanrao Pachpute Vichardhara Trust's Parikrama Group of Institutions, Ahmadnagar, Kashti.
- Member, Board of Studies of School of Biotechnology and Bioinformatics, D. Y. Patil University, Navi Mumbai.
- Member, Ad hoc Board Studies in Biophysics, University Department of Biophysics, University of Mumbai.

Basir Ahmad

- Editor: Special issue in the "Encyclopedia of Bioscience" of the Frontiers in Bioscience
- Reviewer of Journals: Scientific Reports, JPC B, BBA proteins and proteiomics, Biophysical Journal.

Bhooshan Paradkar

- Traval award : Visiting Scientist (June 2017-July 2017) at Centre for Energy Research, University of California, San Diego, USA.

Dipak K. Palit

- Chairperson of a scientific session in DAE-BRNS Theme Meeting on 'Ultrafast Science 2017' in ACRHEM, University of Hyderabad, Hyderabad, November 2 - 4, 2017.

Gopal Krishna

- Continued to serve as Council Member of IUCAA (Pune).
- Appointed Visiting Professor at ARIES (Nainital), *wef.* November 2017.

Jacinta D'Souza

- Member, Society of Biological Chemists, India since 2017.
- Chairperson, IBSC @UM-DAE CEBS, registered under Department of Biotechnology [BT/BS/17/719/2017-PID dated 13.06.2017], India.

Manohar Nyayate

- Member of Board of Studies in Physics (BoS in Phys) of K. J. Somaiya College of Science and Commerce (Autonomous), Vidyavihar, Mumbai, 400077.
- Member of Research and Recognition Committee of Department of Physics (Autonomous) University of Mumbai
- Observer to certify to the Academies that the University can conduct the Science Academies' Refresher Course on Experimental Physics independently at Central University of Karnataka, Gulbarga.

Neeraj Agarwal

- Member of the National Academy of Sciences India, Allahabad (NASI).

Manu Lopus

- Awarded Outstanding Reviewer, Elsevier (2017-18)
- Session Chair, Bio-nano materials, International Conference on Nanotechnology, IIT Roorkee (December 2017)
- Selected to the Life Membership of the National Academic of Sciences, India (June 2017)
- Treasurer, National Workshop on Material Chemistry, organized by the Society for Material Chemistry, UM-DAE CEBS (December 2017)

Neelam Upadhyay

- Organising committee – LC 2017: Frontiers in Light Front Hadron Physics: Theory & Experiment, held at University of Mumbai during Sept 18-22 September, 2017.

P. C. Agarwal

- Member of Advisory Committee on Space (ADCOS) constituted by Chairman, ISRO. He attended 2 meetings of ADCOS for review of Chandrayaan-2 and other space science missions of ISRO.
- Member of the Governing Council (GC) of Aryabhatt Research Institute for Observational Sciences (ARIES) , a DST aided autonomous institute operating 3.6 meter size , the largest optical telescope in India. Attended 3 meetings of the GC at DST in Delhi. He is also Chairperson of the Project Management Board (PMB) of 3.6 meter telescope.
- Member of the Science Advisory Committee (SAC) of Space Physics Laboratory of Vikram Sarabhai Space Center (VSSC).
- Member of the Science Advisory Committee (SAC) of National Atmospheric Research Laboratory (NARL).

R. Nagarajan

- Member of Board of Studies in Physics (BoS in Phys) of Mithibai College of Science (Autonomous), Vile Parle, Mumbai.
- Member of Subject Board of Department of Physics (Autonomous) University of Mumbai.
- Member, Advisory Committee, ARITMS-2018, St. Aloysius College (Autonomous), Jabalpur (M.P.), 12^{th}-13 Jan 2018.
- Special Guest at National Workshop on Advanced Research Instrumentation Technologies in Materials Science (ARITMS-2018), Department of Physics, St. Aloysius College (Autonomous), Jabalpur (M.P.), 12-13 January, 2018.

Sujit Tandel

- Certificate of Outstanding Contribution as Reviewer from Elesiver to review papers submitted to Physics Letters B.

Sangita Bose

- Selected as a member of National Academy of Sciences, Allahabad (NASI), 2018.
- Continued to be a member of Board of Studies for Physics in St. Xaviers, College, Mumbai.
- Life member for Society of Materials Chemistry.

Saradha Natarajan

- Fellow of Indian Academy of Science

Siddhesh Ghag

- SERB travel grants for attending 11th International Congress of Plant Pathology (ICPP-2018), held at Boston, USA (29 July, 2018 to 03 August, 2018).
- Bursary Assistance Award for attending 11th International Congress of Plant Pathology (ICPP-2018), held at Boston, USA.
- Reviewer for PLoS ONE journal.

Sinjan Chaudhary

- Editorial advisory board member of Journal of Chemical Thermodynamics.
- Life member, Society for Biological Chemists, India
- Life member, Indian Biophysical Society
- Life member, Indian Chemical Society
- Life member, Society for Materials Chemistry

Swapan Ghosh

- Council Member (Jan 2015-Dec 2017), Indian National Science Academy, New Delhi.
- Member, Editorial Board of the "Journal of Computational Methods in Sciences and Engineering".
- Member, Editorial Board of the Journal "Current Science" from January 2018.
- Member of Faculty Selection Committee Meeting, IIT, Guwahati, on May 1, 2017.
- Member, DST Swarnajayanti Fellowship Selection Committee Meeting, IASc, Bangalore, on September 8, 2017.
- Member of Faculty Selection Committee Meeting, IIT, Bombay, on November 8, 2017.
- Member of Faculty Selection/Promotion Committee Meeting, NCL, Pune, on November 15, 2017.
- Member, Advisory Committee for the "Asia Pacific Conference on Theoretical and Computational Chemistry (APCTCC-8)" held at IIT Bombay, during December 15-17, 2017.
- Member, Academy Summer Research Fellow Selection Committee, Indian Academy of Sciences, Bangalore, December 20-21, 2017.

- Member, CSIR-SRF/RA Selection Committee (Chemistry), CSIR, January 2-3, 2018.
- Member of the Faculty Selection Committee Meeting, IISc, Bangalore, February 21, 2018.
- Member, Advisory Committee in the Theoretical Chemistry Symposium -2018, to be held at BITS, Pilani in 2018.

Sunita Patel

- Awarded DST Women Scientist in 2018

Sirisha L. Vavilala

- Member of British Phycological society, UK.
- Life member of Indian Women Scientists Association, Mumbai, India.
- Life member of The Indian Science Congress Association, Kolkata, India.

Vimal K. Jain

- Co-Editors-in-chief 'Chemistry Africa-A journal of Tunisian Chemical Society' published by Springer.
- Supervised Ph.D. thesis entitled 'Germanium and tin compounds: Synthesis, characterization and their use as single source molecular precursor' of Mrs. Alpa Y. Shah. The thesis has been submitted to Mumbai University in April 2018.
- Member, Advisory Committee of DAE-BRNS "Symposium at Seleminum Chemistry and Biology, SSCB-2017.
- Member , Adviosry Committee of UGC-SAP Sponsered National Conference on " Recent Development in Chemical Science, University of Mumbai (8-9 March 2018)
- Member, Adviosry Committee of 4th DAE BRNS NWMC-2017 (15-16 December, 2017) UM-DAE CEBS.

6.1 Research activities of School of Biological Sciences

Prof. Jacinta D'Souza

Characterization of Multiprotein Complexes involved in ciliary diseases

Proteins are now known to function together with other protein partners in a given biological process. A Multiprotein Complex (MPC), is therefore, a cluster of two/more associated polypeptide chains, forming a quaternary structure linked by non-covalent interactions. MPCs are broadly classified as stable and transient. They have been using the biflagellated, unicellular alga *Chlamydomonas reinhardtii* for the identification, isolation and characterization of MPCs – the cilium for stable complexes, aberration in protein complexes using ciliary mutants and stress-induced ciliary genes whose proteins contribute to form transient complexes.

Characterization of stable FAP174-AKAP240 complex from the flagellum

Cilia are fine thread-like organelles of motility & sensory perception protruding from several cells. These function as organelles of motility and drive out toxins, bacteria, mucus from the body. Almost 70% of the cells in the human body harbor these structures and any aberration to this organelle leads to ciliary diseases and so, in principle can affect that organ of the human body which contains defective cilia. Although the mechanistic details of motility remain elusive, the dynein-driven motility is regulated by various kinases and phosphatases via the central pair apparatus. This laboratory has used two-pronged approach to dissect the molecular details of the central pair apparatus (CP); mapping the CPA proteome and studying its architecture. They used FAP174 as bait to isolate the AKAP240-FAP174 complex from the C2 of the CPA
(Venkatramanan G. Rao and Jacinta S. D'Souza).

This study has shown that the N-terminus of Chlamydomonas Flagellar Associated Protein (FAP174) orthologous to the mammalian MYCBP-1 is similar to those RII domain-containing proteins that have binding affinities to AKAPs. The binding of this C2-based protein was rather weak with AKAP97/RSP3, while its binding to AKAP240 was very strong. Using immunoprecipation technique, they have shown that the AKAP240-FAP174 complex harbors 6 partners and whether hydin is a part of this complex is being explored. Since the nucleotide sequence of AKAP240 remains unknown, this group has devised a novel idea of confirming the RII-binding properties of FAP174. For this, they have conducted an in silico BLAST of AKAP240 that resulted in CCDC108 as the highest match. All CCDC's contain amphipathic helices and are known to bind to AKAPs via this domain. A variant of CCDC108 was also designed. Hence, the amphipathic helix of CCDC108 and its variant were cloned, over-expressed and peptides purified and used in an exhaustive overlay assay to study its binding to an array of R2D2-containing proteins such as mouse, MYCBP-1, RII-binding protein, full-length RII protein, DPY-30 domain containing protein, FAP174 and its three variants. Studies have indicated that FAP174 binds strongly with CCDC108, but not its variant indicating that it indeed is an R2D2 protein. In silico analyses,

and several biophysical techniques including Raman and FTIR coupled with PLSR have further confirmed that FAP174 is 65% helical in nature

The interactors of AKAP240-FAP174 complex have been identified and is adenylate kinase-rich; these being FAP70, FAP75, FAP147, CPC1, HSP70 and FAP42. Mutations in the respective genes would help characterize this complex and, mutants for FAP174 and hydin genes have been obtained and confirmed using biochemical and molecular tools. Vectors have been designed and constructed so as to rescue these mutants. Screening the transformants for a rescue phenotype is ongoing
(Yogesha M., Percival D'gama Venkatramanan G. Rao, Santhosh Chidangil and JS D'Souza).

Identification of transient protein complexes involved in the stress-induced physiology of Chlamydomonas reinhardtii: a question of survival versus death –

This study showed that the vegetative cells of *C. reinhardtii* respond differentially to abiotic stress conditions and this could be attributed to the various genes that are regulated vis-à-vis the stress. Under certain stress conditions, these undertake a cell death program, while under some other conditions these survive. They have characterized the palmelloid and apoptotic physiologies. Currently, the KCl-induced clustering phenomenon is being investigated in detail
(Kanak Gawde and JS D'Souza).

Their investigation leads to the crucial question of stress-induced survival and death in *C. reinhardtii*; the involvement of cilia in this tug-of-war is being explored. In order to dissect this phenomenon, two molecules have been selected: (1) a Caspase-3-like protein (CrMC2) that might play a role in the stress-induced PCD process; CrMC2 gene and its variant has been cloned, over-expressed and is being purified to homogeneity (Priya Mishra, Akifa Ansari, Pinki Gehlot, Kasuba Chaitanya K. and Jacinta S. D'Souza). (2) Exploring the survival role of a BolA protein. Real-time analyses of bolA transcripts from *C. reinhardtii* cells exposed to abiotic stress conditions is under investigation. Meanwhile, six GRX (1-6) genes have been cloned and the expression of one of these, viz. GRX2 has been successful. The protein has been purified and its biophysical characterization using Raman, FTIR and CD performed
(Yogesha M, Vikram Saini, Dolly K. Khona, Pratik K. Mandal, Maryam Khan, Santhosh Chidangil and Jacinta S. D'Souza).

Electrostatic engineering of charge clouds around DNA inhibits strand breakages: Femtosecond laser-induced damage to plasmid DNA in aqueous medium manifests itself as single and double strand breaks. Such breaks result from interactions involving low-energy OH-radicals (and electrons) in the laser-induced plasma generated in water. We have discovered that strand breakages are significantly inhibited upon addition of salts (in physiologically-significant concentrations) to the aqueous medium. A simple model rationalizes our observations and suggests that it is feasible to electrostatically "engineer" the ion atmosphere around DNA so as to prevent damage-inducing free radicals reaching DNA strands and causing damage.

(Marilyn P. Sequeira, JS D'Souza, AK Dharmadhikari, JA Dharmadhikari, Parinda Vasa and D. Mathur).

Dr. Manu Lopus

The group focuses on understanding the mechanisms of cancer progression and development of strategically-designed anticancer drug formulations against breast cancer, including triple-negative breast cancer (TNBC) and pancreatic cancer. The Lab investigates the means and mechanisms of induction of multi-phase cell cycle arrest, therapeutic targeting of resistance-causing tubulin isotypes, and targeted elimination of cancer cells.

Scope and benefits: Despite the advances in cancer chemotherapeutics research, efficient therapeutic targeting that can specifically and completely eliminate tumour cells is yet to be achieved. With focus two of the most malignant neoplasms, TNBC and PC, the scope of the work includes devising treatment strategies that can induce cell cycle arrest in multiple phases for the complete elimination of the tumor cells, therapeutic targeting of resistance-causing tubulin isotypes, and centrosomes-targeted, specific elimination of tumour cells (Fig 1).

(Grace Nirmala, Prachi Verma, Ms. Nayana Nambiar, M. Lopus).

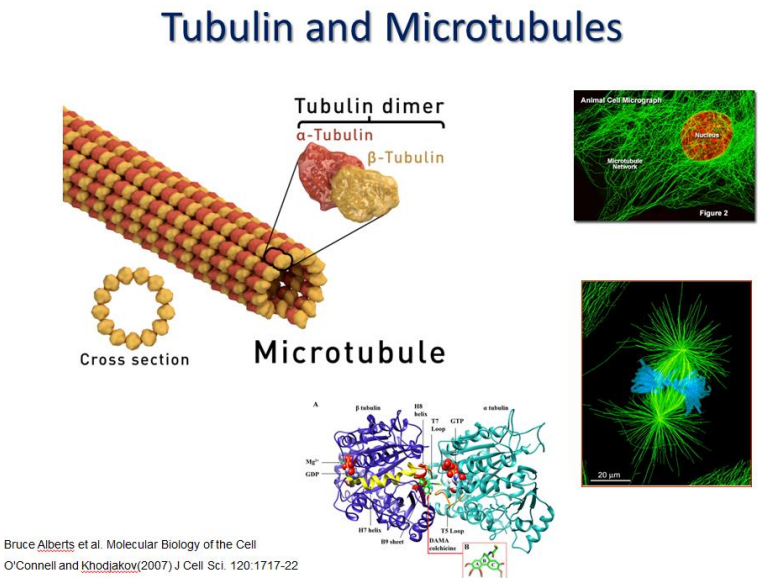


Figure 1: Tubulin and microtubules, the prime targets for anticancer drug development. Microtubules are dynamic cytoskeletal filaments made up of the protein, tubulin. They play several crucial functions in cell division.

Discovery of a novel form of cell cycle arrest by gold nanoparticles and their therapeutic potential

A novel, tubulin-targeted antiproliferative mechanism of action of tryptone-stabilized gold nanoparticles (TsAuNPs) has been unrevelled. TsAuNPs were found to be inhibitory to the viability of human pancreatic, cervical, and breast cancer cell lines with the highest efficacy against PANC-1 cells. TsAuNPs-mediated inhibition of cell viability

involved robust cell cycle arrest (G0/G1 and S-phase) followed by apoptosis. They further demonstrated that that TsAuNPs inhibit cell viability by inducing differential cell cycle arrest possibly through disrupted dynamicity of cellular microtubules. The therapeutic potential of their finding is that if combined with a drug that arrests cell cycle at the G2/M phase and targets this combination to the tumor, it would effectively eliminate tumor cells which are in different phases of their division cycle (Fig. 2).

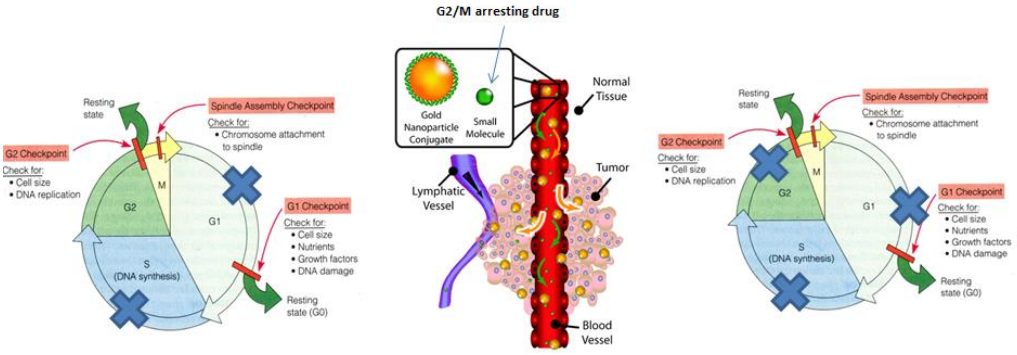


Figure 2: A combinatorial strategy involving the gold nanoparticles and a G2/M arresting drug to eliminate tumor cells which are in different phases of their division cycle

Mechanism of apoptosis induced by a novel clustering of supernumerary centrosomes

Recently a novel mode of cell death induction, that is, by an unusual clustering of supernumerary centrosomes. Many cancer cells harbour multiple centrosomes has been identified. Prompting the centrosomes to cluster in a special manner can bring forth rapid cell death (Fig. 3). It is found that some peptide-stabilized gold nanoparticles can do this job. Key proteins involved in this mode of cell death using mass spectrometry and computer-assisted proteome profiling, are being deciphered.

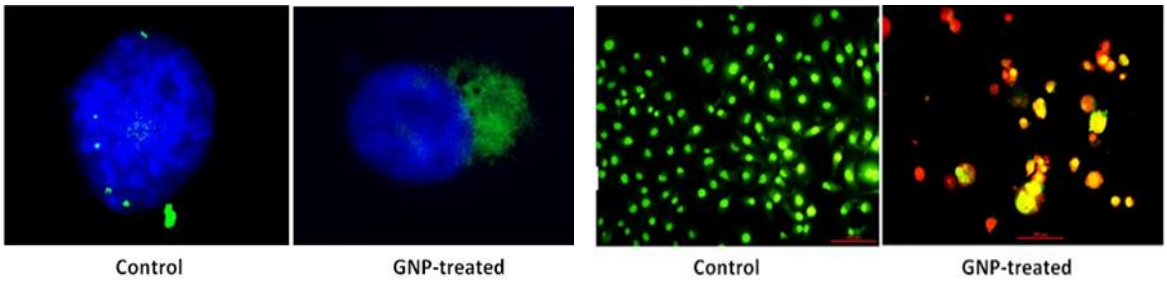


Figure 3: An unusual clustering of supernumerary centrosomes in MDA-MB-231 cells (left two images) and the resultant cell death (right two images)

Other Projects*:* The molecular details of the working of ancient ayurvedic formulations and active natural components in cancer cells are also being investigated. Their research findings on the anticancer mechanism of Triphala were published in the journal, ***Biomedicine & Pharmacotherapy,*** and the studies on Safranal– the aroma-giving component of saffron– was published in ***Phytotherapy Research***. Another project focuses on photodynamic

antitumor theranostics and their mechanism of action in cancer cells. Their findings were published in the ***Journal of Photochemistry & Photobiology A: Chemistry.*** Tubulin isotype-specific interactions and the anticancer potential of a natural product, beta-sitosterol, a study carried out in collaboration with Prof. Pradeep Naik, Sambalpur University, Odisha, was published in the ***Journal of Biomolecular Structure & Dynamics.***

Dr. Sirisha L. Vavilala

The group focuses on identification and characterization of medicinally important bioactive compounds from plants and microorganisms, understanding their coordination with stress response programs and elucidating the regulation of metabolic pathways. The lab uses varied integrated approaches that include plant biology, metabolomics, functional genomics and biochemistry in order to understand and elucidate the metabolic pathway regulators of plant and algal primary and secondary metabolism. Their group tries to decipher the biosynthetic mechanistic pathways of these therapeutically useful compounds and improve their production by metabolic engineering.

Isolation, Characterization and Antioxidant Potential of NaCl Induced Sulfated Polysaccharides from *Chlamydomonas reinhardtii*

The sulfated polysaccharides from *Chlamydomonas reinhartii* a fresh water alga is extracted by hot water extraction method using 80% ethanol. The organism is subjected to increasing concentrations of NaCl such as 5mM, 10mM, 20mM and 30mM to check whether it can produce more amount of sulfated polysaccharides or not. The biochemical analysis showed increased amount of carbohydrate up to 27% in NaCl treated samples as compared to control showing 18%. Sulfate content and amount of uronic acid was also found to be increasing to 23% each as compared to control showing only 7%(sulfate) and 12% (uronic) respectively. The SPs showed hydroxyl scavenging activity of 75-93% in stress samples as compared to control showing only 64%, DPPH scavenging activity of 39-44% in 1mg/ml concentrations. The extracts also showed 62-68% total antioxidant capacity at 1mg/ml concentration of each extracts and metal chelating ability rising from 20-60% in 8mg/ml concentration in presence of increasing concentration of NaCl respectively. The ferrous reducing power of the extracts also increased with increasing concentrations. The significant amount of sulfate and uronic acid content showed that fresh water alga can produce SPs similar to marine algae. The higher antioxidant capacity results under NaCl stress conditions gives an insight that the SPs can be effectively to use to degrade the reactive oxygen species that are known to cause harm to cell machinery, likewise having potential to be used as therapeutic agents or to use them for salt intolerant plants.
(Ramya Iyer and V.L.Sirisha)*

Antioxidant potential of oxidative stress induced sulfated polysaccharides from *Chlamydomonas reinhardtii*

Neurodegenerative diseases are disorders of the central nervous system and a common cause of physiological and economic burden worldwide. In spite of putting significant efforts, effective treatment for cure of disease has not been developed so far. The majority of the currently available drugs for the treatments of neurodegeneration are either

synthetic or obtained from terrestrial based natural products. There is urgent need of efficient drug candidates from alternate natural sources due to sustained failure of conventional drugs in successful prevention of the disease, coupled with the multiple adverse side-effects. Marine ecosystem produces very rich source of potential natural compounds with a broad range of distinctive pharmaceutical activities. It is known that many marine algae species contain sulfated polysaccharides (SPs) and their lower molecular weight oligosaccharide derivatives which are biocompatible, biodegradable and have been shown to offer numerous health benefits. In this study, sulfated polysaccharides (SPs) from Chlamydomonas reinhardtii (Cr) were induced under oxidative stress (2.5µM menadione) and were isolated by hot water method using 80% alcohol. The chemical analysis of the extract showed there is 82% total carbohydrates, 44% of sulfate and 53% of uronic acid content in the menadione treated extract. Further, the Cr-SPs showed significant hydroxyl radical scavenging activity, DPPH radical scavenging activity at 0.01–1 mg mL−1, ferrous chelating ability, and total antioxidant capacity. These results indicate that Cr-SPs find promising opportunities for antioxidation and hence neuroprotection.
(Bitarka Bisai and V.L.Sirisha)

Effect of nitrate stress on antioxidant activity of sulfated polysaccharides isolated from *Chlamydomonas reinhardtii.*

In this study, sulfated polysaccharides from *C. reinhardtii* were attributed to sodium nitrate stress in the concentrations 5mM 10mM, 20mM, 30mM and a control. The extraction was carried out by hot water method using 80% ethanol. The percentage yield calculation resulted in an increased percentage yield from control to 30Mm indicating increase in sulfated polysaccharide due sodium nitrate stress. Biochemical analysis showed high sulfate and carbohydrate content with up to 60% of uronic acid content and 40% phenolic content contributing in its structure and may be function. Also, reducing and non-reducing were found in concentrations up to 6% and 89% respectively, the composition and type of which contributes the bioactivity of the sulfated polysaccharides. Various *in vitro* antioxidant assay have been used to determine its antioxidant capacity in a concentration-dependent manner. Most of the assays obtained higher activity in 5mM and 10mM concentration of sodium nitrate, it can be stated that the nitrate stress worked best at low concentrations. Hydroxyl radical scavenging assay superoxide dismutase activity and reducing potential assay showed promising results with percentage activities up to 80 and 92%; and absorbance about 0.8935 respectively with slight discrepancies in the concentrations of the samples used. While chelating assay, total antioxidant capacity assay and DPPH assay showed moderate antioxidant effect. Therefore, the high sulfate content can be subjected to high antioxidant potential in scavenging hydroxyl radical, reducing ability and dismutase activity.
(*Vaishnavi Harshad Parmar and V.L.Sirisha)*

Dr. Siddhesh Ghag

Destruction of the crop plants by pest and pathogens has developed a serious concern of food security world over. The problem is worse when a staple crop is destroyed. Banana is one such staple food consumed across the tropical and subtropical regions which

mostly constitute the developing regions of the world. Banana production is constraint due to Fusarium wilt disease caused by *Fusarium oxysporum* f. sp. cubense (Foc). Foc are classified into four different races depending on the banana cultivar which they can infect. Race 1 is predominate in major banana growing regions affecting banana cultivars belonging to the Silk and Pome. Race 2 infects cooking varieties of banana whereas race 4 is the most virulent strain of Foc that can infect almost all varieties and which is spreading rampantly. Presently, the banana growers and banana industry is dependent on race 1 resistant cultivar, the Cavendish. But race 4 is capable of infecting the Cavendish cultivars and there are no known edible cultivars of banana resistant to race 4. There were recent reports of race 4 infection in India and all the edible cultivars of India are susceptible to race 4 infections. Sustainable production of banana requires urgent and effective management practices to curb the spread of this disease. Thus it is very important to understand the disease biology and generate innovative strategies.

Studying the role of SGE1 in Fusarium wilt disease of banana

Transcription factors are distinctive class of proteins which regulates the expression of several genes required for a particular functional role. Six Gene Expression 1 (SGE1) is one such transcription factor which regulates the expression of SIX (secreted in xylem) genes which are known to be involved in Fusarium wilt infection. To functionally annotate SGE1, deletion (pCSN44Sge1KO) and complementation constructs (pCSN44Sge1) were generated and subsequently transformed into Foc race 1 strain to give ΔFocSge1 and cΔFocSge1, respectively. The putative transformants were screened on medium supplemented with hygromycin and confirmed by genomic DNA PCR. There was a lower conidial count observed in ΔFocSge1 as compared to the wild-type strain. Moreover, a lower pigmentation was seen in ΔFocSge1 as compared to the wild-type strain. Understanding the involvement of SGE1 in pathogenicity by performing an infection assay in vivo using susceptible cultivars of banana is underway.

(*Vartika Gurdaswani, Narayan Punekar, T. R. Ganapathi & Siddhesh Ghag*)

Identifying the interactors of SGE1

The N-terminus (amino acids 1-180) of SGE1 contains a TOS9 (COG5037) and a Gti1_Pac2 family domain (Pfam09729) and is conserved in the fungal kingdom. The C-terminal region however does not represent any conserved domain but have an unusual long proline-glutamine repeat stretch probably required for transcriptional activation. To study the in vitro interactors of SGE1 protein, the coding sequence of Sge1 was amplified and cloned into pET32a+ vector and transformed into *E. coli* BL21 (DE3) host system for expression of SGE1 protein. The purified SGE1 protein will be used to identify it's in vitro interactors.

(*Vartika Gurdaswani, Jacinta D'Souza & Siddhesh Ghag*)

Characterization of a bidirectional promoter

A DNA sequence of about 1000 base pairs flanked by coding sequences of two genes head-to-head on opposite strands is called a bidirectional promoter region. Bidirectional promoters suggest the likelihood of co-regulation of these genes that function in the same biological pathway. A bidirectional promoter was identified in Fusarium oxysporum which regulates the expression of two enzymes namely; xylanase and xylosidase. These two

enzymes are required for the breakdown of xylan in the plant cell wall and thus contribute towards its virulence. To functionally characterize this bidirectional promoter a plasmid vector was constructed having reporter gene pairs cloned across the ends of this promoter. The plasmid was transformed into Foc and expression analysis of these gene pair in under study. This promoter can further be utilized to simultaneously express two heterologous genes in Fusarium.
(*Ashutosh Dash, Jacinta D'Souza & Siddhesh B. Ghag*)

Dr. Subhojit Sen

How the environment affects us by loss-of-function mutations can be mimicked by highly plastic epigenetic mechanisms of gene silencing (effecting a null phenotype). It is important to recognise, that these plasticities give rise to robustness of an individual's adaptation to stress, which in turn translates to species fitness as a function of natural selection during evolution. The lab tries to evaluate mammalian models (stem cells and cancer cells) for epigenetic processes, in parallel also understands the evolutionary conservation of these mechanisms, by drawing parallels in the unicellular algal model, *Chlamydomonas reinhardtii*.

Using an "inflammation" model (widely observed in smoking, chronic diseases etc), a number of key epigenetic proteins [namely DNA methyl transferases (DNMT1/3a), HDACS (Sirt1), Polycomb complex proteins (PCGs - Ezh2 and Eed's) and histone variant H2A.Z] were shown to respond to oxidative stress and modulate gene expression both at the level of the single nucleosome as well as by modulating gross chromatin changes genome wide (O'Hagan *et al*, 2011, Sen *et al*, 2016). The group hypothesized a ROS responsive epigenetic pathway involving H2A.Z and 'bivalent chromatin' which can predict Polycomb and DNA methylation at gene loci, a form of 'stress' memory in chromatin, which can persist long after the stress has disappeared. In this regard, stressed cells were epigenetically shown to respond differentially in aging *versus* senescence paradigms. In a collaborative study with Johns Hopkins, distinct genetic signatures (modules) were identified, which are more variegated in cancers induced by stress versus very programmed when following the aging paradigm. These studies open up doors towards new biomarker development, in helping us identify cells that might have become pre-disposed to cancer. These results were recently published in the journal Cancer Cell (Xie et al, 2018).

In parallel Polycomb homologue *E(z)* of *Chlamydomonas* was analyzed across unicellular, and multicellular model organisms (both animals and plants) (Fig 1). Chlamy *E (z)* seemed to have maintain many conserved interaction and regulatory domains. The CXC domain which modulates the cataclytic domain, docked five Zn^{+2} ions that predicted an increase enzymatic activity (iTasser, Human Chlamy structural overlap, Fig 1). To test these predictions, a three step epigenetic assay was innovated, which used a phenotype based screening methodology to identify gene silencing processes which interfered effectively with mammalian drugs (HDAC and DNMT inhibitors, Kaginkar *et al*, Ms preparation). The DNA methylation inhibitor, Decitabine, affected epigenetic memory which showed that Cu stress led to DNA methylation of the transgene (alleviated by the drug, Fig 2).

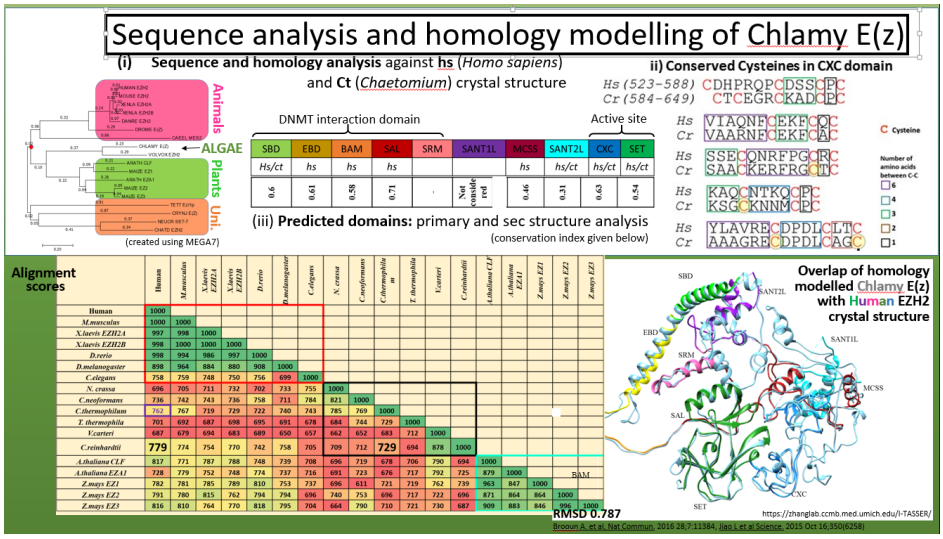


Fig 1: Sequence and Structural conservation: *Analysis of Polycomb E(z) in Chlamydomonas versus Human: Pairwise alignment by ClustalW, Tcoffee score analysis table across model organisms and a structural overlap of the predicted Chlamydomonas E(z) iTasser structure with the Human crystal.*

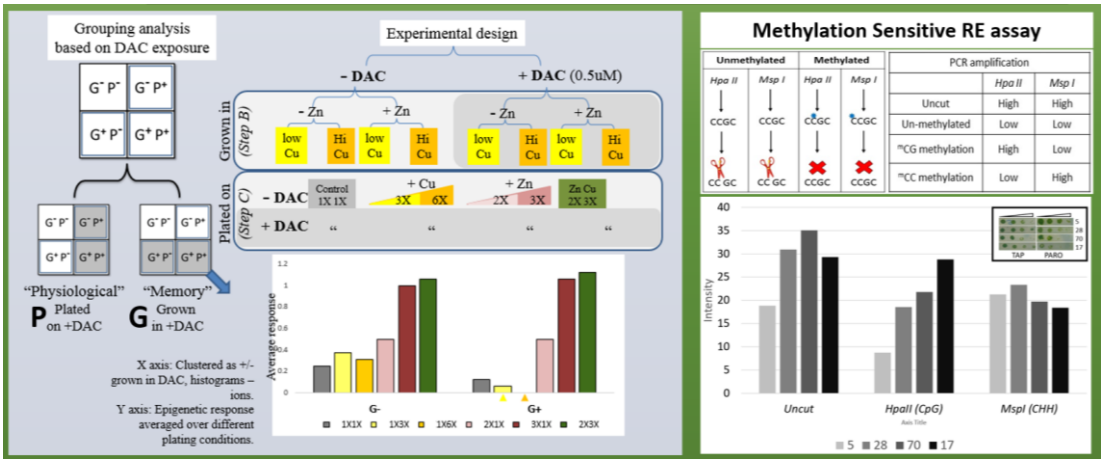


Fig 2: **DNA methylation is required for transgene silencing in Chlamydomonas:** *The figure on the left demonstrates that the memory of DNA methylation that is generated by excess Cu ions and silences the transgene (yellow bars, G-), is wiped out by a DNA methylation inhibitor, Decitabine (G+). The MSRE Assay on the right indicates that this DNA methylation is correlated with CpG methylation and not the CHG context, indicating that the transgene silencing model is more akin to Human studies.*

Chlamydomonas being epigenetically naive as a model system, lacked basic nucleosomal preparation protocols from wild type cells. The only cells where nucleosome maps could be generated were cell wall minus mutants. This was largely due to the hindrance of nuclei isolation due to the cell wall. Towards addressing this, the lab develops two methodologies to obtain nucleosomal ladders from cell wall containing wild type cells (D'Souza *et al*, 2018). Finally, using these substrates to develop chromatin

immunoprecipitation and DNA methylation assays, the group is building a molecularly tractable model for ROS dependent epigenetic gene silencing, to help understand a conservation of mechanisms from cancer to *Chlamydomonas*. Such conservation sstructure tudies will throw light on the lowest common denominator that one can now screen very cost-effectively, to discover novel epigenetically active compounds from indigenous sources, which might harbor epigenetic potential to solve environmentally related health issues.

6.2 Research Activities of School of Chemical Sciences

Dr. Neeraj Agarwal

High dipole moment organic materials for organic electronics

Non-ionic organic molecules with high dipole moments (μ) have been studied for their applications in several emerging areas such as non-linear optics, bulk heterojunction (BHJ) solar cells, etc. Dipole moment of active materials in solid state devices is one of the crucial parameter in charge carrier transport as reported earlier. The high carrier mobilities were explained based on the formation of favourable morphology owing to molecular structure of molecules. Very recently, a few organic molecules (1-4 in Chart 1) having high dipole moment with respect to DMSO (μ = 4.1 D) were developed. Molecules 1,2 have both strong electron pushing and pulling groups while in 3 all six electron withdrawing fluorine atoms are in a facial arrangement. Positioning of electron donating/withdrawing groups is responsible, to some extent, for high dipole moment. Polymer of 4 showed the effect of high dipole moment on better charge separation. Imidazoanthraquninone based new molecules (AQ01 and AQ02) were designed and synthesized in our group. Photophysical, electrochemical and morphological studies show the nano-assembly formation and high dipole moment. High hole mobility for AQ01 was found. Role of dipole moment is studied in the formation of different nano- assemblies which believed to be responsible in deciding the properties of solid state devices.

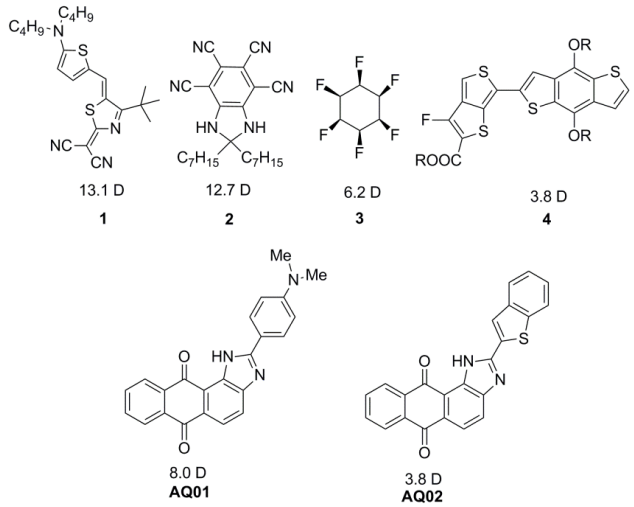


Chart 1: A few examples of high dipole moment organic materials along with **AQ01** and **AQ02** designed for this work

Design and development of TADF materials for OLED application

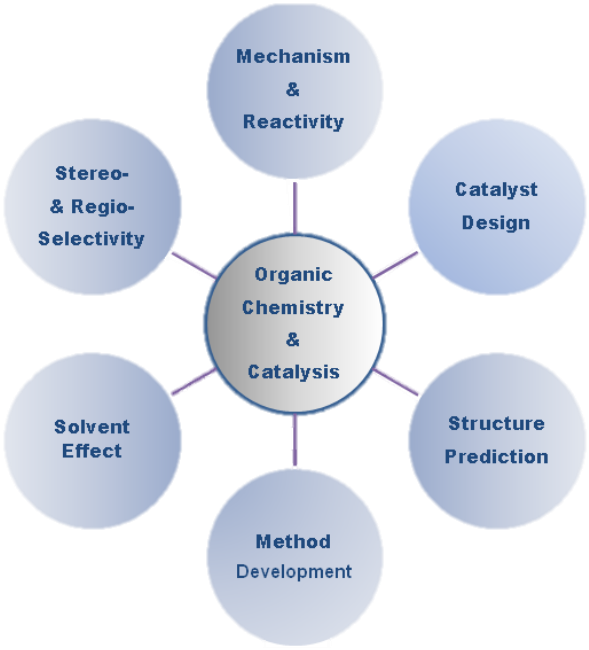
In OLEDs made of fluorescent materials, generation of photons is achieved from radiative recombination of singlets. OLEDs composed of phosphorescent materials were shown to harvest both singlet (S_1) and triplet (T_1) energy excitons. Development of efficient and cost effective phosphorescent materials for entire visible region is still challenging due to several issues like short operational lifetime, poor colour purity etc. Molecules having small energy difference between the lowest singlet (S_1) and triplet (T_1) excited states can up-convert from the T_1 to S_1 by thermal energy absorption at room temperature and radiates from the S_1. Such emission phenomenon is called thermally activated delayed fluorescence. TADF molecules have potential to convert the triplet excitons to singlet and thus produce more emission when used in OLEDs. Therefore, theoretically 100% internal efficiency can be achieved in OLEDs using efficient TADF molecules as is the case with phosphors in OLEDs. The proposed research is aimed to develop new organic TADF materials for high external efficiency of organic light emitting devices in broad visible spectrum to near infra-red region. Acridone based molecules having aliphatic and aromatic diamine substituents were recently reported by us. Substitution of amines on acridone produced the charge transfer properties in these molecules. Photophysical properties revealed the tuning of emission with different substitution. Fluorescence life time decay showed two life times in short and long range. From these encouraging results on acridone-diamine, we believe that it will be worth to explore the detailed photophysical properties of acridone based charge transfer complexes. Currently, new acridone based molecules are under study for better OLED efficiency. In these derivatives substituents is attached to acridone through N and it should give us non-planar twisted structure. Electron donating/withdrawing groups on aryl substituents altered the electronic properties.

New BODIPY derivatives for biological applications

A series of heteroaryl substituted BODIPY dyes were synthesized and reported. 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. BODIPY derivatives having two pyrrole groups showed absorption and emission in therapeutic window (~650 – 800 nm). Quantum yields of these compounds were as high as 0.65 with respect to Rhodamine B. Cellular uptake of a few BODIPY derivatives was demonstrated using cervical cancer, fibroblast and PANC-1 cells. Inhibition of the viability of PANC-1 cells in a concentration- dependent manner was observed. An IC_{50} was found to be ~2.4 μ*M*. Selectivity of these dyes towards the cancerous cells has also been investigated. It has been observed that there is minor difference in the physiological environment of cancerous cells as compared to healthy cells. BODIPY dyes which can sense this small difference in pH, viscosity will be synthesized. Dyes which become fluorescence active and produce singlet oxygen in large quantity near cancerous cells, only. Design and synthesis of new dyes are underway to bring selectivity towards cancerous cells.

Dr. Mahendra Patil

The group has been working in a broad area of organic chemistry and catalysis and focuses on solving problems in organic, bioorganic and organometallic chemistry using experimental and computational methods. The group employs a suite of computational tools to investigate the mechanism of reactions, and to identify the factors responsible for the reactivity and selectivity of the reaction. Insights obtained through computational investigations are used to design new catalyst or to develop new synthetic methodologies



Stereocontrol through Synergistic Catalysis in the Enantioselective α-alkenylation of Aldehyde

In this work, the stereoselectivity-determining step of the enantioselective α-alkenylation of aldehyde was investigated using the density functional theory (DFT) methods to gain insight into the origin of the product selectivity. It has been observed that the catalytic activation of reactants in the form of enamine and alkenyl Cu(III) intermediate significantly reduces the activation barrier of the addition step through an improved interaction between these two intermediates at the transition state (referred as enamine and Cu catalyst fragments of the transition state in the text). The transition state stabilization through interaction between catalytic fragments, as demonstrated by the interaction/distortion model, clearly outperforms destabilization incurred due to the distortion of catalytic fragments and hence is recognized as a major factor contributing to the high stereoselectivity of reaction. Furthermore, the metal–enamine interaction described through the Cu···C7 distance is identified as a vital non covalent interaction at the transition state. Calculations show that the catalytic (covalent) activations and metal-enamine interaction can operate in tandem to amplify the net interaction between two catalytic fragments. The cooperative nature of these interactions is also reflected in the trend of

interaction energies, which show a large variation with a subtle change in the metal-enamine interaction. The computational model presented in this paper, verified for the different catalytic combinations of chiral amine and Cu catalysts successfully rationalizes the experimentally observed stereoselectivity.

Dr. Avinash Kale

Understanding Actin polymerization dynamics/regulation in Apicomplexans

Purification for actin from Bovine muscle is optimized and has been successfully isolated. Currently we are working towards understanding the polymerization process for Actin using Biophysical techniques. Currently working on a manuscript of a review article titled: "Actin regulation in Apicomplexan: the structural, functional, and evolution story so far". Work is also in progress to test the effects of small compound and to set up co-crystallization at IIT, Bombay. I am collaborating with Dr. Prasenjit Bhaumik on this project. Trials so far has yielded crystals for five different complexes. In collaboration with Dr. R. Natesh at IISER Trivandrum we are working on cryo-imaging of the acit-ligand/acting-regulators complexes

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

Mosquito breeding facility has been successfully developed at Haffkine Institute. Ethical clearance for the project has been obtained. About 300 bacterial isolates have been collected from different locations of Mumbai and its suburban areas. High throughput screening is in process to test the larvae-cidal activity of these strains. We had observed differential toxicity for nine of the strains against culex larvae. Have optimized the protocol to isolate the proteins and the metabolites from the above mentioned nine strains. Data have been successfully collected on these proteomes and metabolites using ESI-MS Q-TOF Mass spectrometer. These nine strains have been characterized using 16S-RNA sequencing method and one of the strains is very likely a novel one. Work is progress to characterize is further. Successful imaging of these strains on Scanning Electron Microscope (SEM) has been carried out.

Organelle dynamics and cellular ageing in yeast

This project is in collaboration with Dr. Shirish Nagotu at IIT Guwahati. Work is currently in the progress for optimizing the growth curve for *Saccharomyces cerevisiae*. Clone for an important protein, Pex11, involved in yeast ageing has been made. Work is in progress to optimize the purification of the recombinant protein.

Dr. Sinjan Choudhary

Unravelling the inhibitory activity of Chlamydomonas reinhardtii sulphated polysaccharides against α-Synuclein and its' familial mutants fibrillation

Misfolding, aggregation and accumulation of amyloid-forming proteins leads to varieties of protein aggregation diseases known as amyloidoses. Marine ecosystem produces rich source of potential natural compounds with a broad range of distinctive pharmaceutical

activities. These marine reservoirs such as marine plants, animals and microbes produce various bioactive compounds which have various medicinal properties.

It is known that many marine algae species contain sulfated polysaccharides (SPs) and their lower molecular weight oligosaccharide derivatives which are biocompatible, biodegradable and have been shown to offer numerous health benefits. These algal SPs have high nutritional value and pose anti-malaria, anticoagulant, anti-inflammatory, anti-viral, anti-malaria, antiparasitic, antioxidant, anti-thrombotic, antilipidemic properties which make them suitable for nutraceutical, pharmaceutical and cosmeceutical purposes. Keeping in view of the above background, marine algal polysaccharides could serve as an efficient alternative approach for the therapy and management of protein aggregation diseases. Here, the anti-Parkinson's potential of SPs was demonstrated *invitro*. Sulfated polysaccharides were extracted from the green algae *C. reinhardtii* and then checked their anti-amyloidogenic activity for α-synuclein and its familial mutants aggregation, responsible for Parkinson's disease. In order to check anti-amyloidogenic properties of the SPs extract of *C. reinhardtii*, thioflavinT (ThT) binding assay was performed. Figure 1A and 1B shows that SPs have suppressed the α-synuclein fibrillation significantly in a concentration dependent manner. Figure 1C represents the TEM image of α-synuclein in presence of 1 mg ml-1 SPs after 65 h of the fibrillation process. It was clear from the above results that the polysaccharides inhibit α-synuclein aggregation/fibrillation. The results also demonstrate the therapeutic potentials of sulfated polysaccharides against α-synuclein fibrillation associated diseases and pursue of this project will open up a way for development of new phytopharmaceuticals.

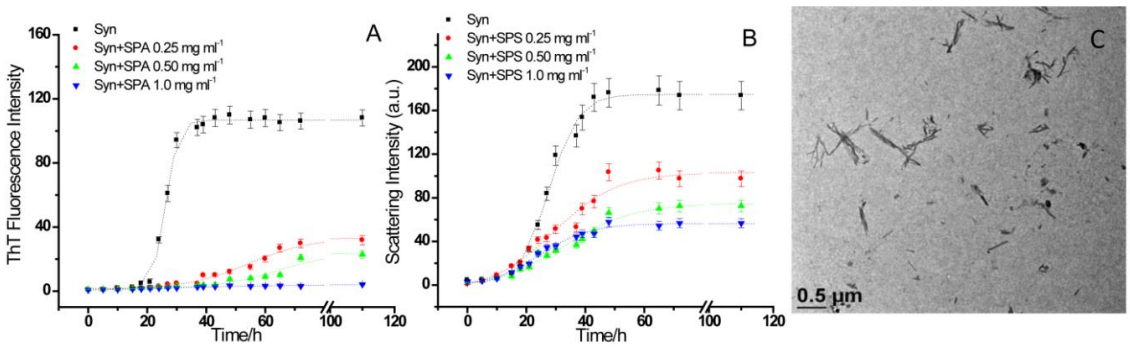


Figure 1: Kinetics of α-Syn fibril extension in the absence and in presence of different concentration of SPs studied by monitoring the changes in (A) ThT fluorescence emission intensity, (B) 90° light scattering intensity and (C) TEM image of α-Syn in presence of 1mg ml-1 SPs after 65 h of the fibrillation process.
(with Dr. V. L. Sirisha, Ms. Shreyada N. Save, Ms. Gitanjali Panigrahi)

Identification of Safranal, a natural compound as anti-Parkinson's agent

Crocus sativus L., commonly known as saffron is cultivated in many countries and is used in cooking, food coloring, in perfumes and cosmetics. Saffron is composed of at least four active ingredients which include crocin, crocetin, picrocrocin and safranal. Safranal is the lipophilic component of saffron and has monoterpene aldehyde chemical structure

which is responsible for aroma of saffron. Safranal has been found to show anti-oxidative and anti-apoptotic properties showing considerable neuroprotective effects. Safranal is known to have anti-tumoral, and anti-oxidant activity in the different diseases such as neurological diseases, cancer, and diabetes mellitus in animal models and several cell lines including lung and prostate cancer, but the effect of safranal for prevention of Parkinson's disease is unexplored. In this background the effects of safranal on the fibrillation of α-Syn has been studied using combination of spectroscopy and microscopy. Kkinetic studies by ThT binding assay (Figure 2) and 90° light scattering assay suggest that safranal inhibits α-Syn fibrillation. The CD results suggest that safranal prevents conversion of α-structures/random coil structures into β-sheet rich structures. The prevention of α-Syn fibrillation by safranal has also been confirmed by TEM experiments.

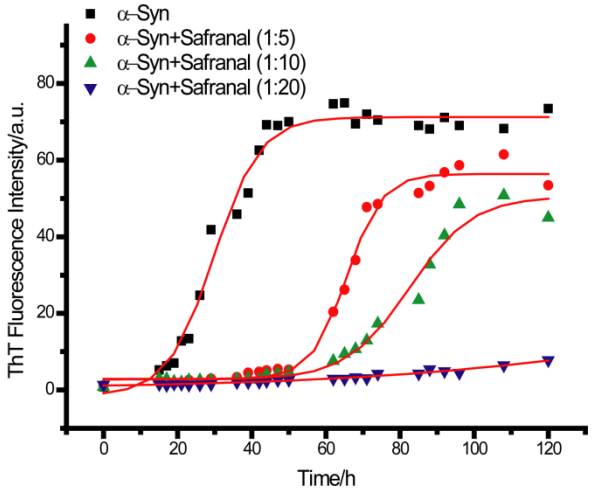


Figure 2: Kinetics of α-Syn fibril extension in the absence and in presence of different concentration of safranal studied by monitoring the changes in ThT fluorescence emission intensity.

(With Ms. Shreyada N. Save)

Effects of natural plant products beutien, fistein, scopoletin on α-Synuclein (α-Syn) aggregation

In spite of investing considerable efforts in searching for suitable therapeutics drugs against protein aggregation diseases not much success has been achieved. Recently some of the natural plant products have been reported to have anti-amyloidgenic and neuroprotective effects and there is possibly of existence of such type of other potent natural products. Plant-derived natural products have made their own niche in the treatment of neurological diseases since time immemorial. Parkinson's disease (PD), the second most prevalent neurodegenerative disorder, has no cure and the treatment available currently is symptomatic. Upon scientific investigations it was found that Mucunapruriens contains long term amelioration of Parkinsonism. Ginsenosid, Rg1, Baicalein, Curcumin, Gastrodin, Resveratrol, Acteoside, Echinacoside and Paneoniflorin are some of the examples of medicinal herbs used to treat Parkinson disease. In this work the binding of plant products daidzein, butein, scopoletin and fisetin with the wildtype α-Syn monomer as well as oligomer and then modulation of α-Syn fibrillation has been studied using fluorescence

spectroscopy. It was found that all four compounds bind with monomeric and oligomeric α-Syn with different binding affinities (Figure 3). ThT fluorescence kinetics studies have demonstrated that binding of butein, fistein and daidzein leads to prevention of fibrillation of α-syn whereas binding of scopoletin causes enhancement of α- syn fibrillation. To know about the mechanism of inhibition or induction of α-syn fibrillation a detailed biophysical investigation needs to be done.

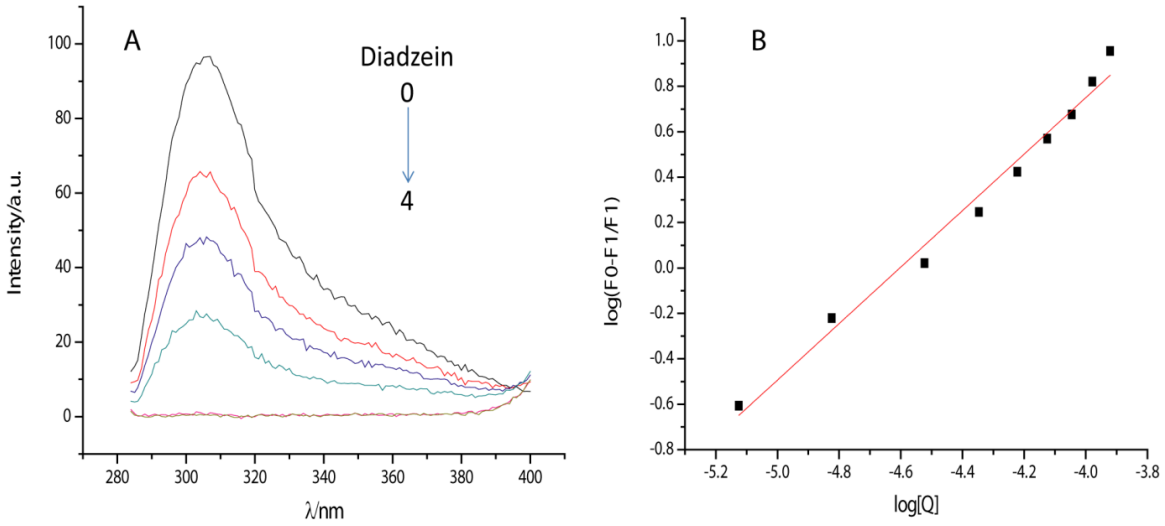


Figure 3: (A) Intrinsic fluorescence emission spectra and (B) Stern-Volmer plot of 15μM α-Syn in the absence and presence of different concentrations of daidzein.
(Name of Student involved- Ms. Akshaya Tawde)

Dr. Basir Ahmad

Multi-angle and multidisciplinary attack on protein misfolding and aggregation

The major goal has been to understand the molecular mechanism of formation, inhibition and disintegration of protein aggregates. Protein aggregation is the process by which proteins misfold, stick to each other and form fibrillar and/or amorphous aggregated species. The formation of proteins aggregates is associated with a spectrum of human diseases of dramatic social impact such as Alzheimer's and Parkinson's diseases, type 2 diabetes, cataract, cystic fibrosis and many others amyloidoses. The aggregation inhibition study deals with the cessation of the process of the aggregation, whereas, the disintegration study deals with dissociation of pre-formed aggregates into monomers and or non-toxic oligomers. Natural, semi-synthetic and synthetic small molecules or protein engineering for inhibition and disintegration studies have been used. Knowledge gained from this investigations would help

1. To elucidate the physicochemical features of protein folding
2. To understand molecular and biochemical basis of aggregation based diseases
3. To develop drugs to prevent the progression of aggregation disease and cure the pre-existing disease.

A molecule that is capable of both preventing conversion of native protein into aggregate and disintegrating pre-formed aggregates into monomer would be an ideal drug candidate for treating aggregation based disease. A broad range of biophysical and imaging methods, including UV/Visible spectrophotometry, fluorescence, circular dichroism, TEM etc have been used for in vitro studies.

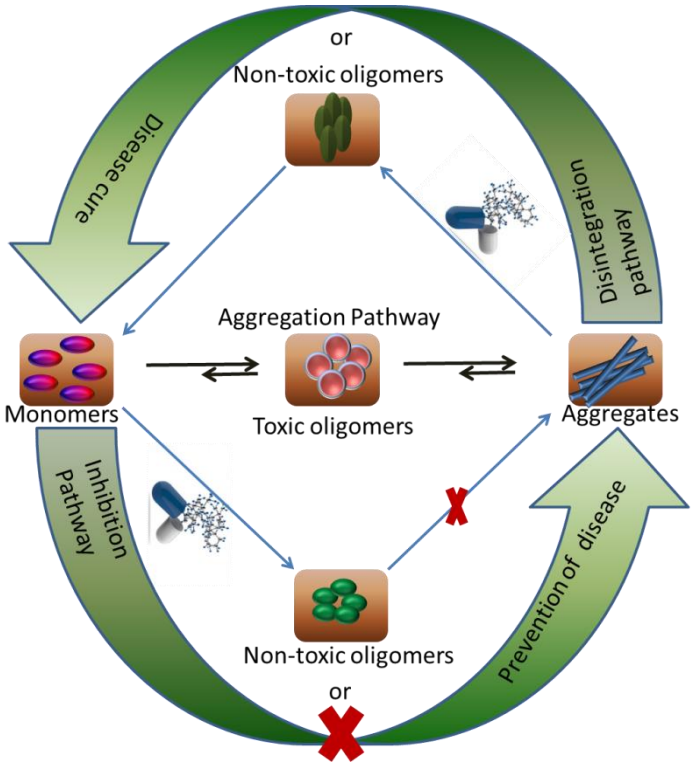


Fig.1. Therapeutic strategies of Dr Basir's Lab for protein aggregation diseases.

Prof. Swapan Ghosh

Theoretical study of optically controlled Electron-Transfer Reaction Kinetics and Solvation Dyanmics

Experimental results for optically controlled electron-transfer reaction kinetics (ETRK) and nonequilibrium solvation dynamics (NESD) of systems like Coumarin 480 in DMPC vesicle show a dependence on the excitation wavelength λ_{ex}. However, the well known Marcus theory and linear-response-theory-based approaches for ETRK and NESD, respectively, predict these processes to be independent of λ_{ex}. In this work, a new theory has been developed in one-dimensional reaction coordinate space, where the effect of innumerable Franck–Condon states is included through λ_{ex}. The present theory not only sheds light on the origin of failure of the existing theories but also gives the correct trend for the effect of λ_{ex} on both ETRK and NESD. More importantly, the calculated results of NESD are in excellent agreement with the experimental results for different values of λ_{ex}. The new

theory therefore advances the knowledge of the dynamics of photoinduced nonequilibrium processes.
(*Kriti Gupta, Ex-student of CEBS, and Alok Samanta of BARC*)

Computational Design of photocatalyst for hydrogen production through water splitting : Enhancement of Visible Light Photocatalytic Activity of $NaTaO_3$ by co-Doping Strategy

Among different photocatalysts developed so far for the generation of hydrogen through water splitting, NaTaO3 has been at the forefront due to its excellent stability and tunable electronic and optical properties. However, to extend its applicability to the range of visible light, the band gap has to be reduced significantly, an efficient way being through doping with carbon in the presence of Cr, or Mo, or W. Although, monodoping with either C or Cr/Mo also reduces the band gap, it introduces localized defect states, which limits the applicability for photocatalytic purpose. This is avoided by forming co-doped systems, using the codopant pairs [(Cr, C), (Mo, C) and (W, C)] in 2:1 relative proportions of the dopant elements, the advantage being that spontaneous formation of vacancy defects, which are efficient sources for charge carrier recombination centers, is minimum due to charge compensation. Besides, synthesis of 2:1 type of codoped system is also found to be energetically more feasible. Among the three 2:1 types of codoping, both (Mo, C) and (W, C) pairs lead to formation of favorable band structure with significantly reduced band gap (2.01 and 2.23 eV, respectively). The calculated frequency dependent dielectric function gives an idea about the shift in optical spectrum toward visible region due to codoping. Finally, the feasibility of water splitting involving the two codoped systems have been checked by aligning their band edge positions with respect to water redox levels.
(B. Modak of BARC)

Computational Exploration of Triazine and Heptazine based Systems as Self Assembled Molecular Materials

Two dimensional materials formed from the molecular self assembly of monomers through non-covalent interactions are of great importance in designing complex nanostructures with desired properties. Carbon nitride based heterocyclic systems, triazine and heptazine are found to be promising candidates for generating various self assembled materials through (N....H) hydrogen bonding. Here, an exploration has been carried out by considering graphyne and graphdiyne like self assembled structures for carbon nitride materials using DFT calculations. The monolayer structures, stacked in different configurations as well as the surface assembly based structures on Au (111) surface, have been systematically investigated. In all the four different monolayer structures, the monomers are found to interact through the N...H hydrogen bonding. The electronic structure results indicate that the electronic properties in these structures can be tuned through the variation in the length of the acetylinic unit. The minimum energy stacked bi-layer structure of triazine based material exactly matches with the experimentally reported structure. Surface assembled studies of triazine based system show strong interaction between Au (111) surface and the carbon nitride monolayer.
(Ankush Singhal, Ex-student of CEBS and K. Srinivasu of BARC)

Dr. Dipak K. Palit

Syntheses and Photophysical Studies of Perylene Derivatives to Look for the Possibility of Singlet Fission Process

Ability to convert light energy into electrical energy is of utmost importance in today's world. The aim of this project is to explore singlet fission (SF) in monophenyl derivatives of perylene, which has the potential to increase the efficiency of organic solar cells by producing two triplet excitons from each absorbed photon. Two positional isomers of monophenyl perylene: Compound A (1-phenyl perylene)(Φ_F=0.89) and Compound B (3-phenyl perylene) (Φ_F=1) were successfully synthesized, purified and characterized. The group have charcterized the excited singlet (S_1) and triplet (T_1) states using steady state and time-resoved absorption and fluorescence spectroscopic techniaues. Further experiments are required to explore their potentails as singlet-fissionm materials and their applications for this purpose.

(*Collaborators: Anjali jayachandran and Neerja Agarwal*)

Dr. Sunita Patel

Unravelling disordered-to-ordered transition by side-specific mutation in the intrinsically disordered protein, Hahellin

Polypeptide chains either take up a definite structure or remain disordered depending upon the sequence and/or cellular conditions. Proteins having definite structures form ordered proteins while the proteins having dynamical ensemble of inter-converting structures under physiological conditions are intrinsically disordered proteins (IDPs). The IDPs are abundant in eukaryotes and are involved in numerous human diseases such as Alzheimer's disease, Parkinson's disease, cancer etc. Here, we propose to uncover the conformational dynamics of an intrinsically disordered protein Hahellin from the βγ-crystallin superfamily by employing the computational and biophysical techniques. Hahellin is an IDP under physiological condition which upon Ca^{2+}-binding undergoes a drastic conformational transformation and acquires a typical βγ-crystallin fold having two consecutive Greek key motifs. The IDP state consists of heterogeneous mixture of native-like and far-native conformations. Such a conformational ensemble resulted due to the repulsive interactions of the negatively charged residues in the Ca^{2+} binding sites in the absence of Ca^{2+}. To understand the conformational transition in the absence of Ca^{2+} from an intrinsically disordered state to an ordered state which is a common event in IDPs, we propose to design Apo-hahellin (AH) mutants, AH-S41R, AH-S80R, AH-S41R-S80R at the Ca^{2+} binding sites and plan to investigate employing REMD, NMR and CD.

Mechanism of amyloid fibril formation in the G-helix of myoglobin protein

Apo-myoglobin (heme-free) is a small α-helical protein found in the muscle. This protein is reported to form amyloid fibrils *in-vitro* having a cross β-structure at a higher temperature (338 K), or in the presence of a denaturant or a point mutation. The isolated full-length G-helix of myoglobin (CH_3CO-IKYLEFISQAIIHVLHSR-NH_2) is also shown to form fibril at 333 K and pH 5. However, the mechanism governing such fibril formation was not discussed. We recently published the mechanism of fibril formation in the short N-

terminal segment (Ac-IKYLEFIS-NMe) of myoglobin G-helix. Therefore, to understand amyloid fibril formation in the G-helix of myoglobin, we performed MD simulations on this peptide. The preliminary MD simulation results showed that the G-helix independently form an asymmetrical β-hairpin starting from its α-helical conformation. The tetrameric state of asymmetrical hairpin starting from the double layered parallel orientation resulted into anti-parallel orientation which is stabilized by several inter-strand main chain hydrogen bonds. Further analyses and some new simulations are in progress.

Characterization of the intrinsically disordered Hahellin through cleavage analysis

Hahellin is an IDP in the absence of Ca^{2+}. However, it adopts a well-ordered βγ-crystallin fold upon binding to Ca^{2+}. IDPs normally take part in signalling and regulatory functions. Therefore, for such proteins a tight control of their temporal existence in that functional state and its clearance thereafter needs to be maintained for proper cellular functioning. Having highly heterogeneous conformational states is an added advantage because such highly unfolded states may easily be acted upon by proteases and degraded thus easing its clearance, when its need in the cellular process is over. Degradation of IDPs is often carried out by several proteases. Preliminary investigations reveal specific cleavage pattern for intrinsically disordered Hahellin while no cleavage observed for Ca^{2+} bound Hahellin under identical conditions. It is not clear yet whether the external proteases do the cleavage or the IDP itself undergo the cleavage. Here, we are investigating the disordered state of Hahellin by analyzing the cleavage fragments employing MALDI-TOF, MS-MS and amino acid sequencer. The study aims to understand the intrinsic disordered nature of Hahellin which further be extended to other IDPs having similar characteristic.

Mechanistic insights into the conformational transition in a highly ordered M-crystallin: Implications for cataract formation

Ordered crystallin proteins are highly stable and are prevalent in the eye lens. They are present throughout the lifespan of an organism. Their concentration in the eye lens is >400 mg/ml. They are water soluble and constitute 90% of the total soluble proteins present in the lens. They form compact and globule-like transparent elastic structure which provide the desired refractive index to the eye-lens. The age-related cataract constitutes 48% of the blindness in the world population which is caused due to aggregation of the lens crystallins. The vertebrate eye-lens crystallins are classified into α-, β- and γ- crystallins. The α-crystallin forms a separate family of small heat shock proteins and act as ATP independent chaperone under stress conditions by binding and rescuing the unfolded/unfolding proteins. On the other hand, the β- and γ- crystallins form a separate family by having similar structural topology. They are shown to play a role in Calcium homeostasis. Binding of Ca^{2+} provide additional structural stability to the βγ-crystallins. The eye-lens βγ-crystallins bind and sequester free Ca^{2+}. The free Ca^{2+} otherwise activate proteolytic enzymes and nucleases that could lead to protein degradation and lens dysfunction. The β- and γ-crystallins comprise of duplicated domains having double Greek key motifs. The proteins under γ-crystallin family are monomeric, whereas the homologous β-crystallin family members form oligomeric structure. The Trp residue in the eye-lens γD-crystallin is conserved and is present in the hydrophobic core. The Trp, in presence of sunlight, causes extensive fluorescence quenching

and protect the lens from ultraviolet damage. An archael protein, M-crystallin from *Methanosarcina acetivorans* is a structural homolog of eye-lens γD-crystallin. It also has a conserved Trp (W45) residue located in the hydrophobic core. The protein 3D structure is solved by X-ray (PDB ID:3HZ2) as well as by NMR spectroscopy (PDB ID:2K1W). The specific β-sheet Greek key motif of βγ-crystallin offers optimal inter- and intra- molecular interactions. There are certain residues at specific position which are important in stabilizing the Greek key motif. Mutation in these residues can lead to partial folding and/or unfolding of the βγ-crystallin topology which often lead to aggregation. Such aggregated structures are insoluble and scatter the visible light and result in loss of lens transparency. Here, we propose to model and characterize the partially folded or unfolded structures of M-crystallin by doing site specific mutations in the M-crystallin. The mutants are M-crystallin-W45R (hydrophobic core), M-crystallin-K34D-S77D (Ca^{2+} binding sites) and M-crystallin-K34D-S77D-W45R (hydrophobic core and Ca^{2+} binding sites). Mutations are identified based on the sequence alignment of M-crystallin with the intrinsically disordered protein, Hahellin and with the highly ordered eye-lens γD-crystallin. The proposed plan will be accomplished by performing replica exchange molecular dynamics simulations (REMD) on the wild type M-crystallin. Subsequently, the mutants will be studied by NMR spectroscopy, CD and DLS. The unfolded and/or partially folded states will be studied by ANS fluorescence and the Ca^{2+} binding will be studied by ITC.

Dr. Kavitha Rachineni and Prof. R. V. Hosur

New Methods for NMR of Complex Organic Molecules

Proton solution state NMR spectroscopy is a very sensitive technique and plays a vital role in structural analysis and quantification of complex organic molecules/ mixtures. Unfortunately, more often severely overlapped 1H-1H scalar couplings hampers the NMR spectral resolution, which makes both the chemical shift analysis as well as quantification of individual chemical constituents is difficult. Under these circumstances, a sensitivity enhanced version of MHOBS-F1F2-DIAG band-selective homodecoupled experiment has been developed for the quantification of diastereomers present in naturally occurring glyco-flavonoids, at high field NMR spectrometers. At the present times, when high field NMR spectrometers are getting prohibitively expensive, working with tabletop low field spectrometers would be an attractive proposition. However, as is well known, chemical shift dispersion is a serious limitation on these systems. The modern strategies of pure shift spectroscopy would not be useful because of lack of gradients, on the one hand, and even when they are there, there will be extreme loss of sensitivity by slice selective gradients in the pulse sequences, on the other. In this regard, an alternate approach for resolution enhancement by employing processing-based (Generalized Indirect Covariance) advancements in the pure shift NMR schemes has been developed and the applications are demonstrated for the data acquired on a 60 MHz NMR spectrometer.

Further, a set of advanced pure shift STD NMR methods have also been designed and optimized for monitoring the small molecule-protein interactions, in systems such as, triphala-α-synuclein and albumin proteins with blood serum constituents. Indeed, the

information that obtains from these systems provides a pave for understanding the interactions, at atomic levels with high accuracies.

Dr. Veera Mohana Rao and Prof. R. V. Hosur

Solution state NMR plays an important role in structural studies of small organic molecule mixtures and proteins. However, more often severely overlapped 1H-1H scalar couplings present in the inherent limited 1H-NMR chemical shift range (~10 ppm) significantly hampers the spectral resolution and that makes the chemical shift analysis difficult. In order to circumvent this issue, different advanced versions of PSYCHE homodecoupling (pure shift NMR) methods have been developed, i.e, NUS-PSYCHE-TOCSY, Hadamard-PSYCHE-TOCSY, CPMG-PSYCHE/ Inversion Recovery (IR)-PSYCHE, for unambiguous chemical shift assignments and to monitor the drug-protein interactions. Additionally, for the simultaneous determination of 1H-1H and 1H-19F scalar couplings in complex steroid molecules, a homodecoupled diagonal-2D experiment, F1-PSYCHE-DIAG has also been developed. On the other hand, to recover the homonuclear scalar coupling information that decouples in the pure shift NMR, two different variants of pulse sequences, viz., selective coupling reintroduction in pure shift (SCRPS) and J-scaled pure shift (JSPS) experiments have been designed; wherein, the earlier one maps complete scalar coupling spin network of complex organic molecules and the latter one facilitates the measurement of valuable long range scalar coupling information at ultra high resolution. The applications of pure shift NMR methods are not only limited to small molecules, and they have been extended for the sequential acquisition of two HSQC spectra (13C-HSQC of small molecules and 15N-HSQC of proteins) in a single NMR experiment (PRO-SMASH-HSQC2). This method permits monitoring the drug-protein interactions at atomic levels and will have a potential applications in drug discovery programs.

Further, a combination of different fast acquisition techniques have been demonstrated for obtaining the rapid chemical shift assignments of proteins. For example, application of Non Uniform Sampling (NUS) along with the Band-selective Excitation Short-Transient (BEST) NMR experiments has been demonstrated for quickly obtaining the important residue-specific atomic level backbone chemical shift values. The application has been demonstrated with both well folded (ubiquitin) and unfolded (α-synuclein) proteins, alike. With this strategy, the experiments required for determining backbone chemical shifts can be performed very rapidly, in ~ 2 hours of spectrometer time, and this data can be used to calculate the backbone folds of proteins, using well established algorithms. This will be of great value for structural proteomics investigations, on one hand, where speed of structure determination is a limiting factor, and for application to the study of slow kinetic processes involving proteins such as fibrillization, on the other.

6.3 Research Activities of School of Mathematical Science

Dr. Swagata Sarkar

Degree Problem: Let G_1 and G_2 be simple, complex, classical algebraic Lie groups with associated compact groups of the type SO(2k+1) and SO(2k), where k is greater than or equal to 2, such that both G_1 and G_2 are of the same type. What can be the possible degrees of maps from G_1/P_1 to G_2/P_2, where P_1 and P_2 are maximal parabolic subgroups?

At present, we are studying maps between spaces of the form G/P, where G is of the form SO(2k+1) or SO(2k), (k is an interger greater than or equal to 2), with a view towards calculating the possible degrees of such maps.

We also plan to study the endomorphisms of cohomology algebras of spaces G/P , of the above form.

(With Samik Basu, Stat-Math Unit, ISI, Kolkata)

We are trying to compute the higher homotopy groups of spaces which are a wedge of spheres with a cell attached.

(With Samik Basu, Stat-Math Unit, ISI, Kolkata and Shilpa Gondhali, BITS, Pilani, Goa Campus)

Study of the homotopy type of function spaces is a well-established and active area of research. We are studying various techniques in rational homotopy theory, with a view towards studying the algebras modelling the rational homotopy type of function spaces *map(X,Y)* and *map^{*}(X,Y)* (of free and pointed type respectively), where X and Y are spaces are homogeneous spaces.

(With Rekha Santhanam, IIT-Bombay, Mumbai)

Prof. S. G. Dani

The exponents of the action of the semigroup of nonsingular integral matrices on spaces of multivectors.

(With Arnaldo Nogueira, University of Aix-Marseille)

Some new results were proved on power maps and exponential maps of Lie groups and homogeneous spaces.

(With Arunava Mandal, Indian Statistical Institute, Delhi)

Variations of Lagrange's theorem for continued fraction expansions of quadratic surds was proved in a generalized setting.

(With Ojas Sahasrabudhe, student at Indian Institute of Technology Bombay)

Prof. Saradha Natarajan

Consider the super elliptic curves of the form

$$\Delta_h = y^l$$

where Δ_h is the product $(x+1)\cdots(x+k)$ with h terms removed. If this equation has a rational solution, the it was shown that $l < e^{3^k}$ under some standard conditions. Stronger results are proved when $h=2$. The case $h=1$ has already been considered by the author along with P. Das and S. Laishram in an earlier work.

These results are of contemporary interest.

(ii) Rankin proved that the Poincaré series which are not cusp forms, have all theirzeros on the unit circle in the standard fundamental domain. The interlacing property of the zeros of such Poincaré series is being investigated.

6.4 Research Activities of School of Physical Sciences

Dr. Ameeya Bhagwat

An exact quantum mechanical treatment to study the phenomena of cluster emission from a variety of nuclei has been developed. The approach assumes that the preformed cluster is a point particle moving in a Gamow state under the effective cluster – daughter interaction potential. The method is found to be very general, and robust.

This approach has been applied to the α and possible cluster decay channels in the neutron deficient nuclei corresponding to the sdg major shell. It has been shown that the cluster decay mode has a small yet sizable branching ratio.

An extensive calculation of α and cluster emission from a very large number of possible superheavy nuclei (about 68,000 possible combinations of charge and neutron numbers), for charge numbers ranging between 100 and 122. In all, 182 possible even - even clusters were considered in this investigation. This question is of importance because it opens up the possibility of identifying superheavy elements through deposition of clusters in the detection system. It was found that the heavy cluster emission probability in the superheavy region is much smaller than the corresponding α emission probability, in contrast with the speculations that particularly near the Z=120 region, certain cluster branches might dominate over α branch, thereby assisting in detection of these nuclei.
(With Prof. Roberto J. Liotta, Department of Nuclaer Physics, KTH, Stockholm, Sweden).

The work on the semi-classical treatment of the Gogny functional is in progress. It is found that the calculated self-consistent potentials and densities can be parameterised as Fermi distributions. As the next step, the parameterised potentials and densities are used to calculate the smooth part of energy and the shell corrections within the Wigner - Kirkwood semi classical averaging scheme. The shell corrections thus obtained, along with a simple

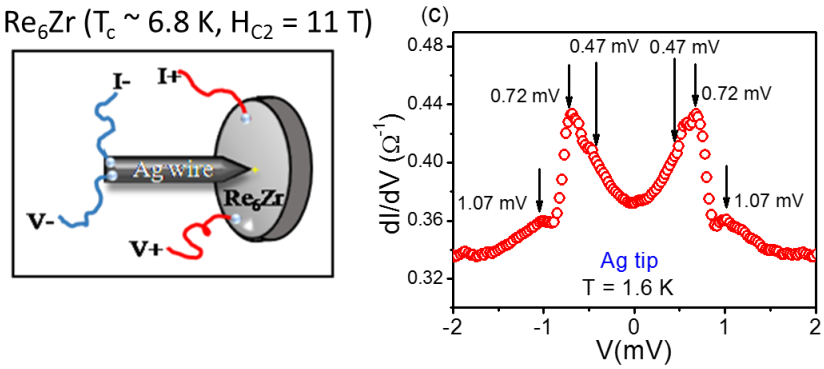
liquid drop prescription is found to yield a reasonably good description of ground state masses for nuclei spanning the entire periodic table. These results are being written up for publication.
(With Prof. Xavier Vinas, Prof. Mario Centelles, Univ. Barcelona, Spain and Prof. Peter Schuck, IPN Orsay).

The work on the Brueckner - Hatree - Fock is in progress. The scattering of 11Be on the protons has been investigated at a variety of energies, with the aim to investigate bearing that the structure of the nucleus 11Be, expected to be a halo nucleus, has on the scattering cross sections. The well-known Argonne v18 has been used to calculate the optical potential within the first order Brueckner - Hartree - Fock scheme, and the matter densities required in the calculations have been determined using a semi empirical density model developed earlier. The results are found to be in good agreement with the measured cross sections, and at the same time, signature of possible halo structure of 11Be has also been found in the differential cross sections. These results have been published.
(With Prof. Wasi Haider and Dr. Manjari Sharma of Aligard Muslim University)

Dr. Sangita Bose

Point contact Andreev reflection studies of a non-centro symmetric superconductor Re_6Zr

In recent times, non-centrosymmetric superconductors (NCS) have attracted considerable interest owing to the complex nature of superconductivity in these materials. In the NCS, where the crystal structure lacks a center of inversion symmetry the superconducting order parameter is characterized by a mixture of spin-singlet spin-triplet states. Despite numerous theoretical predictions, experimental evidence of spin-singlet spin-triplet mixing in NCS has been surprisingly few. A mixed singlet-triplet gap function resulting from antisymmetric spin-orbit coupling would result in two strongly anisotropic gap functions and could in principle also break time reversal symmetry (TRS). Point Contact Andreev Reflection (PCAR) spectroscopy was done on a high quality single crystal of Re6Zr which showed signatures of multiple gaps. The experiments have lead to two possible interpretations. One possibility was that one of the gaps, the bulk gap is the triplet gap which mixes with spin singlet surface gaps. This small triplet-singlet mixing results in the TRS symmetry breaking. The other possibility is that all gaps are isotropic and the gaps originate from different Fermi sheets with the presence of strong inter-band scattering. In this model, the TRS is broken at the superconducting transition, due to the presence of non-unitary triplet pairing Thus, the results conclusively prove unconventional pairing in this NCS superconductor.



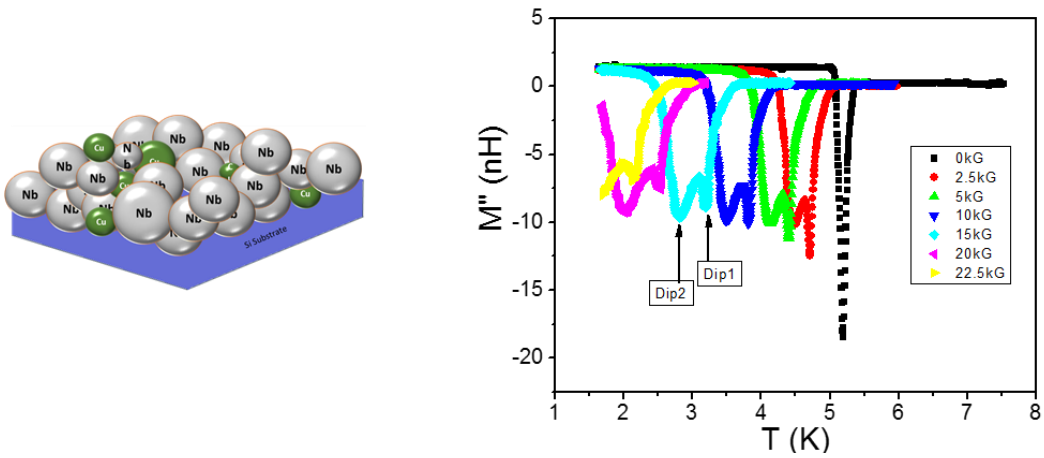
The left panel shows the schematic of the technique of point contact Andreev reflection (PCAR) spectroscopy on a single crystal of Re_6Zr. The right panel shows a representative PCAR spectra showing multiple peaks.

Manuscript submitted (under review)

(With Dr. Ravi Singh, IISER, Bhopal, Ms. Pradnya Parab , CEBS and D. Singh, IISER, Bhopal)

Superconductivity in im-miscible Nb-Cu nanocomposite films

The main objective of the project was to investigate the role of phase fluctuations in the destruction of superconductivity in granular films with array of Josephson junctions in relation with the coupling between the grains. Nb-Cu is an immiscible binary system which is known to be quenched into a metastable alloy phase by suitable growth conditions. The evolution of superconducting properties in these 3D granular films as a function of composition was studied. Superconductivity was seen to be influenced by the coupling between the grains and the presence of phase fluctuations which affected the temperature at which the global phase coherence set in the films. Measurements were done to measure the superfluid stiffness in the films. Interestingly, signatures of the inter-granular and intra-granular coupling was visible in mutual inductance measurements in magnetic field. These were proof of the role of phase fluctuations on superconductivity in these films. (*Project ongoing. Data analysis underway) (with Prdny Parab, CEBS).*



The left panel shows a schematic representation of the Nb-Cu nano-composite films. The right panel shows the imaginary component of the susceptibility as a function of temperature for different magnetic fields of a ~30 nm 88At%Nb film.

Dr. Padmnabh Rai

Nanoscale Optoelectronics & Plamonics:

Plasmonics is emerging as an alternative technology to satisfy constrains of miniaturization of optical devices down to sub-wavelength sizes. This on-chip technology utilizes the unique properties of surface plasmon polariton (SPP) to transmit optical and electrical signals through the same metal-based circuitry. The exceptional electronic and optoelectronic properties of carbon materials, such as, carbon nanotube, graphene and diamond is applicable in next generation photonic and palsmonic devices. Raman spectroscopy (RS) and photoluminescence (PL) measurements is employed to investigate the electronic band structure and optical properties of an individual nanostructure. The key highlights of the current work are following:

1. Synthesis & processing of materials (carbon nanotube, graphene, single crystal diamond).
2. Light emission and detection by nanoscale system based electronic devices.
3. Surface plasmon launching and detection in chip-scale electronic circuity.
4. Remote optical excitation, surface enhanced Raman scattering and photoluminescence of individual molecules/nanomaterials.
5. Optical spectroscopy of NV centered diamond wafers and its applications in high energy detectors and quantum computers.

Dr. Sujit Tandel

During 2017-18, the Nuclear Physics Laboratory at CEBS comprised of Prof. Sujit K. Tandel (UGC Associate Professor), Dr. Dinesh Negi (Research Associate), S. Gholam Wahid (JRF under DST INSPIRE), Poulomi Roy (JRF under BRNS Research Project), Saket Suman (JRF under DST INSPIRE) and Abhay Bakalkar (Laboratory Attendant). The following M.Sc. students had ongoing or completed projects during 2017-18: Vikas Bothe, Kartikeya Sharma (both CEBS) and Atul Prajapati (Department of Physics, University of Mumbai).

Coincidence measurements with fast scintillation and semiconductor detectors using a digital data acquisition system

A number of measurements were performed with fast scintillation detectors BaF2 and BC501 and high-resolution semiconductor detectors. Programs to analyze the coincidence data were developed. The performance of the entire system was validated using standard gamma-ray calibration sources.

Intrinsic excitations and isomers in the vicinity of doubly-magic 208Pb

The structure of Tl isotopes (201,202,203Tl) in the vicinity of doubly-magic 208Pb has been studied. Several new isomers with half-lives ranging from 2 ns to 200 us have been identified and their decay pathways established. Many new transitions and levels have been established in each of the nuclei. Calculations have been performed the underlying configurations of the excited levels particularly the isomeric ones.

Rotational structures in odd-A Pt isotopes

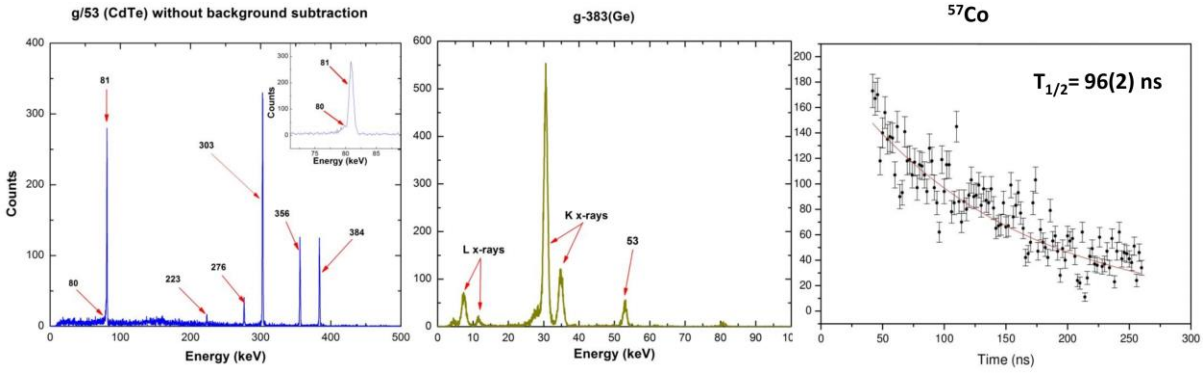
The structure of the isotopes 193,195,197Pt, which lie around the line of stability, has been studied up to high spin through multi-nucleon transfer reactions. Positive- and negative-parity sequences in 193,195Pt have been considerably extended and multiple band crossings have been established. These nuclei are characterized by moderate oblate deformation, and angular momentum generation at high spin in the yrast, positive-parity sequences is attributed to rotation alignment of $i13/2$ neutrons and $h11/2$ protons. A detailed understanding of the observed features has been obtained using tilted axis cranking covariant density functional theory calculations and those employing the Ultimate Cranker code.

Oblate rotation in Hg isotopes along the line of stability

Oblate, rotation-like sequences have been identified in 197,199Hg. The known positive- and negative-parity sequences have been extended to high spin. In 199Hg, a new 3-quasiparticle band structure has been identified which deexcites to the semi-decoupled negative parity band. Cranking calculations have been performed for both isotopes and the results in terms of rotation alignment frequencies and interaction strengths are in good agreement with experiment.

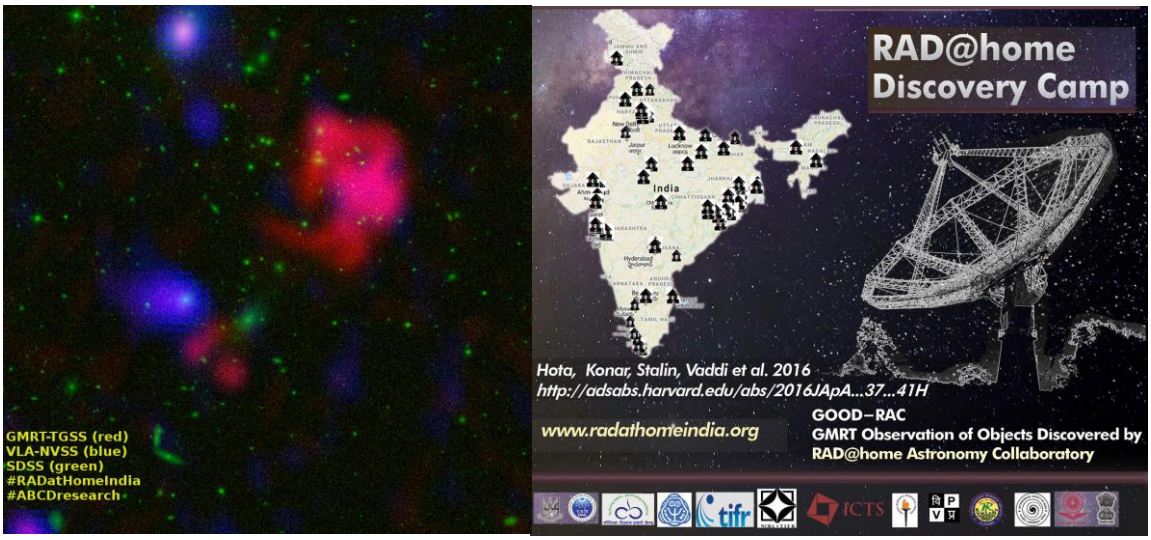
Parity-doublet structures in doubly-odd 216Fr

Parity-doublet structures have been established in 216Fr, which lies at the lower boundary of enhanced octupole collectivity in the trans-lead region. The newly identified levels are established as the simplex partner of a previously reported band leading to parity doublets with small (~55 keV) average energy splitting, a feature typical of nuclei with near-static octupole deformation. Enhanced octupole correlations are evident from the small energy splitting and large $B(E1)/B(E2)$ values.



"Gated spectra and lifetime determination from gamma-ray coincidence measurements performed at CEBS using CdTe, Ge and NaI detectors."

Dr. Ananda Hota



During the report period (2017-18) significant progress has been made in achieving a self-sustainable network of 138 citizen-scientists trained to discover exotic black hole galaxy systems from the low frequency 150 MHz TGSS ADR1 data taken with the Giant Meterwave Radio Telescope (GMRT), largest such in the world and pride of India. As detailed elsewhere in this report, seven different one-week long citizen-science research (CSR) training workshops known as RAD@home Discovery Camps were organised with the help of various institutions including CEBS. Those institutions are International Centre for Theoretical Sciences of the Tata Institute of Fundamental Research (ICTS-TIFR, Bangalore), Institute of Physics (IOP, Bhubaneswar), Nehru Planetarium (Delhi). Following the Discovery Camps the CSR continues from home and facilitated by online e-class cum e-research sessions organised by the PI of the Collaboratory, Dr Hota, for 3 hours a week. Exotic black hole galaxy systems discovered this way were proposed to upgraded GMRT for deep observation and advanced analyses. These proposals named GOOD-RAC: GMRT Observation of Objects Discovered by RAD@home Astronomy Collaboratory, have been rewarded over 50 hours of observing time in this world-class facility after going through standard international competition. Never-seen-before features detecting old/relic magnetised relativistic plasma, emitting preferentially at low radio frequencies of the GMRT (India) than higher radio frequencies of the Very Large Array (USA) telescope, have been detected. One such example presented here shows the old plasma in red colour. Such synchrotron emitting plasma could be due to past ejection of radio jets, millions of light year long, from accretion of matter on to black holes, million to billion times mass of our Sun, located at the centres of massive galaxies. Alternately, part of the plasma could also originate in the turbulences and shock waves produced during the collision between two clusters of galaxies, containing thousands of galaxies each. These cosmic giant particle accelerators, million light years long, accelerate cosmic rays to relativistic speed by Fermi acceleration process and emit synchrotron radiation to be detected by GMRT. Potential of such a modified CSR collaboration in converting the Big Data problem to a Big Prospect for our Big nation has been outlined in the publication Hota, Konar, Stalin, Vaddi et al. 2016

http://adsabs.harvard.edu/abs/2016JApA...37...41H) . Citizen-scientists are co-author in this paper. This has been brought to public notice, in the interest of public, by a News/Press Release in the India Science Wire by the Vigyan Prasar, Department of Science & Technology, Govt of India. The link is available here for details.
http://vigyanprasar.gov.in/isw/inspired_bollywood_flick_power_facebook_indian_scientist_builds_army_e-astronomers_story.html

Dr. Bhooshan Paradkar

Astrophysical dynamo in the partially ionized plasma

Although partially ionized plasma is ubiquitous in the universe, the role of neutrals in astrophysics is still not thoroughly investigated. Especially in the context of our Sun, the density of neutrals can significantly exceed plasma density in the lower atmosphere. Therefore, it is expected that these neutrals will play an important role in the evolution of near-surface magnetic fields. Using mean-field electrodynamics, it is shown that sub-surface dynamo can indeed be operated in the near-surface region of the Sun. In the proposed theoretical model, toroidal magnetic field is generated from poloidal magnetic field through differential rotation in the sub-surface shear region whereas poloidal magnetic field is regenerated from toroidal magnetic field through helicity contributions from neutral, Hall and Ambi-polar velocities in the partially ionized plasma. Through numerical solution of this model, saturation in magnetic field growth due to field dependent ambi-polar diffusion coefficient is demonstrated. It is found that evolution of magnetic field with time follows the pattern-similar to experimentally observed 'butterfly' diagram of Sunspots as shown in Figure below.

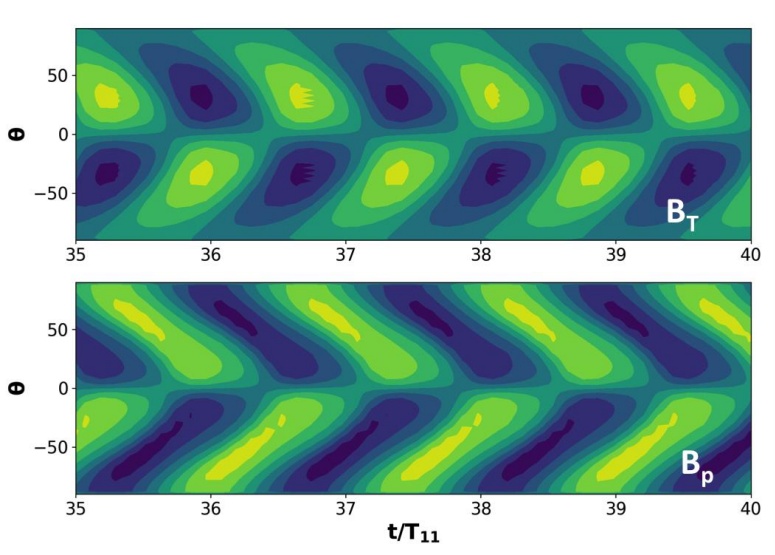


Fig. 1: Temporal variation of toroidal (B_T) and poloidal (B_P) with respect to latitude. Time is normalized by solar cycle period of 11 years.

(With Prof. S. M. Chitre, UM-DAE CEBS and Prof. Vinod Krishan, India Institute of Astrophysics, Banglore, India).

Reynolds stress model for turbulent convection zone of the Sun

Generation of large-scale flows in a turbulent fluid is one of the import problems in fluid dynamics with applications in Geophysics, Atmospheric Sciences and Astrophysics. In Solar physics, large-scale meridional flow in the convection zone is believed to be one of the key players for magnetic field activity inside the Sun. In order to estimate the circulation pattern of such flows, computation of Reynolds stresses is essential to model the feedback of small-scale turbulent fluctuations over the large-scale mean flows. Based on mixing-length theory, a theoretical model is proposed for the computation of Reynolds stresses for the rotating turbulent convection under the Boussinesq approximation. Efforts are made to separate the stress components in diffusive and non-diffusive parts where diffusive part is formulated in terms of fourth-rank viscosity tensor.

(With Prof. S. M. Chitre, UM-DAE CEBS and Prof. D. O. Gough, University of Cambridge, UK).

Transformation Optics using Finite-Difference-Time-Domain (FDTD) Simulations

Finite-Difference-Time-Domain (FDTD) code is developed to simulate propagation of light through anisotropic material. This code is used to design so-called meta-materials having anisotropic permittivity and permeability tensors that were computed theoretically using the technique of Transformation Optics. Meta-material for wave collimators, tapered and bending waveguides were simulated using this code. Simulation result of bending waveguide is shown below.

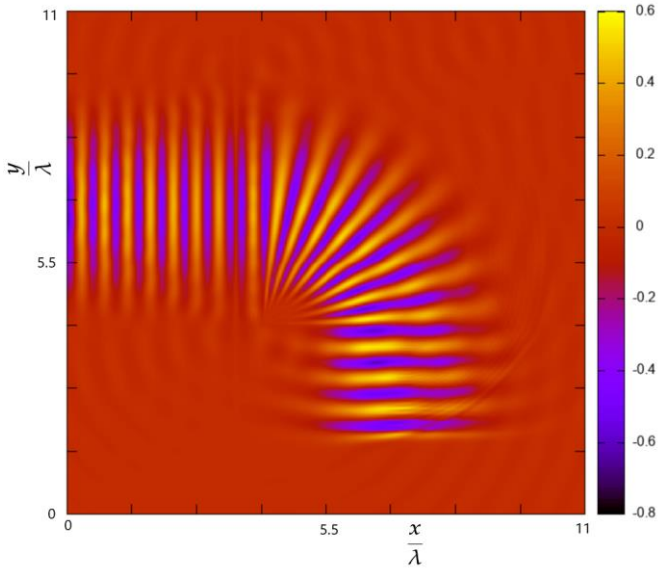


Fig. 2: FDTD simulation of light propagation through a bending waveguide

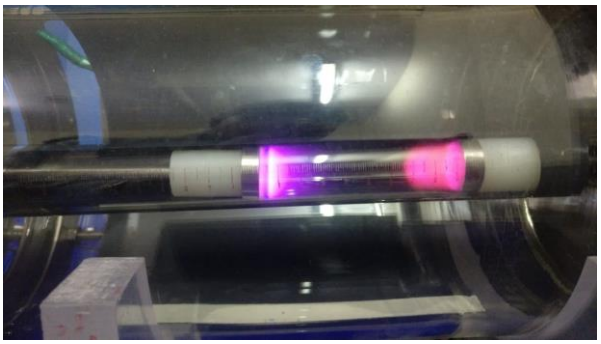
(With Mr. Prerak Dhawan, student of Manipal University, Karnataka as part of his M. Sc. (photonics) final semester project.)

Dr. P. Brijesh

Plasma Experiments Lab

The Plasma Experiment Lab's long-term goal is to develop in-house capabilities to design and field laser-plasma interaction/plasma acceleration experiments on a future Laser Facility in CEBS or any other external DAE facility. In the short-term, it is envisaged that a smaller scale (Plasma Devices) lab be established that can be experimentally active with various high-voltage electrical discharge based plasma systems including accelerator devices. Besides performing research in basic plasma sciences, such an experimental lab activity can also enhance the teaching of plasma physics, accelerator and beam physics. Towards this end, interactions were initiated with the Facilitation Centre for Industrial Plasma Technologies (FCIPT) at the Institute for Plasma Research (IPR), Gandhinagar. In the past, FCIPT had developed five separate plasma experiment systems for educational institutes. For our purpose, two experiments, the Paschen effect and Plasma Striations (Figure-1) system was specifically integrated into one compact system by FCIPT. One of the experiments possible with this system is the Paschen's law that relates the voltage applied across the electrodes with the pressure of the gas contained between the electrodes and the distance between electrodes. This can be used to understand the basic discharge mechanism for creating Plasma [1]. The system was successfully transferred and operationalized in CEBS (Figure-2) and will be soon shifted to the new academic building. A second (Ion-Acoustic Wave) system with emphasis on features such as compactness, mobility and safety is being fabricated by FCIPT and the installation of this system in CEBS is expected before the end of the year. These two plasma devices are the first few steps forward in jump-starting the Plasma Experiments Lab in CEBS.

[1] http://www.plasmaindia.com/News%20letter/update83.pdf



Plasma Striations inside glass chamber

Prof. P. C. Agrawal

Timing and Spectral Study of IGR J19294+1816 with the RXTE: The Discovery of Cyclotron Features

Rossi X-ray Timing Explorer (RXTE)/Proportional Counter Array (PCA) observations of IGR J19294+1816 covering two outburst episodes are reported. In both the cases the PCA observations were made during the decay phase of the outburst, with the source exhibiting

temporal and spectral evolution with the change in flux. At the bright flux level an absorption feature at 35.5 keV is detected in the spectra which may be attributed to Cyclotron Resonance Scattering Feature corresponding to a magnetic field of B = 4.13 × 10 12 Gauss. This is also detected at a lower significance in two other observations. In addition an Fe line emission at 6.4 keV is prominently detected during the highest flux. X-ray pulsations are detected in 9 out of 10 observations; no pulsations were found in the observation with the lowest flux level. Details of the results are discussed.
(Paper published in ApJ.)
(work mainly by Dr Jayashree Roy and Dr Manojendu Choudhary)

Prof. Gopal Krishna

Continued as co-guide of the PhD research scholar Mr. Mukul Mhaskey (Physics Dept., SPPU, Pune). The PhD project involves using the Giant Metrewave Radio Telescope to accurately measure the radio spectra of a new type of radio galaxies, called EISERS (Extremely Inverted Spectrum Extragalactic Radio Sources), which was introduced by this team a few years ago.

Also, continued as the main academic consultant for the PhD projects of 4 research scholars of ARIES (P. Kumar, S. Mishra, V. Ojha and K. Kumar), with Prof. H. Chand of ARIES as their PhD guide. The aim of these projects is use the ARIES optical telescopes to characterize the intranight flux variability of several prominent classes of Active Galactic Nuclei.

Prof. R. Nagarajan

Laser scattering studies in Ferrofluids

Forward laser scattering studies in aqueous magnetic fluids (MF) was continued. Dynamic response of the self-assembly of the magnetic nanoparticles was studied directly under a rotating magnetic field. Commercial magnetic fluid (EMG 707- Ferrotec, Singapore) with 10 nm Fe_3O_4 nanoparticles in aqueous medium, with known magnetic properties, was investigated. Forward laser scattering was studied by passing a diode laser beam (630 nm, < 5 mW) through a cuvette (path length: 1 mm) containing the sample with known dilution. An electromechanical arrangement was made to make a permanent magnet rotate around a cuvette. The scattered light pattern formed on a screen placed at a distance of ~ 30 cm from cuvette was recorded using a CCD camera. The patterns were recorded with 5 mT magnetic field at the sample at rotation speeds of 3 rpm, 6 rpm and 10 rpm. The recorded patterns were analyzed using ImageJ and Matlab software. The results show that self-assemblies of magnetic nanoparticles formed along the magnetic field lines remain stable even under rotating magnetic field (Figure 1 shows a typical pattern), at least up to 10 rpm even in the presence of viscous drag. At higher rotational speeds, the chain structures seem to break into smaller ones due to hydrodynamic interactions. This suggests a limit on the average size of MNP self-assemblies that remain stable at a given rotational speed. The studies are useful for developing magnetic fluid based wireless programmable approach for tunable optical devices

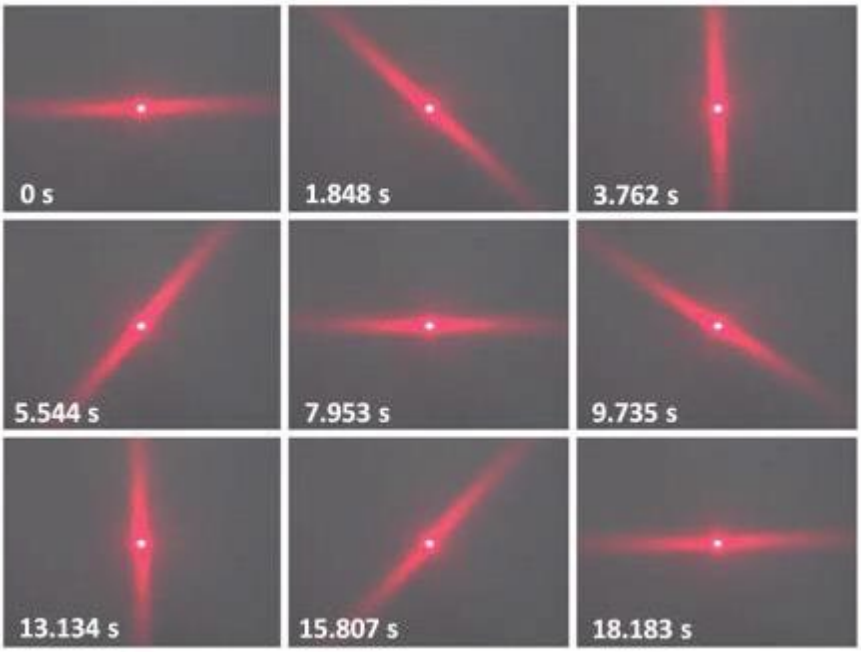


Figure 1: One cycle of forward laser scattering patterns of aqueous magnetic fluid under rotating magnetic field at 3 rpm

(S. Radha, Chintamani Pai, M. Shalini (Department of Physics, University of Mumbai), R.V. Ramanujan (NTU, Singapore), Vijay Kumar Varma (NTU, Singapore)

Prof. Manohar Nyayate

The research work on magnetic properties of rare earth intermetallic, that was initiated at B. N. Bandodkar College of Science, Thane, Maharashtra was continued at the college. Effect of partial substitution of rare earth on magnetostriction was investigated in the giant magnetostriction materials RFe_2 (R is Rare Earth) alloys. Rare earth alloys, $R_xR'_{1-x}Fe_2$, (R = Tb, R'= Gd, x = 0.1 to 0.4) were synthesized by induction melting in argon atmosphere. Their magneto-strictive properties were investigated using strain gauge technique. Doping with Tb seem to reduce the magnetostriction. Detailed analysis of the data is being carried out. Replacing Gadolinium by Dysprosium with different composition is planned.

(Principal Investigator: M.N. Nyayate Collaborator: Jitendra Pendharkar. K. J. Somaiya College of Science and Commerce, Vidyavihar, Mumbai.)

Dr. Neelam Upadhyay

Taylor approximation to treat nonlocality in scattering process

Study of scattering process in the nonlocal interaction framework leads to an integro-differential equation. A readily implementable technique using the second mean value theorem of the integral calculus to solve the integro-differential equation is developed in J. Phys. G Nucl. Part. Phys. 45, 015106 (2018). The advantage of the method is that it

converts the integro-differential equation to the conventional Schrödinger equation. However, to get a precise solution of the integro-differential equation, an iterative scheme has been employed which is initiated by solution to the homogeneous equation. The iterative scheme, thus developed, is found to be robust but is time consuming due to its slow convergence rate.

In this work an efficient approach to solve this integro-differential equation with high degree of precision is developed. This is achieved by employing Taylor approximation for the radial wave function which has been known for a long time. The proposed method converts the integro-differential equation in to a second-order homogeneous differential equation, which is readily solvable. This scheme is found to be computationally efficient by a factor of 10 when compared to the earlier iterative scheme. The calculated observables for neutron scattering off ^{24}Mg, ^{40}Ca, ^{100}Mo and ^{208}Pb with energies up to 10 MeV are found to be within at most 8% of those obtained with the iterative scheme. Further, an improvement over the Taylor scheme has been proposed that brings the observables so close to the results obtained by iterative scheme that they are visually indistinguishable. This is achieved without any appreciable change in the run time.

The technique developed is found to be robust and numerically stable without any dependence on the choice of the form of nonlocality. Hence, it is expected to be useful in diverse areas of science where existence of nonlocality leads to an integro-differential equation.

(N. J. Upadhyay and A. Bhagwat at CEBS)

Dr. Sanved Kolekar

Gravitational memory for uniformly accelerated observers

Recently, Hawking, Perry and Strominger described a physical process that implants supertranslational hair on a Schwarzschild black hole by an infalling matter shock wave without spherical symmetry. Using the BMS-type symmetries of the Rindler horizon, S. Kolekar et. Al. presented an analogous process that implants supertranslational hair on a Rindler horizon by a matter shock wave without planar symmetry, and investigated the corresponding memory effect on the Rindler family of uniformly linearly accelerated observers. It was assumed that each observer remains linearly uniformly accelerated through the wave, in the sense of the curved spacetime generalisation of the Letaw-Frenet equations. Starting with a family of observers who follow the orbits of a single boost Killing vector before the wave, it was found that after the wave has passed, each observer still follows the orbit of a boost Killing vector but this boost differs from trajectory to trajectory, and the trajectory-dependence carries a memory of the planar inhomogeneity of the wave. This classical memory phenomenon is anticipated to have a counterpart in Rindler space quantum field theory.

(Jorma Louko – University of Nottingham UK)

Quantum memory for Rindler supertranslations

The Rindler horizon in Minkowski spacetime can be implanted with supertranslation hair by a matter shock wave without planar symmetry, and the hair is observable as a supertranslation memory on the Rindler family of uniformly linearly accelerated observers.

S. Kolekar et. Al. have shown that this classical memory is accompanied by a supertranslation quantum memory that modulates the entanglement between the opposing Rindler wedges in quantum field theory. Within this new framework, it was important to understand the effect of BMS symmetries on quantum entanglement in the black hole information paradox context. An analysis to understand how the quantum entanglement between the infalling and outgoing Hawking pair is modified from a maximal value when a black hole is implanted with soft hair corresponding to the BMS supertranslations was presented. Investigations with the supertranslated Rindler horizon suggested that, for a Schwarzschild black hole case, within a perturbative treatment, the Negativity measure of entanglement between infalling and outgoing Hawking pair is degraded due to an infalling soft hair implanting shockwave while there is linear order generation of Negativity between two outgoing Hawking particles. A corresponding phenomenon across a black hole horizon may play a role in Hawking, Perry and Strominger's proposal for supertranslations to provide a solution to the black hole information paradox.
(Jorma Louko – University of Nottingham UK)

Dr. Sreemoyee Sarkar

Heavy quark radiative energy loss in viscous QCD plasma:

Recent developements in relativistic heavy ion collision experiments have featured out the fact that produced medium is slightly out of equilibrium with small non-vanishing value of shear viscosity/entropy density and this could be characterized by both transport model and fluid dynamics. Suppression of high p_T heavy and light quarks due to elastic and inelastic energy loss provide an excellent tomographic tool to probe the produced QCD medium. Heavy quarks, are produced in the early stages of collision and because of their large mass their production at the late stages is largely suppressed. Hence, heavy quarks are good probe to explore the evolution of the produced medium. Heavy flavours suffer two types of energy loss while passing through the medium. RHIC investigation of the heavy flavor suppression denotes that while, collisional energy loss has its dominance at low-p_T, LHC provides description of heavy flavor suppression at $p_T > 20$ GeV/c and in this ultra-relativistic domain radiative enrgy loss becomes dominant. Large suppression pattern of D-mesons at high p_T at LHC is quantified by the nuclear modification factor. This is the ratio defined by the yield in AA and pp collisions scaled by binary nucleon-nucleon collisions. The crucial ingredient of reliable suppression relies on precise energy loss calculation taking into consideration of the expansion and viscosity of the QCD medium. We present the first calculation of heavy quark radiative energy loss, first-order in opacity, in a medium with dynamic scattering centres suffering boost invariant longitudinal expansion. Theoretical formalism accounts for medium modified polarization tensor and time dependent cooling because of rapid longitudinal expansion of the QCD medium in relativistic heavy ion collision experiments along with modified phase space. Our results, for heavy quark energy loss is time dependent. We consider the Grad's 14-moment and the Chapman-Enskog-like methods for the nonequilibrium distribution functions. Our numerical results for the charm quark radiative energy loss show that, as compared to an expanding ideal (nonviscous) fluid, viscosity in the evolution lead to somewhat enhanced

energy loss which is rather insensitive to the underlying viscous hydrodynamic models used. Further inclusion of viscous correction induces larger energy loss, the magnitude and pattern of this enhancement crucially depend on the form of viscous corrections used (Ref.Fig.1).

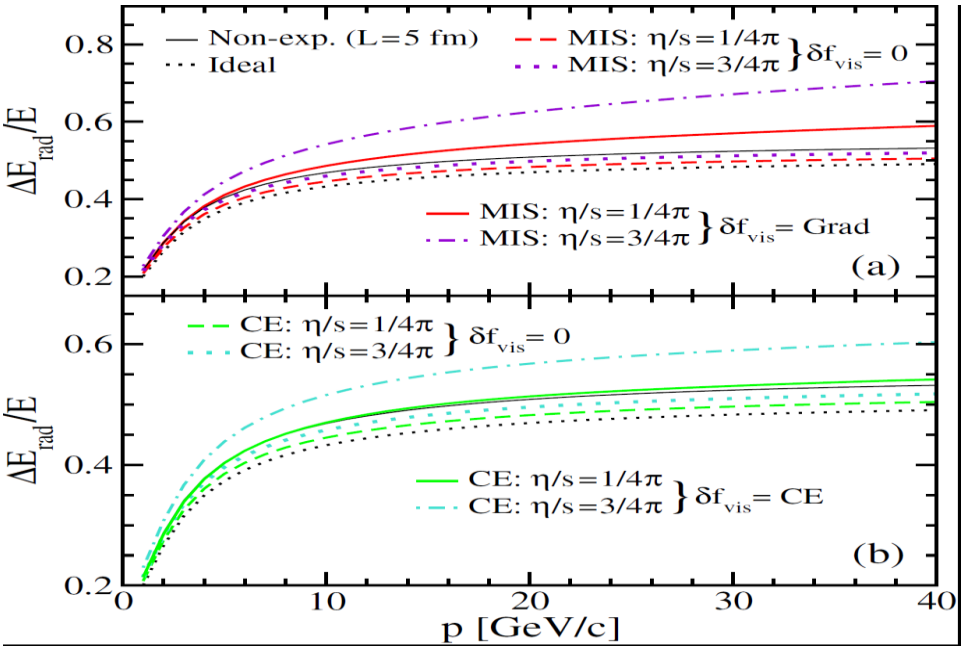


Fig.1: Time integrated fractional radiative energy loss as a function of momentum for charm quarks propagating in a boost-invariant expanding fluid over a total time of $\tau_f = 5$ fm/c with various values of η/s in the M\"uller-Israel-Stewart (MIS) (top panel) and Chapman-Enskog (CE) (bottom panel) frameworks. In a non-expanding plasma at temperature $T_0 = 0.228$ GeV, the fractional energy loss integrated over a path length of $L=5$ fm is also shown (black thin solid line). The initial conditions and the various curves for the expanding medium are the same as in Fig. \ref{Emom:fig}. In addition, results with $\eta/s = 3/4\pi$ are shown without viscous correction in MIS (purple dotted line) and CE (cyan dotted line) theories and with further inclusion of viscous correction in MIS (purple dash-dotted line) and CE (cyan dash-dotted line) methods.

Kinematics of Transport Coefficients in Neutron Star under Strong Magnetic Field

Neutron stars although being an wonderful astrophysical laboratory, a number of problems remain unsolved because of presence of extreme physical conditions in its interior as well as on its surfaces. These compact objects harbor supranuclear densities in the core and the strongest magnetic field of the universe at the surface. Efforts have been extensively put in understanding the constituents of the neutron stars and hence the transport coefficients of the dense matter. Thermal and electrical conductivity are the two important coefficients in the context of the neutron star crust and shear viscosity in the neutron star core. Thermal conductivity relates the inner and the surface temperature of the dense object which eventually determines the thermal evolution and the radiation spectrum of the star. On the other hand, electrical conductivity is one of the input for the dissipative magneto-

hydrodynamics (MHD) equations. Shear and bulk viscosity coefficients are two important inputs to explain current data of $r-$ mode oscillation. Recent interest in formulation of the transport coefficients in the star has led to many important findings but still there are some areas which require improvisation to interpret the observables.

One of the most important features of the transport theory in both the crust and the core is, different scattering process becomes dominant or gets suppressed depending upon the temperature and the density of the crust. We aim to study the formulation of different scatterings with magnetically modified many-body effects leading to more pragmatic study of the transport coefficients and improving the description of cooling, magnetic field evolution and r-mode oscillation.

Shear viscosity of three-flavor crystalline color superconducting quark matter

As an extension of our previous calculation of "Shear viscosity of two-flavor inhomogenous color superconducting quark matter", we are trying to formulate how the shear viscosity of three-flavor FF phase might behave. The phase is characterized by paired strange quarks. In these phases the electrons are few in number and can be ignored as a first approximation. The fermionic excitations are gapless on non-trivial surfaces, as in the two flavor case. It would be compelling to formulate the theory in the three flavor FF phase. The result could have implications on the observed distribution of the neutron stars in the temperature vs rotational frequency plot.

7. Publications

7.1 Publications in peer reviewed Journals:

1. Study of polymorphism in 2,2′-diseleno bis (3-pyridinol)
P. P. Phadnis, A. Kunwar, M. Kumar, R. Mishra, A. Wadawale, K. I. Priyadarsini and **V. K. Jain**
J. Organometal. Chem., 852 (2017) 1-7.

2. Tubulin-targeted cancer chemotherapeutics: Advances and challenges (Editorial)
M. Lopus
Current Topics in Medicinal Chemistry 17 (2017) 2522.

3. Ultra-high resolution in low field tabletop NMR spectrometers
R. Kavitha, V. M. R. Kakita and R. V. Hosur
RSC Adv., 7 (2017) 49102–49104.

4. Structural features of FAP174, a MYCBP-1 orthologue from *Chlamydomonas reinhardtii*, revealed by computational and experimental analyses.
M. Yogesha, V. G. Rao, E. A. F. Martis, E. C. Coutinho, H. Gohlke, S. Chidangil, P. M. Dongre and **J. S. D'Souza**
RSC Adv., 7 (2017) 51391-51402.

5. Synthesis, photophysical, electrochemical and electroluminescence studies of red emitting phosphorescent Ir(III) heteroleptic complexes
F. Ali, P. K. Nayak, N. Periasamy and **N. Agarwal**
J. Chem. Sci., 129 (2017) 1391-1398.

6. Synthesis and studies of imidazoanthraquinone derivatives for applications in organic electronics
B. K. Sharma, **S. Dixit**, S. Chacko, R. M. Kamble and **N. Agarwal**
Eur. J. Org. Chem., (2017) 4389-4400.

7. Optically controlled electron-transfer reaction kinetics and solvation dynamics: Effect of Franck−Condon states
K. Gupta, A. Patra, K. Dhole, A. K. Samanta and **S. K. Ghosh**
J. Phys. Chem. Lett., 8 (2017) 4545−4549.

8. Efficient strategy for enhancement of visible light photocatalytic activity of NaTaO3 by a significant extent
B. Modak, P. Modak and **S. K. Ghosh**
J. Phys. Chem. C, 121(2017) 12980-12990.

9. A computational investigation of the red and blue shifts in hydrogen bonded systems
M. Das and **S. K Ghosh**
J. Chem. Sci., 129 (2017) 975–981.

10. Synergistic enhancement in the drug sequestration power and reduction in the cytotoxicity of surfactants
R. Kalel, A. K. Mora, B. S. Patro, **D. K. Palit** and S. Nath
Phys. Chem. Chem. Phys., 19 (2017) 25446-25455.

11. Backbone and side-chain resonance assignments of Plasmodium falciparum SUMO
J. S. Singh, **V. K. Shukla**, M. Gujrati, R. K. Mishra and A. Kumar
Biomol NMR Assign, 11 (2017) 17-20.

12. Temperature dependent magnetic Compton profiles and first-principles strategies of quaternary half-Heusler alloy $Co_{1-x}Cu_xMnSb$ ($0 \leq x \leq 0.8$)
K. Kumar, **A. Dashora,** N. L. Heda, H. Sakurai, N. Tsuji, M. Itou, Y. Sakurai and B. L. Ahuja
J. Physics.: Condensed Matter, 29 (2017) 425805.

13. Cluster decay in super–allowed α decay region
A. Bhagwat, R. J. Liotta,
Physical Review C, 96 (2017) 031302(R).

14. Shear viscosity of two-flavor inhomogenous color superconducting quark matter
S. Sarkar and R. Sharma
Physical Review D, 96 (2017) 094025.

15. Gravitational memory for uniformly accelerated observers
S. Kolekar and J. Louko
Physical Review D, 96 (2017) 024054.

16. Analysis of ^{11}Be + p elastic scattering using BHF approach
M. Sharma, W. Haider and **A. Bhagwat**
J. Physics G: Nuclear and Particle Physics, 44 (2017) 105107.

17. Timing and spectral study of IGR J19294+1816 with the RXTE: The discovery of cyclotron features
J. Roy, M. Choudhury and **P. C. Agrawal**
The Astrophysical Journal, 848 (2017) 124.

18. A precise measurement of the orbital period parameters of cygnus X-3
Y. Bhargava, A. R. Rao, K. P. Singh, **M. Choudhury**, S. Bhattacharyya, S. Chandra, G. C. Dewangan, K. Mukerjee, G. C. Stewart, D. Bhattacharya, N. P. S. Mithun and S. V. Vadawale
The Astrophysical Journal, 849 (2017) 141.

19. On the incidence of MgII absorbers along the blazar sightlines
S. Mishra, H. Chand, **Gopal-Krishna**, R. Joshi, Y. A. Shchekinov and T. A. Fatkhullin
Monthly Notices of the Royal Astronomical Society, 473 (2017) 5154-5164.

20. Multi-epoch intranight optical monitoring of eight radio-quiet BL Lac candidates
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Monthly Notices of the Royal Astronomical Society, 471 (2017) 606-616.

21. Liquid-gas phase transition in hot asymmetric matter with NL3
B. K. Sharma and **A. Bhagwat**
Acta Physica Polonica B, 48 (2017) 195-205.

22. Symmetries in mirror energy differences
S. Kumar, V. Kumar and **D. Negi**
Acta Physica Polonica B, 48 (2017) 819.

23. MYC-binding protein-1 is an R2D2 protein
J. S. D'Souza.
J. Cell Signalling, 2 (2017) 161.

24. An emerging class of A-kinase anchoring proteins are R2D2-like
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International Biology Review, 1 (2017) 1-40.

25. Tryptone-stabilized gold nanoparticles target tubulin and inhibit cell viability by inducing an unusual form of cell cycle arrest.
T. Mahaddalkar, S. Mehta, S. Cheriyamundath, H. Muthurajan and **M. Lopus**
Experimental Cell Research, 360 (2017) 163-170.

26. The untapped potential: Understanding algal sulphated polysaccharides and their applications: A review.
A. K. Prusty and **V. L. Sirisha**
International Journal of Pharmaceutical Sciences and Health Care, 5 (2017) 1-29.

27. Computational analysis in influenza virus
R. Chavan, S. Bapat, V. Patil, A. Chowdhary and **A. Kale**
Receptors & Clinical Investigation, 4 (2017) 1-11.

28. Host induced gene silencing, an emerging science to engineer crop resistance against harmful plant pathogens
S. B. Ghag
Physiological and Molecular Plant Pathology, 100 (2017) 242-254.

29. Control of magneto-fluidic laser scattering of aqueous magnetic fluids
C. Pai, V. B. Varma, R. Srinivasan, **R. Nagarajan** and R. V. Ramanujan
IEEE Magnetics Letters, 8 (2017).

30. AstroSat/ LAXPC Detection of Millisecond Phenomenon in 4U 1728-34
J. V. Chauhan, J. S. Yadav, R. Misra, **P. C. Agrawal**, H. M. Antia, M. Pahari, N. Sridhar, D. Dedhia, T. Katoch, P. Madhwani, R. K. Manchanda, B. Paul and P. Shah
The Astrophysical Journal, 841 (2017) 41 (5pp).

31. AstroSat: From Inception to Realization and Launch
P. C. Agrawal
J. Astrophysics & Astronomy, 38 (2017) 27.

32. Large Area X-Ray Proportional Counter (LAXPC) Instrument on AstroSat and Some Preliminary Results from its Performance in the Orbit
P. C. Agrawal, J. S. Yadav, H. M. Antia, D. Dedhia, P. Shah, J. V. Chauhan, R. K. Manchanda, V. R. Chitnis, V. M. Gujar, T. Katoch, V. N. Kurhade, P. Madhwani, T. K. Manojkumar, V. A. Nikam, A.S. Pandya, J. V. Parmar, D. M.Pawar, **J. Roy**, B Paul, M. Pahari, R. Misra, M. H. Ravichandran, K. Anilkumar, C. C. Joseph, K. H. Navalgund, R. Pandiyan, K. S. Sarma and K. Subbarao.
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Current Science, 113 (2017) 591-594.

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Magnetic Resonance in Chemistry, 2017, DOI: 10.1002/mrc.4634.

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S. Mishra, H. Chand, **Gopal-Krishna**, R. Joshi, Y. A. Shchekinov, T. A. Fatkhullin
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Adam S. Jermyn, P. Lesaffre, C. A. Tout and **S. M. Chitre**
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N. J. Upadhyay, A. Bhagwat and B. K. Jain
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41. Effect of microheterogeneity in room temperature ionic liquids on energy and electron transfer processes
B. Manna, M. D. Bandyopadhyay, N. Choudhury and **D. K. Palit**
J. Photochem. Photobiol. A: Chem., 356 (2018) 81–91.

42. Synthesis, photophysical studies of positional isomers of heteroaryl BODIPYs, and biological evaluation of Di-pyrrolyl BODIPy on human pancreatic cancer cells
S. Dixit, T. Mahaddalkar M. Lopus and N. Agarwal
J. Photochem. Photobiol. A: Chemistry, 353 (2018) 368-375.

43. Rapid synthesis of gold and silver nanoparticles using tryptone as a reducing and capping agent
S.M. Mehta, M.P. Sequeira, H. Muthurajana and **J.S.D'Souza**
Applied Nanoscience, 8 (2018) 759-769.

44. Stereo-control through synergistic catalysis in the enantioselective α-alkenylation of aldehyde: A computational study
M. Patil
J. Org. Chem., 83 (2018) 1304 –1311.

45. Aqueous extract of Triphala inhibits cancer cell proliferation through perturbation of microtubule assembly dynamics
S. Cheriyamundath, T. Mahaddalkar, S. N. Save, S. Choudhary, R. V. Hosur and M. Lopus
Biomed. Pharmacother., 98 (2018) 76-81.

46. Coupling of replisome movement with nucleosome dynamics can contribute to the parent daughter information transfer
T. Bameta, D. Das and R. Padinhateeri
Nucleic Acids Research, 46 (2018) 4991.

47. Extensive broadband X-ray monitoring during the formation of a giant radio jet base in Cyg X-3 with AstroSat
M. Pahari, J. S. Yadav, J. V. Chauhan, D. Rawat , R. Misra, **P. C. Agrawal**, S. Chandra, K. Bagri, P. Jain, R. K. Manchanda, V. Chitnis and S. Bhattacharyya
The Astrophysical Journal, 853 (2018) L 11.

48. Quantum memory for Rindler supertranslations
S. Kolekar and J. Louko
Physical Reviews D, 97 (2018) 085012.

49. Unravelling the inhibitory activity of *Chlamydomonas reinhardtii* sulphated polysaccharides against α-Synuclein fibrillation.
S. Choudhary, S. N Save and V. L. Sirisha
Scientific Reports, 8 (2018) 5692.

50. Radiative heavy quark energy loss in an expanding viscous QCD plasma
S. Sarkar, C. Chattopadhyay and S. Pal
Physical Reviews C, 97 (2018) 064916.

51. Parity doublet structures in doubly-odd ^{216}Fr
Pragati, A.Y. Deo, **S. K. Tandel**, S. S. Bhattacharjee, S. Chakraborty, S. Rai, S. G. Wahid, S. Kumar, S. Muralithar, R. P. Singh, Indu Bala, R. Garg, A. K. Jain,
Physical Review C, 97 (2018) 044309.

52. Kinematics of heavy quark radiative energy loss in viscous QCD plasma
S. Sarkar, C. Chattopadhyay and S. Pal
Few Body Syst., 59 (2018) 77.

53. Rapid elucidation of chemical shift correlations in complex NMR spectra of organic molecules: Two-dimensional Hadamard pure shift NMR spectroscopy
K. Veera Mohana Rao, Ē. Kupče, J. Bharatam and **R. V. Hosur**
*Journal of Magnetic Resonance, 293 (*2018) *77-81*

54. An efficient combination of BEST and NUS methods in multidimensional NMR spectroscopy for high throughput analysis of proteins
K. Veera Mohana Rao, M. Bopardikar, **V. K. Shukla**, R. Kavitha, P. Ranjan, J. S. Singh and **R. V. Hosur**
RSC Advances, 8 (2018) 17616-17621

55. Effect of synthesis conditions on the nature of $GdBO_3$ phase formed
R. G. Nair, S. Nigam, V. Sudarsan, Rekha Rao, R.K. Vatsa and **V. K. Jain**
Chemistry Select, 3 (2018) 7496-7506.

56. Facile one-pot synthesis of tin selenide nanostructures using dioganotin bis (5-methyl-2-pyridyselenolates)
A.Tyagi, G. Karmakar, A. Wadawale, A. Y. Shah, G. Kedarnath, A.P. Srivastava, V. Singh. **V.K. Jain**
Journal of organometallic Chemistry 873 (2018)15-21.

57. Synthesis and characterization and photovoltaic properties of colloidal Cu2SnSe3 nano-structures using molecular precursors
Adish Tyagi, A.Y. Shah, G. Kedarnath, A. Wadawale, V. Singh, D. Tyagi, C.A. Betty, C. Lal and **V.K. Jain**
J. Materials Science: Materials in Electronics, 29 (2018) 8937-8946.

58. Characterization, and evaluation of bioactive potential of sulfated polysaccharides-enriched extract from Chlamydomonas reinhardtii
P. Kamble, S. Cheriyamundath, M. Lopus and S. Vavilala
J. Appl. Phycol., 30 (2018) 1641-1653.

59. Exposure of aggregation-prone segments is the requirement for amyloid fibril formation
S. Pramanik and **B. Ahmad**
Current Protein and Peptide Science, 19 (2018) 1024-1035.

60. Generating nucleosomal ladders in-vivo by releasing endogenous endonucleases in *Chlamydomonas reinhardtii*.
N. D'Souza, P. Joshi, **S. Kaginkar and S. Sen**
Plant Molecular Biology Reporter, 36 (2018) 363-371.

61. DNA methylation patterns separate senescence from transformation potential and indicate cancer risk.
W. Xie, I. Kagiampakis, L. Pan, Y. W. Zhang, L. Murphy, Y. Tao, X. Kong, B. Kang, L. Xia, F. L. F. Carvalho, **S. Sen**, R. W. C. Yen, C. A. Zahnow, N. Ahuja, S. B. Baylin and H. Easwaran
Cancer Cell, 33 (2018) 309-321.

62. Discovering novel enzymes from marine ecosystem: A metagenomic approach
Priyanka Kamble and Sirisha L. Vavilala
Botanica Marina, 61 (2) (2018) doi.org/10.1515/bot-2017-0075

63. Peroxisomes: Role in cellular ageing and age-related disorders
N. M. Deori, **A. Kale**, P. K. Maurya and S. Nagotu
Biogerontology, 2018 (In Press).

64. Selective measurement of ^{1}H–^{1}H scalar couplings from crowded chemical shift regions: Combined pure shift and spin-echo modulation approach
K. Veera Mohana Rao, K. M. Jerripothula, S. P. B. Vemulapalli and J. Bharatam
*Magnetic Resonance in Chemistry, (*2018) DOI: 10.1002/mrc.4726.

7.2 Publication in Conference proceedings:

1. Optical monitoring of Active Galactic Nuclei from ARIES
Gopal-Krishna, P. J.Wiita
BSRSL, 87 (2018) 281-290

2. Spectroscopic and polarimetric study of radio-quiet weak emission line quasars
P. Kumar, H. Chand, **Gopal-Krishna**, R. Srianand, C. S Stalin, P.Petitjean
BSRSL, 87 (2018) 316-320

3. Revisiting the incidence of Mg II absorbers along the blazar sightlines
S. Mishra, H. Chand, Gopal**-Krishna**, R. Joshi
BSRSL, 87 (2018) 325-329

4. Intra-night optical variability properties of X-ray bright Narrow-line Seyfert 1 galaxies
V. Ojha, H. Chand, **Gopal-Krishna**
BSRSL, 87 (2018) 387-390

5. Probing the central engine and environment of AGN using ARIES 1.3-m and 3.6-m telescopes
H. Chand, S. Rakshit, P. Jalan, V. Ojha, R. Srianand, M. Vivek, S. Mishra, A. Omar, P. Kumar, R. Joshi, **Gopal-Krishna**, R. Kumar
BSRSL, 87 (2018) 291-298

6. Study of Neutron Scattering in the Nonlocal Framework
N. J. Upadhyay, **A. Bhagwat** and B. K. Jain
DAE – BRNS Symposium on Nuclear Physics, Thapar University, Punjab, 2017.

7. Study of Magnetofluidic Laser Scattering Under Rotating Magnetic Field
C. Pai, M. Shalini, V. B. Varma, S. Radha, **R. Nagarajan**, and R.V. Ramanujan
62nd DAE Solid State Physics Symposium, (2018), BARC, Mumbai. Citation: AIP *Conference Proceedings 1942, 050126 (2018); doi: 10.1063/1.5028757*

8. Kinematics of heavy quark radiative energy loss in viscous QCD plasma
S. Sarkar, C. Chattopadhyay and S. Pal
Few Body Syst. 59, 77 (2018)

9. Using algae to target Cancer: Exploiting materials to design novel epigenetic assays and combinatorial therapies.
S. Sen
National Workshop on Materials Chemistry, Mumbai, Dec 2017

10. Degrees of maps between Isotropic Grassmann Manifolds
S. Basu, **S. Sarkar**
Topology Proceedings, Vol. 51 (2018), 133-141

7.3 Book Chapter:

1. Raman Spectroscopy: A Potential Characterization Tool for Carbon Materials
P. Rai and S. K. Dubey
Handbook of Materials Characterizations, *Springer (2018).*

2. Banana and Plantains: Improvement, Nutrition and Health. Reference Series in Phytochemistry. **S.B. Ghag**, T.R.Ganapathi TR (2018)
Bioactive Molecules in Food, KG Ramawat, JM Me´rillon (eds.) Springer, Cham. DOI: 10.1007/978-3-319-54528-8_73-1 (ISBN: 978-3-319-54528-8).

3. Recent Advances in Ultrafast Spectroscopic Technique: Probing the interplay between structure and Dynamics of Molecules, in "Advances in Applied Spectroscopy: Concepts and Techniques"
P. Mathi, **Dipak K. Palit** and B. N. Jagatap (2017)
eds. Y. Dwivedi and S. B. Rai, Chapter 7, page 179 – 222 (2017) (Nova Publishers, New York).

4. Applications of metal-selenium and /-tellurium compounds in materials science
V.K. Jain and G. Kedarnath
In 'Selenium and tellurium reageants in chemistry and materials science'; Eds. R. Laitinen and R. Oilunkaniemi, Walther de Gruyter, Germany

8. Conference, Invited talks and Lecture given outside CEBS

8.1 School of Biological Sciences

Jacinta D'Souza

Conference attended, Invited talks, presentations made:

- As a resource person to deliver a talk at the 3-day programme titled, IRIS for conducting a seminar on the Molecular Biology module, '*Chlamydomonas* - the green yeast with an animal-like tail also experiences stress' held at the Department of Life Sciences, Jain Hind College on 29th July, 2017.
- Presented a poster (by MSc student, Mr. Percival D'gama) titled, 'Binding of proteins with dimerization and docking domain with A-kinase anchoring protein in flagella' at the Mumbai Chapter of Society of Biological Chemists (India) on 19th August, 2017 held at the UM-DAE CEBS, Mumbai. Also the Chief Organizer of this one-day symposium.
- On the topic 'Protein-Protein interactions: The Cellular Prima Donna's' held on 1st November, 2017 as part of the NIUS-Biology camp.
- Invitation to deliver a talk as a **keynote speaker**_at the Advanced Centre for Treatment, Research & Education in Cancer (ACTREC), Tata Memorial Centre, Navi Mumbai who are organizing the 13th National Research Scholars Meet (NRSM) in Life Sciences on 14th-15th December 2017.
- Invited to deliver a talk at the Dept. of Atomic & Molecular Physics, MAHE, Manipal on 9th February, 2018 on the topic, 'Cellular aggregation: united we stand'.
- Invited to deliver a talk at the South Indian Children's Education Society's College of Arts, Commerce and Science, Ambarnath on 24th February, **2018** on the topic, 'Cellular machines' at the One-day seminar on Biophysics.

Collaboration:

- Prof. Deepak Mathur, Senior Professor at TIFR on the project titled, 'Effect of *in situ* generated radicals and free electrons on plasmid DNA'.
- Prof. Santhosh Chidangil, HOD, Dept. of Atomic and Molecular Physics, Manipal University on the project titled, 'Raman Spectroscopy of flagellar proteins'.
- Prof. Takashi Ishikawa (Paul Scherer Institute, Switzerland) on the project titled, 'Molecular and structural insight into an Adenylate Kinase-rich Multiprotein complex in the flagellar/ciliary central pair by in vitro and in vivo cryo-EM imaging'

Seminar/workshop organized:

- Organized the Mumbai Chapter of Society of Biological Chemists (India) on 19th August, 2017 at the UM-DAE Center for Excellence in Basic Sciences, Mumbai.
- Organized an educational trip for the 5th semester students on 24th Aug, 2017 – visit to Maharashtra Nature Park Society's Mahim Nature Park Staff.

Manu Lopus

Invited Talks:

- Invited talk on "Gold nanoparticles as microtubule-targeted cancer therapeutics" in December 2017 at International Conference on Nanotechnology, IIT Roorkee
- Invited talk on "Strategic design of gold nanoparticles for the complete elimination of tumor cells by targeting microtubules", National Workshop on Material Chemistry, UM-DAE CEBS in December 2017.

Collaborations:

- Prof. Jacinta D'Souza, UM-DAE CEBS on "Understanding the role of microtubule dynamics in flagellar paralysis and its therapeutic significance"
- Prof. Srinivas Kantevari, IICT, Hyderabad. "Strategic design of potent noscapine derivatives against breast cancer" .
- Prof. Nandkishore, IIT Bombay: on "Cytotoxicity studies of drug-loaded niosomes".

Sirisha L. Vavilala

Invited talks and conferences:

- Participated in 3 day national workshop on "Healthy and Blissful living through science of Yoga and Ayurveda" at Rashtriya Sanskrit Sansthan, located in Somaiah college, VidhyaVihar West, on March 23rd -25th, 2018 Mumbai
- Attended NASI Conference on Technological Empowerment of Women scheduled on March 08-09, 2018, at Vigyan Bhawan, New Delhi.
- 2017 Poster presentation on "Antioxidant potential of sulphated polysaccharides extracted from *Chlamydomonas reinhardtii*", at "Society of Biological Chemists, Mumbai Chapter" on Aug19th, 2017.

Collaborations:

- Dr. Sinjan Choudhary, UM DAE CEBS, Mumbai on "*In vitro* biophysical investigation on the inhibition of protein fibrillation and dissolution of fibrils by algal sulfated polysaccharides".
- Dr. Manu Lopus UM DAE CEBS, Mumbai on "Understanding the anticancer potential of sulfated polysaccharides extracted from *C. reinhardtii*".
- Dr. Jacinta D'Souza, UM DAE-CEBS, Mumbai "In Vitro Anti biofilm and anti-quorum sensing potential of algal sulphated polysaccahrides".
- Dr. Neelu Joshi, Dr. D. Y. Patil University on "Structural characterization and antioxidant potential of bioactive compounds from plants and algae".
- Sri Satya Sai Instituteof Higher learning, Puttaparti, Andhra Pradesh: Dr. S. Venketesh on Structural characterization and neuroprotective ability of algal sulfated polysaccharides in neurodegenerative diseases.

Siddhesh Ghag

Poster Presentation

- Poster presented in DST-DBT Joint conclave meeting held during 8-10th June 2018 at Hotel Marriot, Jaipur-India, titled "Study of virulence in plant pathogenic ascomycete fungi."

Collaboration:

- Prof. N. S. Punekar, Indian Institute of Technology- Bombay, Mumbai on "Understanding the role of Fusarium pathogenicity factors in Fusarium wilt disease of banana".
- Prof. Jacinta D'Souza, UM-DAE CEBS, Mumbai on "Towards understanding the protein interactors of SGE1 in Fusarium-banana pathosystem".
- Dr. Pratiksha Alaag, National Facility for Biopharmaceuticals, Mumbai on "Understanding the functional significance of a Fusarium effector protein SIX1 involved in Fusarium wilt disease of banana".
- Dr. T. R. Ganapathi, Bhabha Atomic Research Centre, Mumbai on "Developing transgenic banana plants resistant to Fusarium wilt disease using biotechnological approaches".
- Dr. Sirisha L. Vavilala, UM-DAE CEBS, Mumbai on "The untapped antifungal potential of algal sulfated polysaccharides to prevent Fusarium wilt disease in banana".

Seminar/workshop organized

- Society of Biological Chemists (India), Mumbai Chapter-2017 one day symposium titled "Recent Advances in Chemical Biology."

Subhojit Sen

Invited Talks:

- Invited talk on "From basic research to biomarkers in cancer: Where are we headed?" Oncology Conference, Thane, April 2018.
- Invited talk on "Using algae to target Cancer: Exploiting materials to design novel epigenetic assays and combinatorial therapies." National Workshop on Materials Chemistry, Mumbai, 2017.
- Invited talk on "The whole world has brown eyes: Understanding epigenetics to crack cancer." Colloquium at TIFR Hyderabad, 2017.
- Invited talk on "Evaluating cancer epigenetic pathways from humans to Chlamydomonas."Ramalingaswami Conclave, Imphal, 2017.

Lectures given outside CEBS:

- Sayahadri School, Nashik, 2018.
- Graduate course on "Introduction to Epigenetics" at TIFR Hyderabad, 2017.

Collaborations:

- Dr. H. Easwaran, Johns Hopkins, Baltimore, USA on "Cancer Epigenetics in human model systems".
- Dr. V. Patel, NIRRH, Mumbai, on Targeting HIV reservoirs".

- Dr. Siddhesh Ghag and Dr. Jacinta D'Souza, CEBS: on "Studying resistance to *Fusarium* wilt in Banana".
- Dr. Jacinta D'Souza, CEBS, Mumbai, "Developing an eco-friendly detection system for potential diagnostics using the unicellular alga *Chlamydomonas*".

Seminar /workshop organized:

- Workshops organised: National Workshop on Materials Chemistry, Mumbai, 2017.
- Conference organised: Society of Biological Chemists, Mumbai Chapter, 2017.

8.2 School of Chemical Sciences

Neeraj Agarwal

Conference attended, Invited talks:

- Attended National Workshop on Materials Chemistry (Energy and Biology Applications) EN-BIO MAT- Dec 2017
- Invited Talk at International Conference on Nanotechnology: Ideas, Innovations and Initiatives (ICN:3I-2017), IIT Roorkee, Roorkee, India.
- Attended Research Scholars Meet (RSM) held at Jai Hind College, 2018.
- Invited lecture in Chemistry Division, BARC, Mumbai.
- Invited talk at International Conference on Nanotechnology: Ideas, Innovations and Initiatives (ICN:3I-2017), IIT Roorkee, Roorkee, India.

Collaborations:

- Dr. Sangita Bose, School of Physical Sciences, CEBS, Mumbai
- Dr. KRS Chandrakumar, BARC, Mumbai

Mahendra Patil

Collaborations:

- Dr. Shabana Khan, IISER Pune on "Synthesis of a new saturated N-heterocyclic silylene, its reactivity and catalytic application"

Avinash Kale

Conference attended, Invited talks:

- As an invited speaker, delivered a lecture titled "Structural insights into dynamics of RecU-HJ complex formation elucidates key role of NTR and stalk region towards formation of reactive state" at Society of Biological Chemists (India) - Mumbai chapter held at UM-DAE-CEBS. August 2017
- Invited as a chief guest for the scientific event "PARAS" at Hon. Shri. Babanrao Pachpute Vichardhara Trust's Parikrama Group of Institutions. Given a lecture titled, "Research and Innovation". September 2017
- Invited as subject expert to teach at the Protein Crystallization Workshop organized by Synchrotron Light Research Institute (SLRI), Thailand (Government of Thailand). December 2017.

- As an invited speaker, delivered a lecture titled, "It's good to be greedy" at Indian Biophysical Society Meeting (IBS-2018) held at IISER Pune. March 2018.

Lectures given outside CEBS:

- "Bio Crystallography & Magnetic Resonance Techniques (course code PSBP302)" to Department of Biophysics, University of Mumbai.
- "Elements of Bioinformatics & Chemoinformatics (Course code PSBP403)" to Department of Biophysics University of Mumbai.
- "Bio Crystallography & Magnetic Resonance Techniques to St. Xavier's College, Mumbai.

Collaboration:

- Dr. Abhay Chaudhary, Haffkine Institute, Mumbai and Dr. Meera Ramya, Haffkine Institute, Mumbai, Dr. Soumen Manna, SINP, Kolkata. Dr. Prasenjit Bhaumik and Dr. Supreet Saini, IIT-B on "Larvaecidal toxicity".
- Dr. Prasenjit Bhaumik, Haffkine Institute, Mumbai on "Larvaecidal toxicity".
- Dr. Supreet Saini and Dr. Sarath Chandra Dantu IIT-B, Dr. Lipi Thukral, IGIB, New Delhi, on "Actin polymerization dynamics / and resolvase".
- Dr. Ramesh Natesh, IISER, Trivandrum, on "Actin polymerization dynamics"
- Dr. Shirish Nagotu, IIT, Guwahati on "Yeast ageing".

Seminar/workshop organized:

- Worked as member of the organizing committee towards organizing NWMC-2017 workshop organized at CEBS, Mumbai during 15-16 Dec, 2017.

Sinjan Chaudhary

Conference and Invited talks:

- Attended NASI Conference on "Technological Empowerment of Women" on March 08-09, 2018, at Vigyan Bhawan, New Delhi.
- Attended National Seminar and Workshop on "Healthy and Blissful living through Science and Ayurveda" on March 22-24, 2018 at K. J. Somaiya College, Mumbai.

Collaborations:

- Prof. R.V. Hosur and Dr. Manu Lopus, CEBS, Mumbai on "Effects of Ayurvedic medicines and natural products in inhibition of cancer".
- Dr. Mahendra Pstil, CEBS, Mumbai on "Small synthetic indole derivatives based therapeutics for Parkinson's Disease".
- Prof. R.V. Hosur, CEBS, Mumbai, "Effects of Ayurvedic medicines and natural products in inhibition of α-Synuclein fibrillation".
- Dr. Sirisha L. Vavilala, CEBS, Mumbai, "*In vitro* Biophysical Investigation on the effects of algal sulfated polysaccharides on Inhibition of Protein fibrillation and Dissolution of fibrils".
- Prof. H.S. Misra, Molecular Biology Division, BARC, Mumbai on "Effects of *Cyanobacterial* extract on inhibition of protein aggregation/fibrillation".
- Prof. Nand Kishore, Department of Chemistry, IIT –B, Mumbai on "Unravelling the binding thermodynamics of natural plant products with human serum albumin."

Basir Ahmad

Conference attended, Invited talks:

- Poster presentation on "Can small molecules reverse amyloid fibrils into monomeric state?" – Basir Ahmbad
  42nd Annual Meeting of the Indian Biophysical Society (IBS), IISER Pune, March 9-11, 2018
- Young investigator's talk on "Biophysical insights into the earliest steps of protein gelation pathway" Anumita Kumari and Basir Ahmad*
  42nd Annual Meeting of the Indian Biophysical Society (IBS), IISER Pune, March 9-11, 2018
- Poster Presentation on "Small Molecule Induced Modulation of Protein Aggregation Maithreyi Ramakrishnan and Basir Ahmad*
  42nd Annual Meeting of the Indian Biophysical Society (IBS), IISER Pune, March 9-11, 2018
- Poster presentation on "A Comparative Thermodynamic Study of Interaction of Plumbagin with Serum Albumin"
  Poonam Singh and Basir Ahmad*
  42nd Annual Meeting of the Indian Biophysical Society (IBS), IISER Pune, March 9-11, 2018

Collaborations:

- Prof. Rizwan H Khan, Aligarh Muslim University, Aligarh on "Physical basis of prevention of protein aggregation"

Swapan Ghosh

Invited Lectures Delivered / Symposium attended:

- Delivered an invited Lecture at the "International Conference on Energy Materials", held at Vidyasagar University, Midnapore, during April 20-21, 2017.
- Delivered an invited lecture on "Density Functional theory in Parameter Space" at the Symposium in honour of Prof Mihir Chowdhury, held at IIT, Bombay on August 4, 2017.
- Delivered two lectures on "Density Functional theory" at the BRNS Workshop on Electronic Structure Theory of atoms, molecules and Solids", held at BARC, during August 30, 2017.
- Delivered an invited lecture at the "Recent Advances In Condensed Matter Physics and Nonlinear Dynamics", held at University of Pune, during October 30-November 1, 2017.
- Delivered an invited lecture at the "International Conference on Nano- and Functional Materials: Interface between Science and Engineering (NFM-2017)", held at BITS, Pilani, during November 16-18, 2017.
- Delivered an invited lecture at the "Asia Pacific Conference on Theoretical and Computational Chemistry (APCTCC-8)" held at IIT Bombay, during December 15-17, 2017.

- Delivered an invited lecture on Science Academies' Refresher course on "Foundations of Physical Chemistry and its Applications" at the IWSA, Vashi, on December 23, 2017.
- Delivered an invited talk at the "International Conference on Systems and Processes in Physics, Chemistry and Biology (ICSPPCB-2018)", held at Assam University, Silchar, Assam, March 1-3, 2018.
- Delivered an invited Lecture at the "Symposium on Advances in Materials Research and Simulation", held at IACS, Kolkata, during May 25, 2018.
- Invited Speaker at the "Workshop on Electronic Structure Theory", at IIT, Bombay, during July 13-15, 2018.
- Chaired a Scientific Session at the "International Conference on Nano- and Functional Materials: Interface between Science and Engineering (NFM-2017)", held at BITS, Pilani, during November 16-18, 2017.
- Chaired a Scientific Session at the "Trombay Symposium on Radiation and Photochemistry (TSRP)" held at Anushaktinagar, Mumbai on 6th January, 2018.
- Chaired a Scientific Session at the "International Conference on Systems and Processes in Physics, Chemistry and Biology (ICSPPCB-2018)", held at Assam University, Silchar, Assam, March 1-3, 2018.

Lectures Given Outside CEBS:

- Delivered an invited Colloquium on "Role of Density in Chemistry" at IISER, Kolkata, on 25th October, 2017.
- Delivered an invited lecture on "DFT in Parameter Space" at the Centre for Theoretical Studies at IIT, Kharagpur on 26th Feb, 2018.
- Delivered an invited lecture for students on "Basics of density based theories in chemistry" at Tezpur University on 14th May, 2018.
- Delivered a series (twelve) of lectures on "Electronic Structure of atoms and molecules through density functional theory" for the Ph. D. and M. Sc. students of NEHU, during May 15-22, 2018.
- Invited Speaker at the "Preparatory Workshop for the International Chemistry Olympiad Team", at HBCSE, on July 6, 2018.

Dipak Palit

Conference Attended:

- International School on Electron Accelerators, Free Electron Laser and Application of Electron beam/THz Radiation held at IUAC, Delhi, March 6 – 9 (2018).
- "Electronic Structure, Spectroscopy and Dynamics" at Indian Association for the Cultivation of Sciences, Kolkata, Feb. 22 – 25 (2018).
- DAE-BRNS Theme Meeting on 'Ultrafast Science 2017' in ACRHEM, University of Hyderabad, Hyderabad, November 2 - 4, 2017.

Invited Talks:

- Dipak K. Palit, Hydration Dynamics of HSA Protein: Steady State THz Absorption Spectroscopy Study, in International School on Electron Accelerators, Free Electron

Laser and Application of Electron beam/THz Radiation held at IUAC, Delhi, March 6 – 9 (2018).

- Dipak K. Palit, Ultrafast Dynamics of Hydrogen Bond in the Excited State: Time-Resolved Visible Pump – IR Probe Spectroscopic Study, in conference "Electronic Structure, Spectroscopy and Dynamics" at Indian Association for the Cultivation of Sciences, Kolkata, Feb. 22 – 25, (2018).
- Dipak K. Palit, Dynamics of Hydrogen Bond: Steady State and Time-Resolved Infrared and THz Spectroscopic Study, at ACRHEM, University of Hyderabad, Feb. 22, (2018).
- D. K. Palit, High Power THz Generation Using Ultrafast Electron Accelerators and Application in Protein Hydration, in QIP Short Term Course cum Workshop on "Industrial Applications of Terahertz Radiation" at IIT Kharagpur, March 27 - April 2, (2017).
- CEBS Colloquium: Dynamics of Bond Breaking and Bond Making: Utrafast Spectroscopy of the Excited and Excitonic States, April 10, (2017).

Collaborations:

- Subhendu Ghosh,IUAC Delhi and Rajib Mitra S N Bose Institute, Kolkata on "THz Spectroscopy of Biomolecules and Protein Hydration:"

Seminar/workshop organized:

- Member, National Advisory Committee, DAE-BRNS Theme Meeting on 'Ultrafast Science 2017' in ACRHEM, University of Hyderabad, Hyderabad, November 2 - 4, 2017.

Vimal K. Jain

Invited Lectures:

- Invited lecture on "Applications of Inorganic and organometallic compounds in materials science" at Refresher course for University teachers, organized by Department of Chemistry, University of Mumbai, Kalina Campus, Mumbai, 7 November 2017.
- Invited lecture on "Palladium and platinum complexes of chalcogen ligands as catalysts in C-C and C-E bond formation" in the Conference on Advances in Catalysis for Energy and Environment (CACEE), TIFR, Mumbai, January 10-12 (2018).

Sunita Patel

Invited talk, Conference, Seminar attended:

- Invited talk on "Mechanism of amyloid fibril formation in the peptide model, IKYLEFIS, of myoglobin G-helix"in the INDO-GERMAN Workshop on Computing in Chemistry, Biology and Medicine 2017 at IIIT Hyderabad from 29-30 November 2017.

Collaborations:

- Prof. Y. U. Sasidhar, IIT Bombay on "Asymmetrical β-hairpin nucleates formation of amyloid fibril in the G-helix of myoglobin protein."

- Prof. K.V.R. Chary, Director, IISER Berhampur and Dr. Yogendra Sharma, CCMB Hyderabad on "Mechanistic insights from REMD simulations into mutation induced disordered-to- ordered transition in Hahellin belonging to bg-crystallin family".
- Prof. R. V. Hosur (TIFR Mumbai and UM-DAE CEBS) on " An ordered M-Crystallin and an intrinsically disordered Hahellin of βγ-crystallin family provide mechanistic insights into the conformational transition linked to cataract and polypeptide cleavage ".

8.3 School of Mathematical Sciences

Balwant Singh

Lecture given outside CEBS:

- Invited lecture on `The Jacobian Conjecture' on July 22, 2017 at Bhaskaracharya Pratishthana, Pune.

Swagata Sarkar

Invited Lecture at Conferences:

- Degrees of maps between certain homogeneous spaces - 30th Annual Ramanujan Mathematics Society Conference, held at Dept. of Mathematics, University of Delhi, June 1-3, 2018.

Conference/Workshops attended:

- 30th Annual Ramanujan Mathematics Society Conference, held at Dept. of Mathematics, University of Delhi, June 1-3, 2018.
- National Conference on Technological Empowerment of Women, held at Vigyan Bhavan, Delhi, March 8-9, 2018.

Collaborators:

- Prof. Samik Basu, Stat-Math Unit, ISI-Kolkata
- Prof. Rekha Santhanam, Dept. of Mathematics, IIT-Bombay, Mumbai
- Prof. Shilpa Gondhali, Dept. of Mathematics, BITS-Pilani, Goa Campus

S. G. Dani

Conference attended, Invited talks, presentations made:

- An Invited talk in the National Conference on History of Mathematical Sciences at Sri Guru Ram Rai PG College, Dehradun, on 5 October 2017, on Mathematics in Ancient India.
- An Invited talk in the International Conference Exploring the History of Indian Mathematics, at the Indian Institute of Technology Gahdhinagar, on 6 December 2017, on Syamadas Mukhopadhyaya : his life and works.

- An Invited talk in the International Conference on Algebra, Discrete Mathematics and Applications, at Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, on 9 December 2017, on Roots of elements in groups.
- A Keynote Address at the 2nd International Conference on Recent Advances in Mathematical Sciences and its Applications (RAMSA) 2017, at the Jaypee Institute of Information Technology, Noida, on 12 December 2017, on Equations, inequalities and their solutions in integers.
- An Invited Sectional Talk in the conference on Vedic and Modern Sciences, Insights, Interfaces and Integration, held at the Deccan College, Pune, on 12 January 2018, on Ancient mathematics, relevance today and tomorrow.
- An invited talk in the conference Celebrating Centenary Year of Professor S.S. Shrikhande, at the University of Mumbai, on 25 January 2018, on The works of Marina Ratner and Maryam Mirzakhani.
- An Invited talk in the International Conference on Mathematical Sciences and Applications, at the Guru Ghasidas Vishwavidyalaya, Bilaspur, on 23 February 2018, on Images of Power Maps in Groups of Lie Type.

Lectures given outside CEBS:

- A Colloquium talk at the University Science Club of the Savitribai Phule Pune University, Pune, on 19 August 2017, on "Equations, inequalities and their solutions".
- An invited talk in the Indian Women in Mathematics (IWM) Regional Workshop at Indian Institute of Science Education and Research, Bhopal, on 7 October 2017, on Continued fraction expansions and their applications.
- Two invited lectures in the Workshop on Geometry, Groups and Dynamics (GGD) 2017, held at the International Centre for Theoretical Studies (TIFR), Bengaluru, on 20 and 21 November 2017, on Hyperbolic Geometry, the modular group and Diophantine approximation.
- An Invited talk in the Advanced Instructional School (AIS) on Ergodic Theory and Dynamical Systems (2017), held at the Indian Institute of Technology Delhi, on 11 December 2017, on Some unusual large subsets arising as winning sets of some games.
- An invited talk at Ruia College, Mumbai, on 18 December 2017, on Relating Dynamics and Number Theory.
- Two invited talks in the SERB School on Nonlinear Dynamics, held at the Savitribai Phule Pune University, on 20 and 22 January 2018, on Ergodic Theory.
- Two invited talks in the SERB School on Nonlinear Dynamics, held at the Savitribai Phule Pune University, on 27 and 28 January 2018, on History of Indian Mathematics.
- An Invited talk at the National Institute of Science Education and Research (NISER), Bhubaneswar, on 9 February 2018, on Geometry and dynamics of numbers.
- An invited talk in the Number Theory seminar at Institute of Mathematics of Luminy, University of Aix – Marseille, on 19 June 2018, on Continued fraction expansions of complex numbers with Gaussian and Eisenstein integers.

Collaborations:

- Arnaldo Nogueira, Institute of Mathematics of Lumumy, Aix-Marseille University, Marseille, France on "Diophantine approximation with nonsingular transformations"
- Arunava Mandal, Indian Statistical Institute, Delhi on "Exponential maps of Lie groups and homogeneous spaces"
- Ojas Sasrabudhe, Indian Institute of Technology Bombay, Mumbai (student) on "Continued fraction expansions of complex numbers through general algorithms".

Saradha Natrajan

Collaborators:

- Pranabesh Das- Post-doctoral fellow- Institute of Mathematical sciences, Chennai, India
- Shanta Laishram- Associate Professor- Indian Statistical Institute, Delhi, India
- Ekata Saha- Post -doctoral fellow- Tata Institute of Fundamental Research, Mumbai, India
- Divyum Sharma- Post doctoral fellow- University of Waterloo- Canada.

8.4 School of Physical Sciences

Ameeya Bhagwat

Lectures Given Outside CEBS:

- Taught a unit on Nuclear Structure to the University Department of Physics, University of Mumbai (M.Sc. - II) students, 2017.

Collaborations:

- Prof. Xavier Viñas and Prof. Mario Centelles, Department of Physics, University of Barcelona on "Wigner – Kirkwood Mass Formula".
- Prof. Ramon Wyss and Prof. Roberto Liotta, Department of Nuclear Physics, KTH Stockholm on "Wigner – Kirkwood Mass Formula, theories of alpha and cluster emission from heavy and superheavy nuclei".
- Prof. Wasi Haider and Dr. Manjari Sharma, Department of Physics, Aligarh Muslim University on "proton – nucleus scattering process".
- Prof. Peter Schuck, Groupe de Physique Théorique, Institut de Physique Nucléaire (IPN) Orsay, France on "Wigner – Kirkwood Mass Formula".
- Roberto J. Liotta, KTH Stockholm, Sweden on Spontaneous particle emissions from nuclei- the Berggren Space approach"
- Prof. Y. K. Gambhir, Department of Physics, IIT Bombay on "Relativistic mean field theory, superheavy nuclei".
- Prof. Mohini Gupta Manipal Institute of Natural Sciences on "superheavy nuclei".

- Bharat K. Sharma, Matha Amrithanadamati University, Coimbatore, on "Relativistic Mean Field Theory and some of its applications"
- Dr. Neelam J. Upadhyay, CEBS and Prof. B. K. Jain (ex NPD, BARC).

Sangita Bose

Invited talk:

- Invited talk titled "Superconducting Nanostructures" in "National Seminar on Low Temperature Physics" on 5th February 2018 at Chennai.
- Invited talk titled "Non-equilibrium studies in a periodically pinned superconducting film" in "National Conference on Quantum Condensed Matter (Q-Mat) in IISER, Mohali from 25th to 27th July, 2018"
- Oral presentation of our work titled "Study of superconductivity in immiscible Nb-Cu nanocomposite films" by Ms.Pradnya Parab (SRF, UM-DAE CEBS) at the workshop "Superconductivity in atomically thin materials and heterostructures" held during 20th to 23rd November 2017 at CECAM-Lugano, Switzerland."
- Poster presentation of our work titled "Two Gap Superconductivity in Non-Centrosymmetric Re_6Zr Single Crystal by PCAR Spectroscopy" at the DAE Solid State Symposium at BARC, Mumbai, 2017.
- Attended the "National Conference on Technological Empowerment of Women" organized by The National Academy of Sciences, India (NASI) on 8th-9th March, 2018 at Vigyan Bhavan, New Delhi.

Collaborations:

- Dr. R. Singh, IISER, Bhopal on " Superconductivity in non-centrosymmetric superconductors, Name of Collaborator"
- P. Raychaudhuri and R. SenSarma, TIFR, Mumbai, on "Vortex Matching effect in anti-dot array of NbN films"
- Dr. N. Agarwal, UM-DAE CEBS on " Organic Electronic devices"

Seminar/workshop organized:

- Organized a "One-day Hands-on Training Workshop on Organic Electronics by Prof.Amitabh Banerji and team, Institute of Chemistry Education, University of Cologne" on 2nd December, 2017 at UM-DAE CEBS, Mumbai.
- Secretary of the National Workshop on Materials Chemistry (NWMC-17)-ENBIO-MAT on 15th-16th December, 2017 at UM-DAE CEBS, Mumbai

Padmnabh Rai

Collaboartion:

- Dr. Alexandre Bohelier, Université de Bourgogne, Dijon, France on 'Nanoscale Plasmonics'.
- Dr. Satish Kumar Dubey, IIT Delhi on "Surface Enhanced Raman Scattering:, India".
- Dr. Pawan Kumar Tyagi, Delhi Technical University, Delhi on "Field Emission Devices".
- Trushna Exim, Surat, "Single Crystal Diamond".

Sujit Tandel

Invited talks at onferences:

- Invited talk on "Isomers from multi-nucleon hole configurations near doubly-magic 208Pb" at, International Conference on Frontiers in Gamma-Ray Spectroscopy, March 12-14, 2018, Mumbai
- Invited talk on "In-beam and decay spectroscopy of superheavy nuclei, Orientation Programme" DAE-BRNS Symposium on Nuclear Physics, December 19-24, 2017, Patiala

Conference organization:

- International Conference on Frontiers in Gamma-Ray Spectroscopy, March 12-14, 2018, Mumbai: Organizing Committee member.
- DAE-BRNS Symposium on Nuclear Physics, December 19-24, 2017, Patiala: Organizing Committee member.

Collaborations:

- Argonne National Laboratory, USA: R.V. F. Janssens
- Bhabha Atomic Research Centre, Mumbai: D.C. Biswas, S. Mukhopadhyay
- Inter-University Accelerator Centre, New Delhi: S. Muralithar, R.P. Singh
- IIT Roorkee: A.Y. Deo
- Tata Institute of Fundamental Research, Mumbai: R. Palit
- University of Massachusetts Lowell, USA: P. Chowdhury
- University of Manchester, UK: B.S. Nara Singh, D. Cullen

Ananda Hota

Invited talk:

- Gave an Invited Lecture, on 28th Feb 2018, titled " #BhiMyRa : Black Hole in My Rashi, Do you want to see yours using GMRT data? " at Institute of Physics (Odisha) in the Silver Jubilee function of the Samanta Chandrasekhar Amateur Astronomers Association (SCAAA).

Conference, workshop attended:

- Presented three Poster papers in the annual conference of the Astronomical Society of India meeting (5 - 9 February, 2018), organised in the Osmania University campus, Hyderabad.

Title of the poster papers are as follows:

- "Five year report on discoveries using GMRT and RAD@home a nation-wide inter-university collaboratory of 100+ citizen-scientists. Ananda Hota et al.
- "Discoveries from GMRT by RAD@home citizen-scientists: Three intriguing cases of jet- galaxy interaction as laboratory for AGN feedback in galaxy merger" Sumanta Kumar Sahoo, …. Ananda Hota.
- "Recent discoveries using GMRT & the growing community of #RADatHomeIndia e-astronomers leveraging Any Bsc/BE Can Do research approach" Akanksha Tiwary … Ananda Hota

Collaborations:

- Huib Intema, Leiden Observatory, Leiden University, Leiden, The Netherlands

- Marek Jamrozy, Astronomical Observatory, Jagiellonian University, Poland
- Luca Cortese, International Centre for Radio Astronomy Research, University of Western Australia, Australia
- Soo-Chang Rey, Chungnam National University, Daejeon 34134, Korea
- Chiranjib Konar, Amity University, Noida, India
- Sravani Vaddi, National Centre for Radio Astrophysics, TIFR, Pune, India
- C S. Stalin, Indian Institute of Astrophysics, Bangalore, India
- Ananta Charan Pradhan, NIT Rourkela, India

Seminar/workshop organized:

- Organised RAD@home Discovery Camp in UM-DAE CEBS from 15 to 21 May 2017
- Organised RAD@home Discovery Camp in Institute of Physics (Bhubaneswar) from 5 to 11 June 2017
- Organised RAD@home Discovery Camp in UM-DAE CEBS from 26 to 30 June 2017
- Organised RAD@home Discovery Camp in Nehru Planetarium (Delhi) from 3 to 8 July 2017
- Organised RAD@home Discovery Camp in UM-DAE CEBS from 15 to 21 July 2017
- Organised RAD@home Discovery Camp in ICTS-TIFR (Bangalore) from 7 to 13 May 2018
- Organised RAD@home Discovery Camp in UM-DAE CEBS from 11 to 17 June 2018

Bhooshan Paradkar

Collaborations:

- Prof. Vinod Krishan, Indian Institute of Astrophysics, Banglore, India on "Astrophysical dynamo in partially ionized plasma".
- Prof. Douglas Gough, University of Cambridge, UK on "Reynolds stress model for turbulent convection zone of the Sun".

Manojendu Choudhury

Workshop:

- Participated and was a resource person a the Workshop on Develpoment of Astronomy-Themed Experiements, held at IUCAA, Pune, during 18-20 June, 2018. He was the mani resource perosn for development of high energy astronomy based experiments to be deployed undergraduate and post-graduate laboratories all over India.

Lectures given outside CEBS:

- Manojendu Choudhury was a resource person at Orientation Cum Selection Camp (OCSC) of the Astronomy Olympiad Camp at HBCSE, 22 April – 08 May, 2017 and gave lecture on Binary Stars.
- Manojendu Choudhury was a resource person at Orientation Cum Selection Camp (OCSC) of the Astronomy Olympiad Camp at HBCSE, 24 April – 11 May, 2018and gave two lectures: Binary Stars, and Variable Stars.
- lecture on Optics at the Astronomy Olympiad Exposure Camp heldn in HBCSE, 31 October – 03 November, 2017.

- Manojendu Choudhury was a resource person at Orientation Cum Selection Camp (OCSC) of the Earth Science Olympiad Camp at Anna University, Chennai, in May, 2017 and gave three lectures on the solar system and planetology.

P. Brijesh

Conference/Workshop:

- Attended user workshop on utilization of accelerator based THz radiation at the future Delhi Light Source at IUAC-Delhi, March 8-10, 2018.

Collaboration:

- Prof. Dipak Palit, CEBS, Mumbai In anticipation and preparation for the future accelerator based THz activity at the Delhi Light Source (DLS) of IUAC-Delhi, expression of interest in using the facility was submitted in the form of a preliminary research proposal
- Dr. Kushagra Nigam and Dr. G. Ravi , FCIPT-IPR for developing and installing plasma experimental systems at CEBS for enhancing teaching of basic plasma sciences.

R. Nagarajan

Lecture given outside CEBS:

- Demonstration of laser-based teaching experiments at Science Academies' Two-day Lecture Workshop on "Lasers and their Applications" held by Indian Women's Science Association (IWSA) 20th and 21st January 2018.
- "Physics in Toys" Popular lecture, at National Workshop on Advanced Research Instrumentation Technologies in Materials Science (ARITMS-2018), Dept. of Physics, St. Aloysius College (Autonomous), Jabalpur (M.P.), 12th-13 Jan 2018.
- "Physics in Toys" at IISER, Bhopal, 15th Jan 2018.
- "Basics of Superconductivity" at IIT, Indore 16th Jan, 2018.
- "Physics in Toys" at IIT Indore, 16th Jan 2018.
- "Overview of Superconductivity – The Phenomenon, Materials and Applications", 100th Refresher Course in Experimental Physics (RCEP-100), Physics Dept., Panjab University, Chandigarh, 19th July 2018.
- "How a discovery is made – Discovery of superconductivity in Quaternary Borocarbides", RCEP-100, Physics Dept., Panjab University, Chandigarh, 19th July 2018.

Collaboaration:

- Dr. Radha Srinivasan, Dept. of Physics, Univ. of Mumbai and Prof. R.V. Ramanujan, National Technological University, Singapore on "Laser scattering studies in Ferrofluids".

Conference/workshop:

- Convenor for the Science Academies' Two-day Lecture Workshop on "Lasers and their Applications" held by Indian Women's Science Association (IWSA) 20th and 21st January 2018. Dr. Lalitha Dhareshwar (former Scientist form BARC and presently Vice President of IWSA) was the coordinator of the course. Experimental part of the

workshop was conducted with equipment from CEBS. Demonstrated, along with Prof. M.N. Nyayate, many laser experiments for teaching.

Manohar Nayate

Lectures Given outside CEBS:

- Taught a unit each on Mathematical Physics and Solid State Physics of Post graduate course for M.Sc. (Part-I Programme of University of Mumbai at colleges of University of Mumbai, B. N. Bandodkar College of Science, Thane, 400601 and S. H. Kelkar College of Arts, Sciences and Commerce, Deogad, Dist. Sindhudurg.
- Demonstration of laser-based teaching experiments at Science Academies' Two-day Lecture Workshop on "Lasers and their Applications" held by Indian Women's Science Association (IWSA) 20th and 21st Jan. 2018.
- Resource Person for the Indian Academy of Sciences' Refresher Course on Experimental Physics at:
    - Bahra University, Simla Hill, Himachal Pradesh - 10th to 24th May 2017.
    - Ramnarain Ruia College, Mantunga, Mumbai, in association with UM-DAE CEBS - 25th Sept to 10th Oct 2017.
    - I.I.T., Patana - 6th to 21st Nov 2017.
    - Rajeev Gandhi Central University, Arunachal Pradesh - 26th March to 10th April 2018.
    - Central University of Karnataka, Gulbarga - 1st to 16th June 2018.
    - Panjab University, Chandigarh, - 17 to 19th July 2018

Neelam Upadhyay

Conference, workshop attended:

- Presented a contributory talk on "*Study of neutron scattering in the nonlocal framework*" in 62nd DAE – BRNS Symposium on Nuclear Physics organised at Thapar University, Patiala, India during 20th-24th December 2017.

Lectures given outside CEBS:

- Shared teaching M.Sc. Semester-IV elective course on Nuclear Reactions at University Department of Physics, University of Mumbai with Dr. Vivek Parkar from BARC for the duration of January 2018 to April 2018.

2) Shared teaching M.Sc. Semester-II core course on Nuclear Physics at University Department of Physics, University of Mumbai with Prof. Anuradha Misra and Dr. R. Chakrabarti from University Department of Physics for the duration of March 2018 to June 2018

Collaboration:

- Dr. A. Bhagwat and Dr. B. K. Jain from CEBS.

Sreemoyee Sarkar

Presentation:

- Oral Presentation named "Kinematics of heavy quark radiative energy loss in viscous QCD plasma", Light Cone-2017 (September), Mumbai.
- "Role of Landau damped gluons on shear viscosity of two flavor color

superconducting quark matter" has been selected for Oral presentation in Conference "Strong and Electroweak Matter (SEWM 2018)" held in Barcelona.

Collaboration:

- Prof. Rishi Sharma, TIFR, Mumbai on "QCD aspects of Neutron Star".
- Prof. Subrata Pal, Chandrodoy Chattopadhyay, TIFR Mumbai on "Heavy Ion Phenomenology".
- Amol Pawar and Tejas Joshi (Msc Student), University of Mumbai on "Transport Theory under strong magnetic field in neutron star".
- Dr. Sushan Konar, NCRA-TIFR on "Physics of Neutron Star".

9. Externally funded Research Projects:

Name of the Principal Investigator	Title of the Project	Funding Agency	Duration	Total Project Amount
Dr. Ameeya Bhagwat	Nuclear Structure Near the Limit of Stability	Department of Science and Technology (DST)	3 years 01.05.2015 to 30.04.2018	27,42,000/-
Dr. Sangita Bose	SERB Women Excellence Award	Science and Engineering Research Board (SERB)	3 years 01.07.2014 to 30.06.2017	18,00,000/-
Dr. Sujit Tandel	Low Energy photon spectroscopy and internal conversion studies	Board of Research in Nuclear Sciences (BRNS)	3 years 01.04.2015 to 31.03.2018	24,85,000/-
Dr. Sinjan Choudhary	Physico-chemical insights into the mode of action of small molecules in the prevention of aggregation/fibrilization of proteins: Quantative aspects	Science and Engineering Research Board (SERB)	3 years 14.07.2014 to 13.07.2017	23,30,000/-
Dr. Neelam Upadhyay	Identification of resonances in reactions of astrophysical interest	Science and Engineering Research Board (SERB)	3 Years 18.01.2017 to 17.01.2020	26,24,400/-
Dr. Neeraj Agarwal & Dr. Sangita Bose	Design, development and understanding of thermally activated delayed fluorescence enabled small organic molecules and their OLEDs applications	Science and Engineering Research Board (SERB)	01.10.2017 to 30.09.2020	27,13,480/-

10. Colloquia 2017-2018:

CEBS organises colloquia on Tuesdays at 3.45 pm. on topics of academic interest by reputed speakers, researchers, scientist, etc. to facilitate exchange of ideas. The list of such colloquia held during 2017-18 is given below:

Sr. No.	Date	Speaker	Title
1.	August 22, 2017	Prof. S. G. Dani	Geometry and Dynamics of Numbers
2.	September 09, 2017	Prof. S. D. Samant, ICT, Mumbai	Interplay of Kinetics and Thermodynamics in Organic Reactions
3.	September 12, 2017	Prof. Stanley Brodsky, Stanford Linear Accelerator Centre, Stanford University, USA	Light-Front Holography: A new approach to Hadron Physics and Quark Confinement
4.	October 03, 2017	Prof. Arnab Bhattacharya, TIFR	Seeking N-Lightenment, One Cup at a Time
5.	October 10, 2017	Prof. M. Ravikanth, IIT-B	Our Rendezvous with Pyrrole Based Macrocycles and Fluorescent Systems
6.	October 17, 2017	Prof. Ullas Kolthur Seetharam, DBS-TIFR	Food for thought: science of aging and diseases
7.	October 24, 2017	Prof. Ankona Datta, TIFR	Chemical Probes for Imaging Essential Biomolecules
8.	October 31, 2017	Dr. Srikumar Banerjee, DAE Homi Bhabha Professor, Bhabha Atomic Research Centre and Former-Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy, Government of India	How to See an Atom?
9.	November 14, 2017	Prof. Tarun Souradeep, IUCAA	LIGO-India: Beyond discovery into Gravitational- wave Astronomy
10.	January 01, 2018	Dr. Sushanta Dattagupta, Bose Institute, Kolkata	Saha Ionization Equation - A Century of Hindsight
11.	January 09, 2018	Dr. Cecile Sicard, University of Paris-Sud	Protein Oxidation mechanism by radiolysis
12.	January 16, 2018	Prof. Sandeep Juneja, TIFR, Mumbai	Queueing games: To wait or to be late
13.	February 06, 2018	Dr. Shankar Rama Murthy	Bench to Bedside Medicine - ideas

			for budding basic scientists
14.	February 20, 2018	Prof. Bikas K. Chakrabarti, J. C. Bose National Fellow and Emeritus Professor at Saha Institute of Nuclear Physics	Econophysics of Income & Wealth Inequalities
15.	March 20, 2018	Prof. Vimal K. Jain, Director, UM DAE CEBS	Retrosynthesis of 2-D metal Chalcogenides"
16.	April 04, 2018	Professor Jayant Narlikar, IUCAA, Pune	How well do we know our universe
17.	April 10, 2018	Dr. D. K. Palit, CEBS, Mumbai	Dynamics of bond breaking and bond making: Ultrafast spectroscopy of the excited and excitonic states
18.	April 16, 2018	Prof. Murali Sastry, CEO of the IITB-Monash Research Academy	Nanotechnology and consumer products: my Tata Swach experience

11. Events

11.1 Meetings:

During the year 2017-2018, the following meetings were held:

A total six Faculty Meetings were held during 2017-2018

25th Meeting of the Governing Council:	May 19, 2017
26th Meeting of the Governing Council:	October 18, 2017
27th Meeting of the Governing Council:	April 06, 2018
16th Meeting of the Academic Board :	August 23, 2017
17th Meeting of the Academic Board :	August 23, 2017
18th Meeting of the Academic Board :	April 27, 2018

11.2 Academic events:

- **Foundation Day Programme:**

The 10th CEBS Foundation Day lecture was scheduled on September 18, 2017 in the Green Technology Auditorium, University of Mumbai, Kalina. Prof. J.B. Joshi, Emeritus Professor, HBNI has been invited to give the lecture on "Generation of National Wealth through Education and Research" Welcome address given by Jacinta D'Souza.

This Programme was followed by the Musical Event by CEBS students, staff and faculty members.

- **Natioanl Science Day Celeberation**

CEBS has celebrated National Science Day on February 28, 2018. In the first session Prof. B. N. Jagtap, IIT-B has given a National Science Day lecture on "Celebrating National

Science Day: What does (should) it mean to us?". The lecture was appricated by CEBs students and faculty members.

In the second session Dr. D. B. Naik, BARC has given lecture on "Creating objects of art using thermocol" followed by a demonstration on how we can make beautiful art objects using thermocol.

- **Visit Nuclear Energy Agency (NEA) delegation to CEBS:**

Nuclear Energy Agency (NEA) delegation comprising of the following, officials accompanied by Shri. Ranjith Kumar (head, Nuclear Controls & planning Wing, DAE) visited CEBS on November 22, 2017 at 10.00hrs.

1. Mr. William Magwood, Director General NEA
2. Mr. Danial Iracane, Deputy DG NEA
3. Ms Giovanna Picarreta, Counse Internation Affairs
4. Ms. Aditi Verma

The dinitaties has a meeting with the Director, CEBS who gave a brief introduction about the Centre. A meeting with the students and faculty meebers was held in the Seminar Hall of prefab. Mr. William Magwood, Director General NEA gave a presentation about NEA. The presentation was quite informative and generated enthusiasm amoung the students and Faculty.

- **Society of Biological Chemists (India) Mumbai chapter**

The Xth Annual meeting of the Society of Biological Chemists (India) Mumbai chapter was hosted by UM-DAE Centre for Excellence in Basic Sciences and held on August 19, 2017 in the Green Technology auditorium, University of Mumbai Kalina Campus. The conclave received a very good response with a total number of 140 registered participants. The diverse and high impact nature of the scientific sessions resulted in a very high percentage (over 90%) of registrants attending the conference throughout the day. Prof. Hari Mishra, Local Chapter Co-convenor of SBC(I) inaugurated the function and spoke extensively about the scientific activities of SBC (I). Prof. Ramakrishna Hosur, Director, UM-DAE CEBS was felicitated by Prof. Sanjeev Galande of IISER Pune, in the inaugural function for his immense

contributions to chemical biology research. Prof. Galande then delivered the keynote speech in which he discussed the utility of epigenetics in understanding complex diseases.

The meeting was divided into five sessions, namely, Chemical biology of unicellular organisms; Complexities of biological chemistry in humans; Multicellular Systems and their environment; structure and function of biological macromolecules; and industrial applications of biological chemistry. Prof. Hema Rajaram (BARC), Prof. Rama Koti (TIFR), Prof. PV Devarajan (ICT), Prof. Sanjay Gupta (ACTREC), Dr. Deepak Modi (NIRRH), Dr. Mahesh Subrahmaniam (BARC), Dr. Amit Dutt (ACTREC), Dr. Abhijit Majumdar (IIT Bombay), Dr. Srishti Dar (TIFR), Dr. Pushpa Mishra (University of Mumbai), Dr. Avinash Kale (UM-DAE CEBS), Dr. S. Chatterjee (ICT), and Dr. Varsha Kelkar-Mane (University of Mumbai), presented their work. Prof. Hari Misra, Prof. Ramakrishna Hosur (Director, UM-DAE CEBS), Dr. V. K. Jain (UM-DAE CEBS), Prof. Swapan Ghosh (UM-DAE CEBS), Prof. S. Sivakami (formerly University of Mumbai), and Dr. Prasanna Venkatraman (ACTREC) chaired the sessions.

The conference received a very active participation of researchers from Colleges and Institutions across the Mumbai city who showcased as many as 27 posters of which three were awarded with the best poster award. The entire conference saw a highly engaged audience who went away with significant learnings and new connections across the scientific community. The concluding remarks were made by Prof. S. Sivakami (formerly UoM).

- **Summer Associate Research Programme at UM-DAE CEBS:**

L to R: Mr T. Naveenprasath, Mr Arnab Goswami, Mr Uttiya Roy, Prof V. L. Sirisha, Mr Avinash Kumar, Prof Sinjan Choudhury, Prof Basir Ahmad (Co-coordinator, SARP), Ms Sadhavi Srivastava, Prof Ananda Hota (Coocdinator, SARP), Prof Vimal K. Jain (Director, CEBS), Ms Komal Ahire, Dr Sunita Patel, Mr Tejas Joshi, Dr Sreemoyee Sarkar. Absent during photography Prof Avinash Kale, Prof Swagata Sarkar, Dr Sanved Kolekar, Mr Kunal Borase & Ms Rachel Bijoy

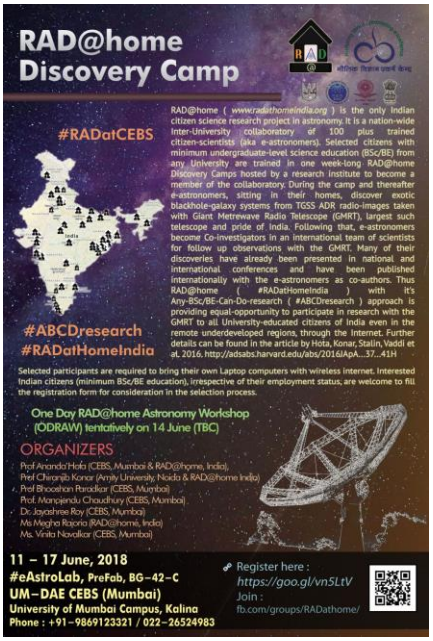
Recently, the 4th Summer Associate research Programme of CEBS (#SARPatCEBS) has been successfully completed (14th May to 13th July 2018). Nine projects were offered from CEBS faculties. Students from various institutions participated. So far, since the launching of SARP in 2015, Fifty students from all over India have got exposure to research. Some results have already reached draft manuscripts. Students from remote Universities or under-developed regions are encouraged to apply for this programme. So far, over 700 students have applied to participate in this programme. The SARP-trained student names, host universities, CEBS-guide name, duration and SARP-project title are listed in the following link http://goo.gl/VYLM2t. The group photograph shows the SARP-2018 participant students and guides along with the Co-ordinator Dr Ananda Hota, Co-coordinator Dr Basir Ahmad and Director CEBS, Dr. Vimal K. Jain.

- **National Workshop on Materials Chemistry (NWMC-2017):**

The focus of the National Workshop on Materials Chemistry (NWMC-2017) was on the synthesis and characterization of different types of materials and their applications in energy and bio-medical areas. The workshop offered common platform to experts, young scientists and research scholars working in the area of materials chemistry and bio materials for discussion of the current research in the national and international context.

The two day workshop on Materials Chemistry covered different aspects of materials for energy and biological applications. NWMC-2017 had lectures and discussion on several topics such as Materials and Characterization of Solar Cells, OLEDs, Catalysis and water splitting, Novel biomaterials: synthesis and applications, Nano-materials in health and diseases and drug delivery etc. About 25 experts from IIT Bombay, BARC, TIFR, UM-DAE CEBS, IISER, Bhopal and about 150 research scholars and M.Sc students participated in the workshop.

- **RAD@home Discovery Camp @ UM-DAE CEBS**



A RAD@home Discovery Camp was organised at UM-DAE CEBS during 11-17th June 2018. Along with the convener Dr Ananda Hota (CEBS and PI of the RAD@home collaboration) names of the other organising committee members are Dr Chiranjib Konar (Amity University), Dr. Bhooshan Paradkar (CEBS), Dr Manojendu Chaudhury (CEBS), Dr Jayashree Roy (CEBS), Ms Megha Rajoria (RAD@home), Ms Vinita Navalkar (CEBS). Eight students from different parts of India participated in it. They were given full, accommodation and food support by CEBS, as it is for RAD Camps elsewhere. Along with Dr Hota and Dr

Roy, Mr Charitarth Vyas (DAAD scholar, Argelander Institut für Astronomie Bonn, Germany), Dr Amit Shukla (Eidgenössische Technische Hochschule (ETH), Zurich, Switzerland) gave talks in the Camp. Three potential discoveries achieved during this Camp are as follows. 1. A lightening bold-shaped relic/fossil radio plasma which does not belong to any galaxy but located in a cluster of galaxy. A giant 1 Mpc size unreported radio galaxy. 3. A new episodic radio galaxy where the supermassive black hole stops creating radio jet for a few million years and starts again. Reason behind this is unclear. This could be due to two epochs of fuel supply or could also be due to merger of two supermassive black holes.

11.3 Students' Activities

The primary aim of education is to foster all round development of a student and to fulfil these objectives, there is a prime need of striking a balance between syllabus, curriculum, and books. They actually complement the academic activities and help the students to develop a well-rounded personality. Recognizing this, CEBS has been actively supporting sporting, educational and cultural activities of its students. Given below are some of the activities of students ending March 2017.

Inter IISER Sports Meet (IISM)

This is a competitive sports event open to students of IISERs, NISER, CEBS, and IISc. CEBS has been participating in this event since the past 3 years. Students are given coaching in professional coaches. The event was held at IISER Mohali during 18 to 22 December 2017. The overall performance of the students has improved over the past 3 years. In one of the track events – 1000 M race, a student from CEBS secured gold medal.

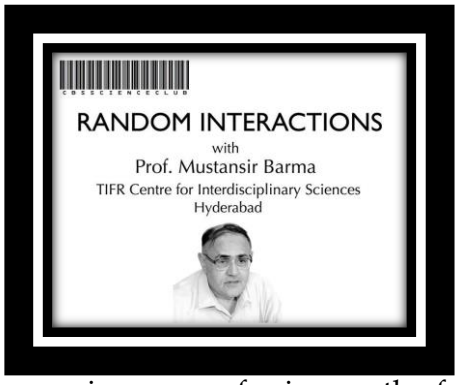
ORIS

The Art Club of the Centre has been arranging ORIS, the annual drawing/painting event. This is one of the earliest student activities that started in CEBS in 2008, and is a non-competitive event and is open to all members of CEBS and the University of Mumbai. Apart from drawing, photographic exhibition and Origami is also organized. In the year under report, two new activities were introduced: Pottery painting and decorative chandliers made of discarded PET bottles.

Dhwani – Music Club

A music club, entirely managed by students, has been formed under the supervision of a faculty member. Musical instruments like guitar, drums etc have been provided. The club organizes several informal events. The two most eagerly events are Symphonia – a vocal and instrumental event. The Club also performs high-quality events on the occasion of Dhwani – the musical event and also during CEBS Foundation Day.

Science Club



Science Club has been very active in the last few years. They organize several events: *Open Mic* where students and in-house faculty speak impromptu on a given topic. The field is then left open for discussions, and *Rendezvous*. In *Rendezvous* an eminent academician is invited to interact with the students. The session is more interactive and not merely a talk as it happens in Colloquia sessions. The students benefit immensely from such interactions since they become aware of the emerging areas of sciences, the facilities available in the country, and the challenges and opportunities in a given field. Eminent academicians like Dr. Srikumar Banerjee have interacted with students.

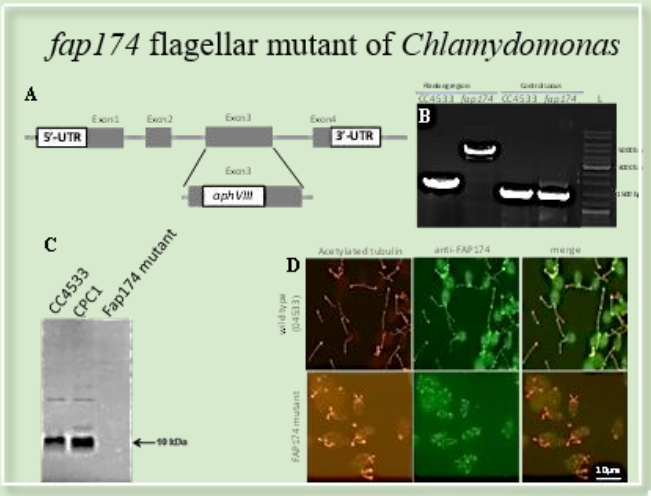
Novellus – the Literary Club

Novellus, the literary magazine of the Centre brings out an annual issue every year. An editorial team of students invites articles from staff and faculty. Short stories, articles of popular interest, interview with a scientist, and photographs are included in the magazine. Staff members and students contribute to the magazine.

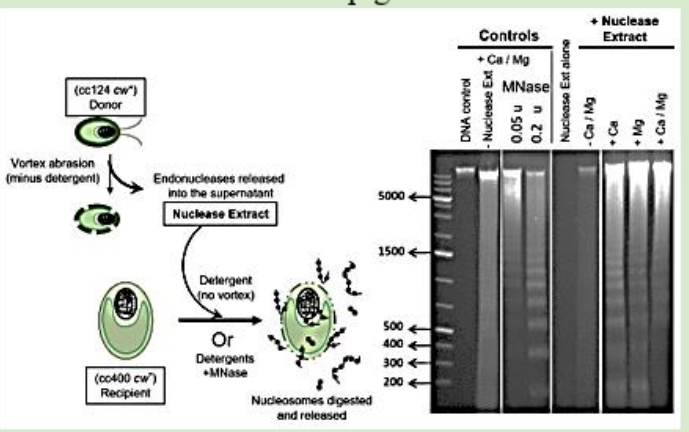
Blood Donation Camp

Many surgical interventions and medical procedures require blood transfusions, which is always in short supply. There is a need for socially committed individuals to come forward and donate blood voluntarily which can save lives. With this aim in mind, students of the Centre has been arranging blood donation camps every year. Blood Collection Unit of a government or municipal hospital is invited to the Centre and students and volunteers donate blood. The camp was arranged on April 3 and a total of approx. 40 bottles of blood were collected.

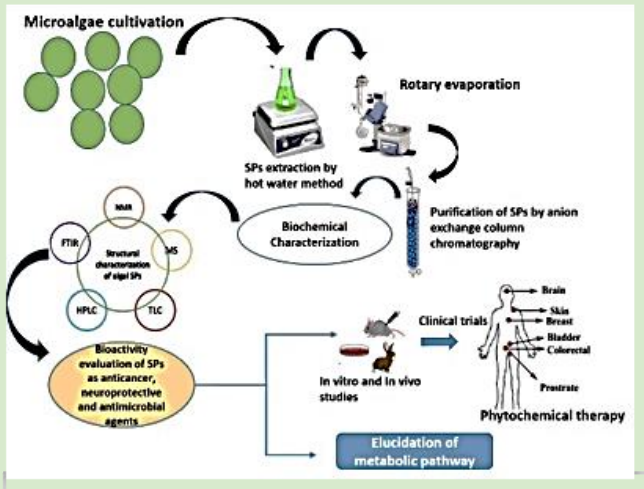
fap174 flagellar mutant of *Chlamydomonas*



Molecular epigenetics

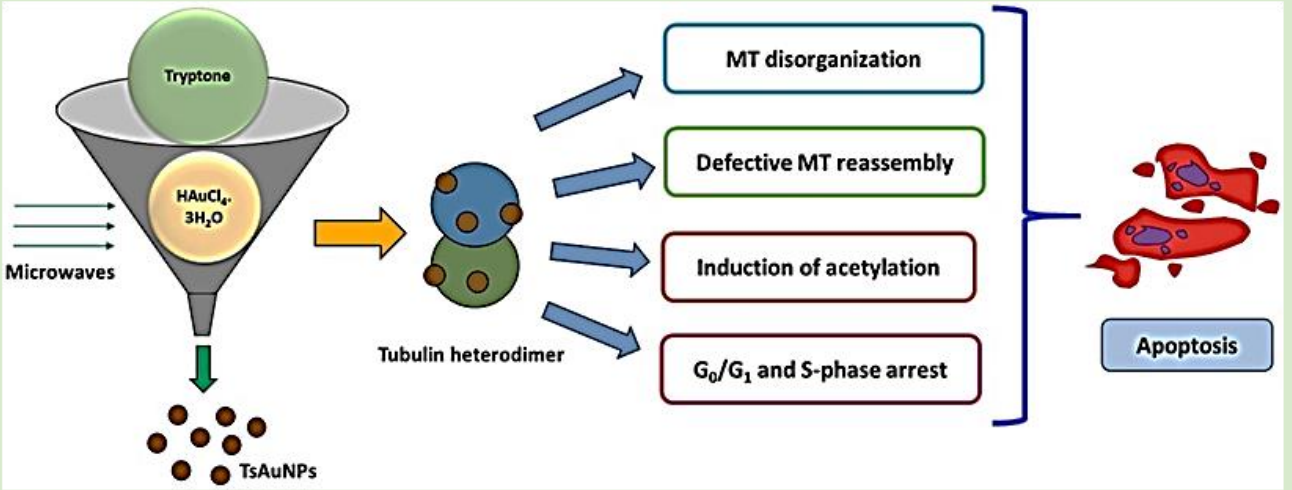


Algal sulphated polysaccharides and their bioactivity evaluation



Fusarium mutants and Banana micropropagation

Identification of a novel antiproliferative mechanism of action of gold nanoparticles in cancer cells that involves multiphase cell cycle arrest



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