



वार्षिक प्रतिवेदन  
Annual Report  
2017-18



भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान तिरुपति  
INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH TIRUPATI

IISER TIRUPATI





वार्षिक प्रतिवेदन  
Annual Report  
2017-18

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## Prof. K.N. Ganesh assumes the office of Director at IISER Tirupati



The MHRD appointed Prof. K.N. Ganesh as the first full-time Director of IISER Tirupati and he assumed the office on November 1, 2018. In his capacity as Director IISER Pune, Prof. Ganesh has been associated with IISER Tirupati as mentor Director ever since it was established in 2015. He was instrumental in initiating and establishing teaching and research facilities in the temporary campus at Sri Rama Engineering College, Karkambadi Road, Tirupati and recruiting competent faculty and non-teaching staff and ensuring that quality is not compromised. Prof. Ganesh comes with a rich experience of establishing IISER Pune for the last 11 to 12 years and contributed immensely to make IISERs a brand name for science education and research in the country as well as abroad. Prof Ganesh thus has a rare honor of being the Founding Director of two Institutes of National Importance.





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# Governance

## Board of Governors

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### *Chairperson*

**Shri Kewal Kumar Sharma**, IAS, Secretary, Higher Education  
Ministry of Human Resource Development, Shastri Bhavan, New Delhi  
(upto 28-2-2018)

**Shri R. Subrahmanyam**, IAS, Secretary, Higher Education  
Ministry of Human Resource Development, Shastri Bhavan, New Delhi  
(from 1-3-2018)

### *Members*

**Shri V.L.V.S.S. Subba Rao**, Sr. Economic Advisor, MHRD, New Delhi

**Ms. Darshana Dabral**, Joint Secretary and Financial Adviser, MHRD, New Delhi

**Prof. K.N. Ganesh**, Director, IISER Tirupati

**Prof. Anurag Kumar**, Director, IISc, Bengaluru

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**Prof. Srikumar Banerjee**, Homi Bhabha Chair Professor, Department of Atomic Energy

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**Shri. Sukhbir Singh Sandhu**, Additional Secretary, MHRD

**Prof. L.S. Shashidhara**, IISER Pune

**Prof. A. Raghuram**, IISER Pune

**Prof. Vijayalakshmi Ravindranath**, Chairperson, Centre for Neuroscience, IISc, Bengaluru

### *Secretary*

**Col. G. Raja Sekhar (Retd.)**, Registrar, IISER Pune



## Finance Committee

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### *Chairperson*

**Shri Kewal Kumar Sharma**, IAS, Secretary, Higher Education  
Ministry of Human Resource Development, Shastri Bhavan, New Delhi  
(upto 28-2-2018)

**Shri R. Subrahmanyam**, IAS, Secretary, Higher Education  
Ministry of Human Resource Development, Shastri Bhavan, New Delhi  
(from 1-3-2018)

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**Ms. Darshana Dabral**, Joint Secretary and Financial Adviser, MHRD, New Delhi

**Prof. K.N. Ganesh**, Director, IISER Tirupati

**Shri. C.P. Mohan Kumar**, Registrar, TISS Mumbai

**Ms. Indumati Srinivasan**, Finance Officer, IISc Bengaluru

### *Secretary*

**Col. G. Raja Sekhar (Retd.)**, Registrar, IISER Pune

## Building and Works Committee

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### *Chairperson*

**Prof. K.N. Ganesh**, Director, IISER Tirupati

### *Members*

**Prof. L. S. Shashidhara**, Professor (Biology), IISER Pune

**Col.G. Raja Sekhar (Retd.)**, Registrar, IISER Pune

**Dr Ramesh Srikonda**, Dean, Professor and Head, School of Architecture, Vijaywada

**Er Sushant Baliga**, Additional Director General ( Retd.), CPWD, New Delhi

**Mr. Mohan Khemani, Retd.** Chief Engineer (E), CPWD, New Delhi

### *Secretary*

**Er. Y. S. Rajput**, Superintending Engineer, IISER Pune

## Senate

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### *Chairperson*

**Prof. K.N. Ganesh**, Director, IISER Tirupati

### *Members*

**Prof. K.N. Satyanarayana**, Director, IIT Tirupati

**Prof. S. Sankararaman**, Professor, IIT Madras

**Prof. P. Sailaja**, Professor, University of Hyderabad

**Prof. P.C. Deshmukh**, Visiting Professor, IISER Tirupati

**Prof. Srinivas Hotha**, Professor, IISER Pune

**Dr. Bhas Bapat**, Associate Professor, IISER Pune

**Dr. Sutirth Dey**, Associate Professor, IISER Pune

**Dr. Umeshreddy Kacherki**, Deputy Librarian, IISER Pune

### *Secretary*

**Col. G. Raja Sekhar (Retd.)**, Registrar, IISER Pune



## Foreword

I am delighted to present the Institute's Annual Report for the year 2017-2018. This is the third year of the establishment of Institute, which has made notable progress. This year saw the admission of more than 100 students for the BS-MS program and needed appropriate scale up of classroom and hostel facilities as well. A 150 classroom named CV Raman Hall was created in the second floor. Sri Rama Engineering college management graciously built a 400 capacity hostel building for IISER Tirupati use and the Institute occupied the three floors of the building in August 2017. This has dining hall, student gym, wellness clinic, day care center, TV room etc- all made as per our requirement. I am grateful to the college management for providing these facilities in time for our use. This year the main building space was also reorganized to create faculty offices, additional research laboratories, PhD and Post-doc sitting spaces etc. Further, the lift was commissioned in the building in our efforts to make the building friendly for differentially abled persons.

I joined the Institute in Nov 2017 as full term Director and immediate priority was on appointment of architect for permanent campus and processing the papers for DPR approval. Through duly approved process and architectural competition, M/s ARCOP Associates was selected as the architect for designing the Master plan. All pending actions were taken with the State government regarding completion of boundary wall of the permanent campus and initiating actions regarding provision of water and electricity for the permanent campus. I should thank Mr Pradumna, the District Collector for facilitating many actions with state government. He also visited our campus on 22<sup>nd</sup> November, 2017 and addressed the students, staff and faculty.

The DPR approval process with MHRD was initiated through the Board of Governors. Another important action was for advertising and starting the processes for recruitment of faculty in different disciplines. The faculty advertisement attracted 250- 300 applications in each discipline, which is a good indicator of the emerging position of IISER Tirupati. Going through the process, the very first appointment was that of Prof Basuthkar J Rao, a distinguished cancer biologist from TIFR as Chair of Biology, who accepted and joined Institute on 1<sup>st</sup> April 2018.

The Institute offered 78 courses during the two semesters across the 3 batches of BS-MS students, even with limited faculty strength of less than 30. For PhD program, 32 PhD students were admitted during the year across all disciplines


and 5 post-doc fellows joined in this year. The faculties have published 32 research papers from the Institute. There are 20 research projects currently running in the Institute and Institute received about ₹ 1.65 crores of extramural grant this year from different agencies. The Institute placed orders for more than ₹ 10 crores worth of research equipment, the most important one being advanced mass spectral system (₹ 5.6 crores) for proteomics and imaging purpose and 400 MHz NMR spectrometer (₹ 4 crores). In addition, the Institute acquired several routine analytical equipment such as Glove boxes, gel imaging system, ultracentrifuge, FACS and solvent purification systems. The G. N. Ramachandran Library at the Institute houses close to 6000 textbooks subscribes to 200 E-Journals and 47 print journals.

During this year the Institute attracted very many distinguished speakers for delivering Institute Colloquia (15) and research seminars (15). Most notable event is the organization of first international conference at the Institute in January 2017 in collaboration with IIT Tirupati, on "The Topical Conference of the Indian Society of Atomic and Molecular Physics" which attracted 120 participants with 17 international speakers. The 3<sup>rd</sup> Foundation Day of the Institute was celebrated on 28<sup>th</sup> March 2018, with Prof. Ajay Sood, FRS, Distinguished Physicist, and President INSA as Chief Guest. Another important event at the Institute was the meeting of the Directors of all 7 IISERs to deliberate on issues of common interest – academic and administrative- and exchange experiences on good practices at each Institute.

It is also heartening to see that Institute has become a bee-hive of students activities, ranging from academic to cultural and sports. Institute encourages all such activities of students which has the effect of giving them not only chance to develop life long competency skills, but also a chance for experiential learning.

Finally, I wish to acknowledge all the support that I have received from the faculty and staff of the Institute, without whose hard working and sincere efforts, Institute could not achieve what it has till now. I wish to thank the members of Board of Governors, Finance Committee, Building Works Committee, Senate, members of all selection committees and all the visiting faculty for their guidance and suggestions to me in administering the Institute. IISER Tirupati is now poised for take off in terms of its academic pursuits and permanent campus development. As its motto says, it is becoming a place to achieve "infinite possibilities"

Tirupati  
November 24, 2018



(K.N. Ganesh)

# Campus Update

**Transit campus:** The Institute has hired a building of about 1 lakh square feet in 2015. This was used for the first two years both for teaching, research as well as student hostel amenities. With cumulative increase in student strength every year, additional building of another 1 lakh square feet was hired in the same premises for student hostel and other amenities, thus giving more space in the first building for expansion of teaching and research facilities. It is hoped this area will be sufficient for the next two years by which time it is proposed to create some facilities on the permanent campus. A 150 seater auditorium (C.V. Raman Auditorium) has been set up in the academic building. A cell culture facility and mass spectrometry facility have been developed.

## Progress in setting up permanent campus

**Boundary wall:** State Government has completed the construction of the boundary wall on the land allotted to the institute. The total area is approximately 226 hectares as per the architect survey. The original advance possession of land given to the institute was for 255 acres or 102 hectares. The matter is being pursued with the state government for allotment of the deficit area.

**Appointment of architect:** As provided in the SFC, process for appointment of architect was initiated by issuing an Expression of interest for procurement of architectural, structural design and comprehensive services design consultancy for establishment of IISER Tirupati campus. Going through a competition process and due procedure approved by BWC and the Board, the architectural firm Arcop Associates Pvt. Ltd. was appointed as architect for the development of Master plan for the campus.

**Constructions on permanent campus:** As the intake of students is increasing every year and the available space in the temporary campus will be constrained by next year, it was decided to immediately construct student hostel of 700 capacity and UG laboratory block with a lecture hall. After following the due processes and approvals by BWC and Board, the hostel construction work was awarded. It is likely to complete by Aug 2019. As part of master plan, it was also decided to construct one pre-engineered building for managing the undergraduate teaching labs on the campus from August 2019.

State Government has prepared a DPR for providing drinking water supply to IISER Tirupati and IIT Tirupati. The expenditure will be shared by both the institute.

# BS MS Program

The 5 year dual degree BS MS program is the flagship program of the IISERs. The curriculum provides a good blend of class room teaching and laboratory experiments enabling the students to get exposure to scientific research under the guidance of active researchers.

During the 2017 admission process, 104 students took admission to this program. Out of these, 8 were admitted through JEE stream 2 from KVPY stream and the remaining through IISER Aptitude Test. The names of the students are given below:

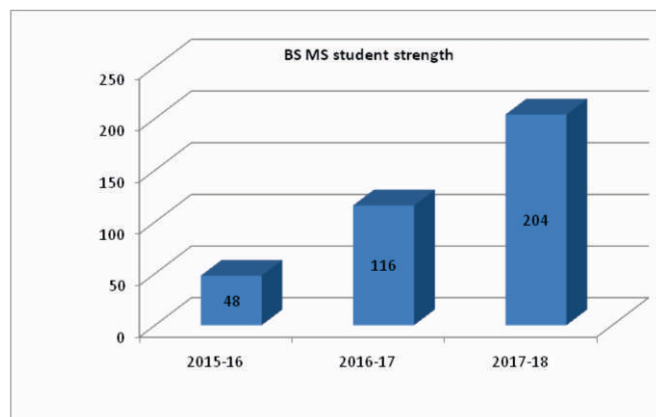
Deepthi Naik Banavathu	Kartikeya Avadhani	Mukesh Kumar S.
Neelima K.	Swapnil Mane	Abhinaba Mazumder
P.S. Vishnuprasad	Routhu Yashwanth Yetirajan	Cheenepalli Lohitha
Nikita Balodhi	Aishwarya Lakshmi M.G.	Karan V.
Chinmay Ajay Pabshettiwar	Vishnu A.	Ajey Prasanna A.R.
Elizabeth Shibby	Uppu Harish	Omkar Mohapatra
Geethanjali T.V.	P.S.V.R. Maneesh	Mrigaraj Goswami
Darsan H.	Akshaya Keerthi C.S.	Dodda Naga Vyshnavi
Sagarika V.K.	Ishita Amar	Ishika Ghosh
Kaslod Srujankumar Sayalu	Dilip Jarupala	Bismiya Fasni C.K.
Amartya Bera	Punnya A.J.	Annena Rinu
Vedang Devendra Tamhane	Meera Joy	Anagha K.S.
Suyash Sawant	Bijas N.	Prajwal Dattatray Pisal
Pavuluri Sushhama Seshu	Purva Damle	Hrishikesan K.P.
Prerak Joshi	Aakash Arun Singavi	Bhavya B.S.
Deevitha Balasubramanian	Shana Shirin P.	Pradnya Deulkar
Nimmi V Shaji	Adithya S.	Ranganathan B.R.
Susmit Sadanand Bansode	C. Nandhini	Vemavarapu Pravallika
Srividya Vyjayanthi T.	Athulaji P.	Devika C.D.
Jasmine P. Jacob	Shubhrika Jain	Pratibha Sazawal
Angel Rose Thomas	Hiba Anshad	Manudeep Rao
Megha Maria Jacob	Asirin P.M.	Arya Krishna T.
Navya Priya R.S.	Prasanna More	Jenochristina J.P.
Shinoj S. Nair	Vignesh V.G.	Aarathi Krishna G.
Aswin S.C.	Yavarna Nagapramodkumar	Sahyadri Krishna

Spoorthy Gowda	Naresh Badhavath	Subiya Haque
Keerthi O.	Vasundhara K.	Kedar Prasanna N.D.
Rrejusha P.	S. Dheeraj Kumar	Abdul Rahman Sadiq
Aman Mukesh Desai	Sutirtha Chattopadhyay	Nunsavath Saraswathi
Vaishalee Yadav	Mude Mounika	Beraboina Divya
Sahil Atri	Beharuza Farha K.	Konda Hemahasan Sai
Harsha Jagadeesh	Sulthana Beegam	Lalithkumaar Muniyandi
Gayathri Ramesan	Sudhanshu Sekhar Dalai	Neeraja P.
Sabanna Bhajantri	Veesam Prathyusha	Gorla Anusha
Karunakar Vislavath	Shadiya Kondachan Parambil	

Out of these, 56 are boys and 48 are girls from 17 states, maximum being from Kerala (39), followed by Andhra Pradesh (15) and Maharashtra (13) states.

Of the students admitted in 2017, 23 students were found eligible for DST-INSPIRE scholarship. The cumulative BS-MS students strength as on March 2018 is as follows.

	GE		SC		ST		OBC		Total
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	
2015 batch	14	4	2	4	3	2	5	6	40
2016 batch	15	18	10	1	0	2	10	10	66
2017 batch	22	22	7	5	5	7	11	19	98
<b>Total</b>	<b>51</b>	<b>44</b>	<b>19</b>	<b>10</b>	<b>8</b>	<b>11</b>	<b>26</b>	<b>35</b>	<b>204</b>



## Academic achievements of students

The CNR Rao Educational Foundation Prize for student securing highest CGPA in Semester 1 and 2 was given to Ms. Riya P. Mamachan (201601044) for getting a CGPA of 9.2 in 1<sup>st</sup> and 2<sup>nd</sup> semesters.

Academic Excellence Awards were given to Mr. Ranadeep Roy (201501028; 9.3 SGPA for 5<sup>th</sup> semester), Mr. Aditya Kulkarni (201501031; 9.3 SGPA for 5<sup>th</sup> semester); Ms. V. C. Thamarai Valli (201601070; 9.5 SGPA for 3<sup>rd</sup> semester) Ms. Akshara Vincent (201601072; 9.1 SGPA for 3<sup>rd</sup> semester).

## Courses offered

The BS MS program aims at providing a broad knowledge of all basic disciplines of science in the first two years followed by an in-depth coverage of the subjects and topics in the remaining years. The fifth year is fully devoted to research work. All the courses of semester 1 to IV are compulsory to all students. Students have a wide spectrum of courses to choose from 3<sup>rd</sup> semester onwards.

### Monsoon 2017 Semester

Course code	Course Title	Instructor	Credits
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#### Semester I

BIO111	Introductory Biology I: Basic Principles	Dr. Suresh Babu Pakala and Dr. Eswarayya Ramireddy	3
BIO112	Biology Lab I: Basic Biology	Dr. Raju Mukherjee and Dr. Vasudharani Devanathan	3
CHM111	General Chemistry	Dr. Raghunath O. Ramabhadran	3
MTH111	Introduction to Discrete Mathematics	Dr. Anilatmaja Aryasomayajula	3
MTH110	Maths Refresher	Dr. Gururaja and Girija Shankar Tripathi	0
PHY111	World of Physics I: Mechanics	Dr. Sudipta Dutta	3
PHY112	Physics Lab 1	Dr. Dileep Mampallil (Sudipta Dutta, Arunima Banerjee & J. Jose)	3
IDC111	Mathematical Methods	Dr. Thokala Soloman Raju	3
HSS110	Functional English	Dr. P Lakshmana Rao	0

#### Semester III

BIO211	Introductory Biology III. Evolution and Ecology	Dr. Nandini Rajamani and Dr. V. V. Robin	3
BIO212	Biology Lab III: Ecology and Evolution	Dr. V.V. Robin and Nandini Rajamani	3
CHM211	Inorganic Chemistry	Dr. Pankaj Koli and Dr.Sudipta Roy	3
CHM212	General Chemistry Lab II	Dr. Ashwani Sharma and Dr. Gopinath P.	3



Course code	Course Title	Instructor	Credits
HSS211	Critical Reading, Writing and Communication	Dr. P. Lakshmana Rao	2
MTH211	Multivariable Calculus	Dr. B. Subhash	3
PHY211	World of Physics III. Electricity and Magnetism	Dr. P. Yogendran	3
PHY212	Physics Lab II	Dr. T. Solomon Raju, Dr. Chitrasen Jena and Dr. Sunil Kumar	3

## Semester V

BIO311	Basic Immunology	Dr. Sivakumar Vallabhapurapu	4
BIO312	Basic Molecular Biology	Dr. Pakala Suresh Babu	4
BIO313	Evolution	Dr. Nandini Rajamani	3
BIO314	Basic Biochemistry	Dr. Raju Mukherjee	4
BIO315	Plant Physiology and Development	Dr. Eswarayya Rami Reddy	4
BIO316	Neuroscience	Dr. Vasudharani Devanathan	4
BIO317	Ecology	Dr. V.V. Robin	3
BIO318	Semester Project - Biology	All faculty of Biology discipline	3
CHM311	Quantum Chemistry I	Dr. Raghunath O. Ramabhadran	4
CHM312	Physical Organic Chemistry	Dr. Gopinath Purushottam	4
CHM313	Chemistry of Main Group Elements	Dr. Sudipta Roy	4
CHM314	Separation Science and Technology	Dr. Ashwani Sharma	4
CHM315	Semester Project - Chemistry	All faculty of Chemistry discipline	3
MTH311	Algebra I	Dr. Girja Shankar Tripathi	4
MTH312	Analysis I	Dr. R. Lakshmi Lavanya	4
MTH313	Topology	Dr. H.V. Gururaja	4
MTH314	Linear Algebra	Dr. C.G. Venkatasubramanian	3
MTH318	Combinatorics (NKN Course from IISER Pune)	Dr. Kaneenika Sinha (IISER Pune) local coordinator: Dr. Anilatmaja Aryasomayjula	4
PHY311	Quantum Physics	Prof. PC Deshmukh; Dr. Sunil Kumar	4
PHY312	Classical Mechanics- I	Dr. Arunima Banerjee	4

Course code	Course Title	Instructor	Credits
PHY313	Electrodynamics	Dr. K.P. Yogendran and Dr. Jessy Jose	4
PHY314	Lab IV – Electronics Lab	Dr. Chitrasen Jena	4
PHY315	Semester Project - Physics	All faculty of Physics discipline	3

## Spring 2018

### Semester II

BIO121	Introductory Biology II: Cellular and Molecular Biology	Dr. Suchi Goel and Dr. Raju Mukherjee	3
BIO122	Biology Lab II: Biochemistry, Genetics & Molecular Biology	Dr. Pakala Suresh Babu and Dr. Sivakumar Vallabhapurapu	3
CHM121	Physical Chemistry	Dr. Vanchiappan Aravindan	3
CHM122	Chemistry Lab I	Dr. Shibdas Banerjee; Dr. Gopinath P.	3
MTH121	Single Variable Calculus	Dr. Souradeep Majumder	3
MTH122	Linear Algebra and Applications	Dr. R. Lakshmi Lavanya	3
PHY121	World of Physics II: Waves and Matter	Dr. Chitrasen Jena	3
IDC121	Introduction to Computation	Dr. Sudipta Dutta, Dr. Sasmita Mohakud, Dr. Raghunath O. Rambhadran and others	3
HSS121	History of Science	Dr. K.P. Yogendran	2

### Semester IV

BIO221	Introductory Biology IV: Biology of Systems	Dr. Vasudharani Devanathan	3
CHM221	Organic Chemistry	Dr. Ashwani Sharma	3
CHM222	Chemistry Lab 3	Dr. Sudipta Roy and Dr. Shibdas Bannerjee	3
MTH221	Probability and Statistics	Dr. Girja Shanker Tripathi and Dr. Nandini Rajamani	3
MTH222	Basic structures in Mathematics	Dr. C.G. Venketasubramanian	3
PHY221	World of Physics IV: Early Quantum Physics	Dr. Jessy Jose	3
PHY222	Physics Lab III	Dr. Sasmita Mohakud, Dr. Dileep Mampallil and Dr. Arunima Banerjee	3

### Semester VI

BIO321	Microbiology	Dr. Suchi Goel	4
BIO322	Evolutionary & Phylogenetic Analyses	Dr. Nandini Rajamani and Dr. Robin Vijayan	4

Course code	Course Title	Instructor	Credits
BIO323	Cancer Biology and Inflammation I	Dr. Sivakumar Vallabhapurapu and Dr. Pakala Suresh Babu	4
BIO324	Animal Physiology I NKN course offered from IISER Pune	N.K. Subhedar, Nixon M Abraham, (IISER Pune) local co-ordinator: Dr. Vasudharani Devanathan	4
BIO325	Development Biology NKN offered from Pune	Dr. Girish Ratnaparkhi and Dr. Richa Rikhy, (IISER Pune) local coordinator: Dr. Eswarayya Rami reddy	4
BIO326	Semester Project – Biology	Individual instructor/Students	3
ECS321	Introduction to Earth and Climate Science	Dr. Aniket Chakrabarty and Dr. K. Sai Kranthi	4
CHM 321	Advanced Thermodynamics and Chemical Kinetics	Dr. Raghunath O. Ramabhadran	4
CHM 322	Organic Synthesis I	Dr. Gopinath P.	4
CHM 323	Organometallic Chemistry	Dr. Sudipta Roy and Dr. Pankaj Kumar Koli	4
CHM 324	Spectroscopy and its Application in Organic Chemistry	Dr. Pankaj Kumar Koli	4
CHM325	Semester Project – Chemistry	Individual instructor/Students	3
MTH321	Algebra-II	Dr. Anilatmaja Aryasomayajula	4
MTH322	Complex analysis	Dr. B. Subhash	4
MTH323	Calculus on Manifolds	Dr. H.A. Gururaja	4
MTH324	Ordinary Differential Equations	Prof. V. Raghavendra	4
MTH325	An Introduction to the Isoperimetric Problems NKN course offered from Pune	Dr. Anisa Chorwadwala, (IISER Pune) local coordinator: Dr. Gururaja	3
PHY321	Quantum Mechanics II	Dr. T. Soloman Raju	4
PHY322	Statistical Mechanics I	Dr. Arunima Banerjee	4
PHY323	Fluid Dynamics	Dr. Dileep Mampallil	4
PHY324	Optics	Dr. S. Sunil Kumar and Dr. Thokala Soloman Raju	4
PHY325	Lab V	Dr. S. Sunil Kumar	4

# PhD program

In order to give a boost to research activities, doctoral program and postdoctoral program were started in 2017-18. Enrollment for PhD students was done in August 2017 and January 2018. A total of 32 students were admitted.

## Biology

Guddeti Rohith Kumar  
Patil Saniya Tanaji  
Ramadevi Mutra  
Harsha K Kumar  
Nivetha M  
Mali Anil Suresh  
Sapana Sharma  
Samriddha Ghosh  
Prerna Bali  
Bijayeeta Deb  
Gowthaman S  
Swati Udayraj  
Krishna K Das

## Chemistry

Yatheesh N  
Rajat H S  
Sorakayala Thripati S  
Sakamuri Sarath Babu  
Himadri Shekhar Roy  
Maria Francis  
Borkar Gaurav Abhay Sarita  
Shahid M  
Ekta Nag  
Mahesh Yenuganti

## Mathematics

Sanjeev Kumar Pandey

## Physics

Salvi M  
Arka Bhattacharya  
Souren Adhikary  
K. Aditya  
Soumya Gupta  
Krishnan Gopal

Of these 5 students have qualified for receiving fellowship from external agencies such as CSIR, DBT and DST-INSPIRE

## Post-doctoral program

Institute also has started post-doctoral research program from August 2017. The following post-doctoral fellows have joined the Institute in different disciplines.

### Biology:

Dr. Harshini Chakravarthy, Dr. Sudhakar Rao V. Kola  
Dr. Pranava Shankar Mishra, Dr. Ankur Mandal  
Dr. Palande Aseem Sanjay, Dr. Shyam Kumar Madhusudhana

### Chemistry:

Dr. Shelke Ganesh Mahaodeorao, Dr. A. Prasanna Kumar

# Academic Activities of the Faculty

## Research Publications in 2017

1. Aravind, M., Baikie, T., Ulaganathan, M., Guang, Y., Copley, M., **Aravindan, V.** and Madhavi, S. (2017). Structural, thermal and electrochemical studies of novel  $\text{Li}_2\text{Co}_x\text{Mn}_{1-x}(\text{SO}_4)_2$  bi-metallic sulphates. *Journal of Physical Chemistry C* 121 :24971-24978.
2. Choia H. J., Kim, S.Y., Gong, M.K., Vignesh, H., **Aravindan, V.**, Lee, Y.G. and Lee, Y.S. (2017). Tailored perovskite  $\text{Li}_{0.33}\text{La}_{0.56}\text{TiO}_3$  via an adipic acid-assisted solution process: A promising solid electrolyte for Lithium batteries. *Journal of Alloys and Compounds* 729 : 338-343.
3. Roh, H.K., Kim, M.S., Chung, K.Y., Ulaganathan, M., **Aravindan, V.**, Madhavi, S., Roh, K.C. and Kim, K.B. (2017). Chemically bonded  $\text{NaTi}_2(\text{PO}_4)_3/\text{rGO}$  microsphere composite as high-rate insertion anode for sodium-ion capacitor. *Journal of Materials Chemistry A* 5: 17506-17516.
4. Sennu, P., **Aravindan, V.**, Nahm, K.S. and Lee, Y.S. (2017). Exceptional catalytic activity of hollow structured  $\text{La}_{0.6}\text{Sr}_{0.4}\text{CoO}_{3-\delta}$  perovskite spheres in aqueous media and aprotic  $\text{Li-O}_2$  battery. *Journal of Materials Chemistry A* 5 : 18029-18037.
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Note: All publications with IISER Tirupati affiliation of any one author have been included in this list. It is possible that in case of some publications, a part or entire work may have been carried out by the author/s before joining at this institute.

## Invited talks

### Anilatmaja Aryasomayajula

- *Estimates of automorphic forms* Inter-IISER Math meet, IISER Pune, May 11, 2017
- *Estimates of Mumford form* IIT Bombay, May 9, 2017
- *Estimates of cusp forms* University of Hyderabad, January 22, 2018

### Aravindan V.

- *Nanostructured Materials for Energy Storage Applications* UGC Sponsored Refresher Course in Nanosciences (Interdisciplinary) held at Bharathidasan University, Tiruchirappalli, December 23, 2017

### Arunima Banerjee

- *Origin of Low Surface Brightness galaxies: A dynamical study* Invited Plenary Session talk at the Annual Meeting of the Astronomical Society of India, Osmania University, Hyderabad, February 9, 2018

### Shibdas Banerjee

- *Mass spectrometric imaging of prostate biopsy samples: Cancer margin assessment from the distribution of small metabolites and lipids* 253<sup>rd</sup> American Chemical Society (ACS) National Meeting, San Francisco, USA, April, 2017
- *Cancer diagnosis and margin analysis by molecular assessment of biopsy specimens using Mass Spectrometric Imaging*; World Cancer Congress, Kolkata, September 20, 2017; National Institute of Mental Health and Neurosciences (NIMHANS) Bengaluru, November 15, 2017; All India Institute of Medical Sciences (AIIMS) New Delhi, December 9, 2017

- *Mass spectrometry in the service of human health and mankind* 4<sup>th</sup> National Conference on Frontiers in MS Technology & Emerging Applications', Chennai, November 23, 2017
- *Mass spectrometry in clinical laboratory'* continuing medical education (CME) organized by Suraksha Diagnostics, Kolkata, March 31, 2018

#### Vasudharani Devanathan

- *Signalling molecules, receptors, G protein signaling and drug discovery* Invited lecture in Institute for pharmacology and toxicology, Tuebingen, Germany, July 19, 2017 ; Invited resource person and speaker for IPTCON, Tirupati conducted by Sri Padmavathi Mahila University, Tirupati, 23 March 2018.
- *Cell biology course modules* Guest lecture teaching at IMSc, Chennai (visiting faculty) for doctoral students.

#### Sudipta Dutta

- Short course on "*Extremum Action Principle*" for undergraduate and Master students in Kwasei Gakuin University, Sanda, Hyogo, Japan

#### H.A. Gururaja

- *Differential geometry of plane curves* Invited Lecture, Rani Chennamma University, Belgaum, May 15, 2017
- *On some global theorems on surfaces* Invited Lecture, TIMC Regional Program, National College, Bengaluru, October 22, 2017

#### Chitrasen Jena

- *Event Generators* Lectures in XI SERC School on Experimental High-Energy Physics, NISER Bhubaneswar, November 7-27, 2017

#### R. Lakshmi Lavanya

- Resource person at the Mathematics Training and Talent Search (MTTS) Programme 2017, IIT Guwahati, 29 May – 17 June, 2017 (Delivered 18 lectures)

#### Souradeep Majumder

- *Parabolic Bundles in Positive Characteristic* Algebraic Geometry and Number Theory conference, ISI Bangaluru, December 20, 2017

#### Soumit Sankar Mandal

- *New Developments in Single molecule techniques*, Physics Department, Tezpur University, Assam.

#### Pankaj Kumar

- *Mechanistic investigation of nitric oxide dioxygenation reactions: peroxy nitrite to nitrate or nitrite* Recent Advances in Materials for Sustainable Energy, IIT-ISM Dhanbad, March 3 - 5, 2018

#### Nandini Rajamani

- *Distribution and occurrence of marmots in the Trans-Himalayan regions of Kashmir and Ladakh.* (Lead



Lecture), National Seminar on Himalayan Biodiversity: Characterization and Bioprospection for Sustainable Utilization, September 18-19, 2017 (with Senan D'Souza and Swati Udayraj).

- *Understanding distribution and modeling range shifts of sympatric small mammals in the Trans-Himalayas* Alexander Von Humboldt Kolleg 2018 Meeting on Climate Change and Energy Options, Aurangabad, Maharashtra. February 2-4, 2018

#### Raghunath O. Ramabhadran

- *Computers and Chemistry: The Trees and the Forest*, DST-INSPIRE camp, JNNCE, Shimoga, March 2018

#### Eswarayya Ramireddy

- *Root cap derived cytokinin regulates primary root meristem size and lateral root branching in Arabidopsis* International Conference on Plant Developmental Biology and 3rd National Arabidopsis Meeting, NISER Bhubaneswar, December 12-16, 2017
- *Innovations in plant biology for improved agriculture production* DST-INSPIRE Science Camp, Loyola Degree College, Pulivendla, March 25-29, 2018

#### Robin, V.V.

- Pondicherry University, Invited Talk and Chief Guest, Wildlife Week Celebration, November 5, 2017
- *Sky Islands, evolution and bird songs - what do we understand of our biodiversity?* DST Inspire camp, Government Arts College, Ooty. February 5, 2018

#### Girja Shanker Tripathi

- *Product structures on some quotients of algebraic Cobordism* Universitaet Osnabrueck, Germany, June 2018.

#### Venketasubramanian C.G.

- Series of lectures as resource person for Linear Algebra Level II, Mathematical Training and Talent Search Program, Regional Institute for Education, Mysore, May 22 – June 6, 2017
- Lecture Series on Algebra, Govt. College, Chittur, Kerala. June 12-19, 2017

## Participation in Conferences/Symposia/Workshops

#### Anilatmaja Aryasomayajula

- Invited Participant "Discussion meeting on complex geometry" at TIFR, Mumbai, February 8-17, 2018

#### Arunima Banerjee

- *How cold are super thin discs?* Galaxy Evolution Dynamics Structure (GEDS) - 1, Inter University Centre for Astronomy & Astrophysics, Pune, Date, January 2018

#### Aniket Chakraborty

- EMSI – 2017, International Conference on Electron Microscopy and Allied Techniques and XXXVIII Annual Meeting of Electron Microscope Society of India, Mahabalipuram, Tamil Nadu, July 17-19, 2017

### Chitrasen Jena

- ALICE-India Collaboration Meeting at VECC Kolkata, March 26 - 28, 2018.

### Jessy Jose

- *Star formation under extreme environmental condition* Thirty Meter Telescope Science Forum, Mysore, November 2017 (contributed talk)
- *The youngest free-floating planets: A transformative survey of nearby star forming regions with the novel W-band filter at CFHT-WIRCam* 36<sup>th</sup> Meeting of the Astronomical Society of India, Hyderabad, February, 2018 (contributed talk)
- *Interstellar bubbles and their impact on star formation* International Conference on 'Bubbles big and small', IISc, Bengaluru, June 2018 (contributed talk)

### Lakshmi Lavanya

- Advanced Training in Mathematics Workshop (ATMW) - Harmonic Analysis, Indian Institute of Science, December 12-16, 2017.

### Dileep Mampallil

- IUNP hands-on training workshop, IISc, Bengaluru, July 18-28, 2017

### Soumit Sankar Mandal

- EMBO Research, Leadership Course, Organised by Wellcome Trust/DBT India Alliance, Hyderabad, March 26-29, 2018

### Nandini Rajamani

- Bruce DeJong, Mihir Sule, Robin V.V. and R. Nandini *Genetic drift among isolated populations of tree Euphorbias in the Western Ghats* International Biogeography Conference, Bengaluru, September 26-28, 2017 (poster)
- R. Nandini, Uma Ramakrishnan and Sushma Reddy *Phylogenetic relationships amongst civets in the genus Viverra, including the Malabar Civet* International Biogeography Conference, Bengaluru, September 26-28, 2017 (poster)
- M. Nivetha, R. Nandini *Evolution of female-biased size dimorphism in gliding mammals* Young Ecologists Talk and Interact, Ahmedabad, January 22-25, 2018 (poster)
- Senan D'Souza, Swati Udayraj, R. Nandini *Distribution and occurrence of two species of marmots in Kashmir & Ladakh* Young Ecologists Talk and Interact, Ahmedabad, January 22-25, 2018 (poster)
- Harsha Kumar, R. Nandini *Evolution of mouth patterns in Estrelid finches* Young Ecologists Talk and Interact, Ahmedabad, January 22-25, 2018 (poster)
- A.C. Shijisha, R. Nandini *Coat color variation in Funambulus palm squirrels* Young Ecologists Talk and Interact, Ahmedabad, January 22-25, 2018 (poster)
- R. Nandini *Small mammals in changing environments: responses and adaptations* Young Investigators Meeting, Thiruvananthapuram, March 6, 2018 (poster)

### V.V. Robin

- V. V. Robin and Purushottam *Bird song variation across biogeographic and anthropogenic barriers in a Sky Island system* XXVI International Bioacoustics Conference, Haridwar, October 8-13, 2017 (Oral presentation)
- V. V. Robin *Evolution on Shola Sky Islands – Impact of isolation at contemporary and evolutionary time.* 10<sup>th</sup> Young Investigators Meeting 2018, Thiruvananthapuram, March 5-8, 2018
- C.P. Harikrishnan, M. Arasumani, V.V. Robin *Mapping wetlands of Tirupati using remote sensing* Young Ecologists Talk and Interact 2018 Baroda, January 20-28, 2018 (talk by Harikrishnan)
- Viral Joshi. *Song mimicry of Tawny Lark* . (poster)
- EMBO Research, Leadership Course, Organised by Wellcome Trust/DBT India Alliance, Hyderabad, March 26-29, 2018

### Sai Kranti

- *Deep and shallow rain occurrence and vertical structure of precipitation with sea surface temperature over Bay of Bengal and Arabian Sea during the southwest monsoon season as inferred by TRMM-PR 2<sup>nd</sup>* Conference on India radar meteorology, National Atmospheric Research Laboratory, Department of Space, Gadanki, Tirupati, January 8-11, 2018 (oral presentation)

### Girja Shankar Tripathi

- *Suslin Spectral sequences* at Hausdorff Institute for Mathematics in Bonn, Germany, July 2018

## National and International Visits

### Anilatmaja Aryasomayajula

- Research visit to University of Hyderabad to continue collaboration with Dr. Suman Kumar, May 15 – June 15, 2017
- Research visit to ICTS, Bangaluru to continue collaboration with Prof. Indranil Biswas, TIFR, December 4-12, 2017

### Vasudharani Devanathan

- Visited Leica microsystems, Mannheim, Germany, July 11-12, 2017
- Visited Institute for Pharmacology and Toxicology, Tuebingen, Germany, July 16-21, 2017

### Sudipta Dutta

- Visited Kwansai Gakuin University, Sanda, Hyogo, Japan for collaborative research for the duration of one month during December 10, 2017 to January 9, 2018. This visit was totally funded by Hyogo Overseas Research Network (HORN) fellowship

### Gururaja, H.V.

- Visited TIFR Bangaluru for research collaboration, May 20-July 20, 2017

### Souradeep Majumder

- Visited ISI Bengaluru for collaboration with Dr. Manish Kumar, September 26 to October 2, 2017.
- Visited ICTS Bengaluru to participate in a discussion meeting on Analytic and Algebraic Geometry, March 19-24, 2018

### Dileep Mampallil

- Visited Eral Lab at Delft University in Netherlands as part of collaboration (duration)

### Girja Shanker Tripathi

- Visit to Universitaet Osnabrueck, Germany, June 2018
- Visit to Hausdorff Insitute of Mathematics, Bonn, Germany, June-July, 2018

### Venketasubramanian C.G.

- Research visit to University of Hyderabad, May 15 -17, 2017 and June 26 – July 8, 2017

## Memberships and Affiliations

### Arunima Banerjee

- Life Member, Astronomical Society of India
- Visiting Associate, Inter University Centre for Astronomy & Astrophysics, Pune

### Aniket Chakraborty

- Honorary Life Membership, Mineralogical Society of Great Britain and Ireland

### Sudipta Dutta

- Member, American Physical Society (APS) Editorial Board Member: Scifed Journal of Metallurgical Science

### K.N. Ganesh

- Vice-President, Indian Academy of Sciences, Bangalore ; Fellow, National Academy of Sciences, Allahabad ; Fellow, Indian National Science Academy, New Delhi ; Fellow, The World Academy of Sciences (TWAS), Trieste ; Honorary Professor, JNCASR, Bengaluru
- *Committee Memberships:* Chairman, Research Advisory Committee, Indian Association of Cultivation of Science, Kolkata; Chairman, Research and Academic Advisory Council (RAAC), Institute of Nano Science and Technology (INST), Mohali; Chairman, Finance Committee, Welcome Trust-DBT India Alliance, Delhi; Chairman, Member, FIST Advisory Board (FISTAB), DST, New Delhi ; Co-Chair, Scientific & Technical Appraisal & Advisory Groups (STAGs) on Knowledge Generation and Discovery Research, New Tools and Technologies, DBT, New Delhi; Chairman, Technical Expert Committee on Nanobiotechnology, DBT, New Delhi; Member, Board of Directors, Venture Centre, NCL Innovation Park, Pune ; Member, Oversight/Umbrella Committee for DBT's Bioenergy Centres and New Centre (Pan-IIT) ; Member, Nano Science Advisory Group-Biological Sciences (NSAG-II) ; Member, Board of Directors, Innovasynth Technologies (I) Ltd ; Member, Board of Management, DIAT Pune ; Member,

Board of College & University Development (BCUD), Swami Ramanand Teerth Marathwada University, Nanded Chairman, Research Council, High Energy Material Research Laboratory, DRDO, Pune ; Member, Executive Council of Central University of Tamil Nadu, Thiruvavur ; Member, Planning & Monitoring Board (PMB), DIAT Pune ; Member, Governing Council, Association of Indian Universities (AIU); Member, Management Board, Symbiosis International University, Pune.

- *Memberships of Editorial Boards of Journals: Journal of Organic Chemistry* (ACS–International Editorial Advisory Board); *Chemistry – An Asian Journal* (Wiley, Germany) ; *Artificial DNA: PNA, XNA* (Landbiosciences, U.S.A.); *Oligonucleotides* (Mary Ann Liebert Inc, U.S.A.); *Nature: Scientific Reports* (Nature Publishing Group); Founder Co-Editor, *ACS Omega*, USA.

### Jessy Jose

- Member of the American Astronomical Society (AAS)
- Member of the International Science Development Team (ISDT), Thirty Meter Telescope
- Member of the Astronomical Society of India

### Laxmana Rao

- Member, International Literacy Association ; Member, English Language Teachers' Association of India

### Lakshmi Lavanya, R

- Member, Ramanujan Mathematical Society

### Sasmita Mohakud

- Member, American Physical Society (APS)

### Raju Mukherjee

- Life member, Proteomics Society of India

### Eswarayya Ramireddy

- Member of German Botanical Society (DBG) ; Member of International Society of Root Research (ISRR); Member of European Plant Science Organization (EPSO)

### V.V. Robin

- International Biogeographic Society

### Ashwani Sharma

- Life member, International Society on Aptamers (INSOAP)

### T. Soloman Raju

- Member of Optical Society of America (OSA)

### Sunil Kumar

- Life time member, Indian Society of Atomic and Molecular Physics

### Sivakumar Vallabhapurapu

- American Society of Hematology

## Awards and Honours

### Sai Kranti

Young Scientist Award in the 2<sup>nd</sup> Conference on India Radar Meteorology held at National Atmospheric Research Laboratory, Department of Space, Gadanki, 8-11 January 2018

### Sudipta Dutta

Hyogo Overseas Research Network (HORN) fellowship of one month duration to visit Kwansai Gakuin University, Sanda, Hyogo, Japan to deliver a short course on "Extremum Action Principle" and to pursue collaborative research on "Electronic properties in atomically thin nanomaterials" with Prof. Katsunori Wakabayashi. This fellowship is awarded every year in memory of Kobe earthquake victims and the collaborative research should be based on socially relevant research topic.

### Sivakumar Vallabhapurapu

Wellcome Trust-DBT intermediate fellowship award to be activated from September 2018.

## Extra-mural Research Projects

S. No	Project No.	Title of the project	Principle Investigator	From -- to---	Total sanction (in Rs.)	Grant received during the year (Rs.)
1	EMR/SERB/BIO/16/002 30216002	Targeting metastasis associated protein 1 (MTA-1) modulated histone modifications in triple negative breast cancer (TNBCs)	Pakala Suresh Babu	01-04-2016 to 31-03-2018	20,57,291 10,54,395	0
2	EMR/SERB/CHE/16/003 30216003	Computational prebiotic chemistry: probing abiogenesis via electronic structure theory	Raghunath Ramabhadran	29-06-2016 to 28-06-2019	3955000	0
3	EMR/INSPIRE/MTH/16/005 30116005	INSPIRE FACULTY	Anilatmaja Aryasomayajula	28-07-2016 to 27-07-2021	3500000	332163
4	EMR/INSPIRE/PHY/16/006 30116006	INSPIRE FACULTY	Sasmita Mohakud	20-08-2015 to (01-08-2016) to 19-08-2020	3500000	1148109
5	EMR/SERB/PHY/16/007 30216007	Atomic sheet based electronic applications: A theoretical perspective	Sudipta Dutta	02-09-2016 to 01-09-2019	3377931	0
6	EMR/SERB/PHY/16/008 30216008	Surface acoustic wave microfluidics: micro-particle patterning to biosensors	Dileep Mampallil	28-09-2016 to 27-09-2019	4375162	0
7	EMR/SERB/BIO/16/009 30216009	Automatic analysis of avian acoustics	Robin Vijayan	10-01-2017 to 09-01-2020	1768158	0
8	EMR/SERB/BIO/16/010 30216010	Understanding small molecule permeation in <i>Mycobacterium tuberculosis</i> : Towards rational design of drugs with penetrating scaffolds	Raju Mukherjee	06-02-2017 to 05-02-2020	4647170	0
9	EMR/SERB/CHE/16/011 30216011	Synthesis and stabilization of heterodiatom(c)0 compounds of main group elements/mixed main group-transition-elements and their applications in homogeneous catalysis	Sudipta Roy	03-03-2017 to 02-03-2020	4312000	0

S. No.	Project No.	Title of the project	Principle Investigator	From -- to---	Total sanction (in Rs.)	Grant received during the year (Rs.)
10	EMR/SERB/BIO/16/012 30216012	Unravelling the role of root-cap specific mannose-binding lectin proteins in root development and their implications in shaping the plant response to environmental cues	Eswarayya Ramireddy	22-03-2017 to 21-03-2020	5202560	1320987
11	EMR/SERB/BIO/16/013 30216013	Does sciurid response to human habitat modifications mimic climate change? A study of demographic response on the highest mountains of Western Ghats	Nandini Rajamani Robin	23-03-2017 to 22-03-2020	4234996	0
12	EMR/INSPIRE/PHY/17/014 30216014	INSPIRE FACULTY	Arunima Banerjee	14-11-2014 to 13-11-2019	3500000	1236217
13	EMR/SERB/CHE/17/015 30217015	Nitric Oxide Dioxygenation reactions and their mechanistic insights	Pankaj Kumar	17-07-2017 to 16-07-2020	4474600	2750000
14	EMR/SERB/CHE/17/016 30217016	Ramanujan Fellowship	V. Aravindan	01-08-2017 to 31-07-2022	8900000	1780000
15	EMR/SERB/CHE/17/017 30217017	DNA/RNA/XNA based smart nanocages for targeted drug delivery	Ashwani Sharma	14-03-2016 to 13-03-2019	4050000	957688
16	EMR/DBT/BIO/17/018 301317018	Tuberculosis diagnostics based on Mycobacterial Glycolipid-protein interactions	Raju Mukherjee	10-01-2018 to 09-01-2021	4491800	2500000
17	EMR/INSPIRE/PHY/17/019 30117019	INSPIRE Faculty	K. Saikranti	09-11-2017 to 08-11-2022	3500000	0
18	EMR/SERB/RJN/CHE/17/020 30217020	Ramanujan Fellowship	Gopinath Purushothaman	19-02-2018 to 18-02-2023	3800000	600000
19	EMR/SERB/CHE/17/021 30217021	Nuclease Resistant Aptamer-nanoparticle Conjugate against B7-H3 as targeted therapy and imaging in Retinoblastoma	Ashwani Sharma	26-03-2017 to 25-03-2020	3174600	1045000
20	EMR/SERB/PHY/17/022 30217022	Theoretical Investigation of Magnetism at Different Length Scales	Sasmita Mohakud	12-03-2018 to 11-03-2021	3812600	2604200
		<b>Total</b>				<b>16274364</b>



# Research Infrastructure

Efforts are being made to create necessary research infrastructure in the temporary campus for the faculty to pursue their research priorities. Some of the equipment will be used both for teaching and research purposes. During the year under report, an amount of Rs. 8.21 crores was spent for purchase of sophisticated equipment. Some of the major and important ones are listed below. So far, equipment worth more than Rs. 11 crores was procured.

Sr. No.	Name of equipment	Manufacturer	Cost in lakh Rupees
1	Glove Box Workstation	M. Braun Inertgas-SystemeGmbh	37.53
2	Solvent Purification System	M. Braun Inertgas-SystemeGmbh	21.75
3	Spinsolve 60 MHz Ultra	Margitek Limited	38.68
4	AmershamTyphoon Gel and Blot Imaging System	GE Healthcare Pvt. Ltd., Hongkong	59.68
5	Spectrofluorometer	Jasco International Co. Ltd., Japan	19.84
6	NMR spectrometer	Bruker Biospin AG, Germany	230.75
7	High Solution Slide Scanning System	Hamamatsu Photonics (UK) Ltd.	27.90
8	Ultra Centrifuge	Beckman Coulter International, Switzerland	48.71
9	Gel Imaging System	GE Healthcare Pvt. Ltd.	21.43
10	Fast Protein Liquid Chromatography (FPLC)	Bio-Rad Pacific Ltd. Hongkong	31.81
11	Fluorescence-Activated Cell Sorting (FACS)	Becton Dickinson Holding PTE Ltd., Singapore	58.50
12	LED Trinocular Fluorescence Microscope	Leica MicrosystemeVertrieb GmbH, Germany	14.25
13	QIAxcel Advanced System	Qiagene, U.S.A.	10.85
14	High Speed Floor Centrifuge	Beckman Coulter International S.A.	29.25
15	Mass Spectrometer System	Thermo Fisher Scientific Pte. Ltd.	591.07
16	High Speed Camera	Vision Research Inc.	14.62
17	Scanning Tunneling Microscope	Quazar Technologies Pvt. Ltd.	11.46
18	X-ray	LD Didactic GmbH	11.25



Ultra Centrifuge



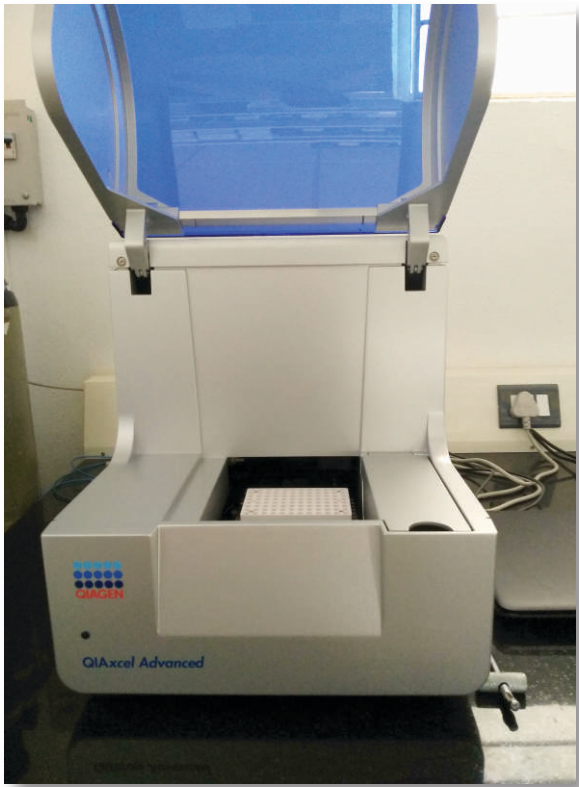
Table Top NMR



Spectrofluorometer



Solvent Purification System (SPS)



QIAxcel Advanced System



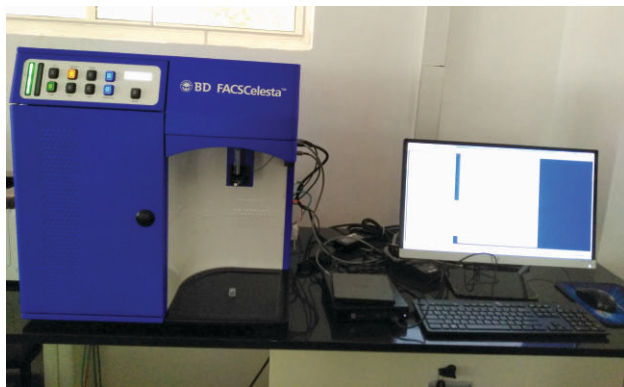
LED Trinocular  
fluorescence



Gel imaging system



FPLC



FACS



4 Port Glove Boxes



Amersham Typhoon

# Library and Information Services

IISER Tirupati Library ( G.N. Ramachandran Library) started functioning from August 2015 to meet the teaching, learning and research needs of the students, faculties and staffs of the Institute. It aims to provide knowledge and information services for building excellent communities in the scientific world and promoting each individual to get success in their R&D activities with well-established library facilities.

The Library houses a good collection of textbooks, general books and reference books such as encyclopaedia, dictionaries, laboratory manuals etc. Library also provides online access to various journals as well as full-text and bibliographic databases available in the field of basic sciences and allied subjects. The Library is a member of e-Shodh Sindhu: Consortium for Higher Education Electronic Resources and IISER Library Consortium.

This year Library has procured the titles of following series in Mathematics:

- Graduate Studies in Mathematics (American Mathematical Society)
- Student Mathematical Library (American Mathematical Society)
- London Mathematical Society Student Texts (Cambridge University Press)
- Progress in Mathematics (Birkhauser)
- Annals of Mathematics Studies (Princeton University Press)

More than 1800 books have been added to the Library's collection during the last financial year. Library is using Koha -Library Management Open Source Software for housekeeping operations of the library.

Collection Statistics of the Library as on March 31, 2018

Books: 5770

Gratis Books: 76

Print Journals/Magazines: 47

E-Journals: 200

E-Databases: 3

Library Users: 250

The following online journal resources are available for access by faculty and students

- American Association for Cancer Research
- American Association for the Advancement of Science
- American Chemical Society
- American Mathematical Society

- American Physical Society
- American Society for Biochemistry and Molecular Biology
- American Society for Microbiology
- American Society of Plant Biologists
- Annual Reviews
- Cambridge University Press
- Cold Spring Harbor Laboratory Press
- Company of Biologists
- Duke University Press
- Heldermann Verlag
- International Press
- Mathematical Sciences Publishers
- National Academy of Sciences, USA
- Optical Society of America
- Rockefeller University Press
- Springer Nature

### Bibliographic online databases

- MathSciNet
- SciFinder Scholar

### Writing Support Tool

- Grammarly@edu

Access provided by National Digital Library of India through e-Shodh Sindhu

### Consortium

- South Asia Archive
- World e-Book Library



# Colloquia & Seminars

## Colloquia

Speaker	Title of talk	Date
Prof. Sitabhra Sinha, The Institute of Mathematical Sciences, Chennai	Patterns, broken symmetries and computation: Emergent complexity in collective dynamics of diffusively coupled oscillatory media	August 18, 2017
Dr. Nagaraj Balasubramanian, IISER, Pune	Integrin mediated adhesion as a regulator of cellular trafficking and function	September 8, 2017
Prof. Siddhartha Gadgil, IISc, Bengaluru	Automating Mathematics?	September 15, 2017
Dr. V. Subramanian, CSIR-CLRI, Chennai,	Basic principles and applications of molecular modelling	October 6, 2017
Prof. Srinivas Hotha, IISER Pune	Diversity to discovery - A serendipitous 'golden' odyssey into glycochemistry	October 13, 2017
Prof. Ravi Kulkarni, Emeritus Professor, IIT Bombay	Algorithmic constructions of representations of finite solvable groups	November 3, 2017
Prof. C. S. Rajan, TIFR, Mumbai	The local - global principle in number theory	November 10, 2017
Prof. B.J. Rao, Tata Institute of Fundamental Research, Mumbai	Spatial movements of chromosomes facilitate their repairs	November 17, 2017
Prof. L. S. Shashidhara, IISER Pune	Evolution of Human Cognition	January 19, 2018
Prof. Richard Henderson, Nobel Laureate in Chemistry 2017, MRC Laboratory of Molecular Biology Cambridge, U.K. (through NKN from Pune)	The Cryo EM revolution in structural biology	January 21, 2018
Prof. H. S. Mani, Chennai Mathematical Institute, Chennai	Light in a medium---Slow light and Fast light	February 2, 2018
Prof. Raghuram Raju, IIT Tirupati	The impact of heliocentric view on the rise of anthropocentric view in humanities	February 9, 2018
Dr. S. Shivaji, L. V. Prasad Eye Institute, Hyderabad	Antimicrobial resistance is a global phenomenon and also occurs in ocular microbes	March 9, 2018
Prof. Rajaram Nityananda, Azim Premji University, Bengaluru	The many faces of entropy	March 16, 2018

## Seminars

Speaker	Title of talk	Date
Amitava Bhattacharya, Ramakrishna Mission Vivekananda University, West Bengal	Muon spin rotation/relaxation studies of unconventional superconductors	April 6, 2017
Sabyasachi Mukhopadhyay, Weizmann Institute of Science, Israel	Biological fingerprints in molecular electronics	April 11, 2017
Victor Mukherjee, Weizmann Institute of Science, Rehovot, Israel	Control in open quantum systems out of equilibrium	August 14, 2017
Moitri Maiti, Joint Institute for Nuclear research (JINR), Dubna, Russia	Dynamical response of Josephson junctions	September 12, 2017
Jatish Kumar, Marie Curie Post-doctoral fellow, CIS bioma GUNE, Spain	Organic and plasmonic nanomaterials for chiral luminescence and biodetection	December 14, 2017
D.S. Nagaraj, Institute of Mathematical Sciences, Chennai	Algebra in geometry	February 14, 2018
K. S. Viswanathan, IISER Mohali	Hydrogen bonds – pawns in the game of molecular chess	February 28, 2018
Harini Chakravarty, Post doctoral scientist, Stanford University, USA	Converting adult pancreatic islet alpha cells into beta cells by gene targeting	March 1, 2018
Ramprasad Misra, Weizmann Institute of Science, Rehovot, Israel	Reconstitution of carotenoid and retinal in light harvesting thermophilic Rhodopsin-salinixanthin complex	March 8, 2018
Sharmila Mande, TCS research, Pune	Understanding the microbiome for improving human health	March 9, 2018
R. Nityananda Azim Premji University, Bengaluru	Changing without changing – The geometric phase and its cousins	March 15, 2018
Ramana Athreya IISER Pune	Diversity and distributions on mountain systems	March 20, 2018
Anupam Bandopadhyay, Postdoctoral associate, Massachusetts Institute of Technology Cambridge, MA, USA	Molecular recognition enabled by nonribosomal amino acids	March 27, 2018

# Outreach Activities

IISER Tirupati outreach has three components:

## Science and MHRD outreach in Schools

Students and faculty conduct several science related or other MHRD mandate related outreach workshops and presentation in the school premises of several schools in and around Tirupati. Government school at Annasamepalle, ZP higher secondary school at Karakambadi and Bharatiya Vidya Bhavan are some schools where our students and faculty regularly visit.

## Social outreach

Kids from underprivileged regions and rural areas of Tirupati visit IISER Tirupati campus. A team of students and faculty teach them various topics varying from Math, English, Science and Computers. They also conduct spoken english sessions. The campus venture is not just about science but its about proving opportunity to these kids to play in our play grounds and use IISER T indoor game facilities.

Inspiring science videos are screened to these students.

## Science outreach in campus

In 2017, 75 students from various Navodaya Schools visited the institute and they were shown around the laboratory facilities.

IISER Tirupati organised Nobel day lectures (Screened from IISER Pune) and students from schools were invited. The institute has open day on science days and school students are invited to participate in the science day. Unnati team conducts science day quiz for school students.

IISER Tirupati also supports visits from nearby schools where school students get to visit the labs and learn more about the techniques that they study in the school as a part of their higher secondary curriculum.



Foldscope outreach by UNNATI at a School in Silchar as part of North east Twinning Project from DBT.



Visit of students from Navodaya School to IISER Tirupati



# Conferences and Events

## Conferences

### The Topical Conference of the Indian Society of Atomic and Molecular Physics

Organisers: P.C. Deshmukh, IIT Tirupati, Bhas Bapat, IISER Pune and S. Sunil Kumar, IISER Tirupati

IISER Tirupati and Indian Institute of Technology (IIT) Tirupati jointly organised the Topical Conference on "Quantum Collisions and Confinement of Atomic and Molecular Species and Photons" during January 6-8, 2018. The Indian Society of Atomic and Molecular Physics (ISAMP) is an organization of researchers in India working in the broad field of Atomic, Molecular, and Optical Physics. It was formed in 1975 at Ahmedabad, with the purpose of bringing together the atomic physicists in India. The major topics dealt by the community involve structure and dynamics of atomic and molecular systems, the interaction of light with matter, trapping and manipulation of quantum systems, etc. The Society holds a biennial national conference alternated by a biennial topical meeting. The conference was attended 120 participants with 17 invited speakers from abroad.

The deliberations on 6<sup>th</sup> and 8<sup>th</sup> January 2018 were held at IISER Tirupati and on 7<sup>th</sup> January 2018 at IIT Tirupati. Dr. Sunil Kumar coordinated the conference as the conference secretary, along with P. Gopinath and Pankaj Kumar.



## International Biogeography Society (IBS) India

Organiser: V.V. Robin

V.V. Robin was one of the three lead organizers for the International Biogeography Society (IBS) India meeting held at Bengaluru. IISER Tirupati was one of the organizing institutions. This was the first time that the IBS meeting, a biannual event internationally, was being held in South Asia and helped Indian biogeographers to come together and discuss issues of common interest. The meeting was attended by 225 participants which included 28 participants from 15 countries. 68 professionals and 142 students. There was a public discussion on biogeography & society which was attended by Forest Department officers and other conservationists and a session on biogeography of rivers.

## IISM at IISER Mohali

December 18-22, 2017

A contingent of 89 students participated in this sports event. They secured third position in the march past, next to IISER Mohali and IISER Bhopal. Following prizes were won by the students.

1. Gold in the 4 \* 100 relay for women (Thamarai Valli, Neelima, Revathi Sajeev, Pradnya)
2. Silver in women's Kho-Kho.
3. Ms. Thamarai Valli won the trophy for best athlete in the women category with three gold (100 m, 200 m, relay 4 \*100) and a silver (long jump)
4. Ms. Revathi won the silver in 200 meters dash



## IISER Directors' Meeting

January 15, 2018

A meeting of Directors of all IISERs was organized at the institute. Directors of all seven IISERs participated in the meeting and deliberated on issues of common interest to be taken up with the Ministry.



## National Science Day 2018

February 28, 2018

National Science Day was observed with much enthusiasm by the faculty and students of the institute. The function started with opening remarks by Prof. K.N. Ganesh, Director, IISER Tirupati, highlighting the importance of observing Science Day to create awareness among the common people about the role of science in day to day life. There were two lectures on this occasion. (1) "Making a difference to peoples' lives life through R &D in industry" by Dr. Gopal Krishna Desika, Senior Vice-President, Pfizer Biologics Development Centre, Chennai and (2) "Happy accidents in Chemistry" by Prof. K.S. Viswanathan, IISER Mohali. This was followed by a display of science based models, science day quiz, and skywatch during the night. School students from nearby schools were invited to visit the exhibition. Students interacted with the school children in explaining the models prepared by them. Dr. Vasudharani Devanathan and Dr. Sudipta Roy provided guidance to the students.



## DAAD Seminar

March 22, 2018

German Academic Exchange Service (DAAD) organized on a seminar for the benefit of staff and students. Ms. Padmavathi Chandramouli, from DAAD information Centre, Chennai gave details of research opportunities in Germany and DAAD funding policies. The seminar was coordinated by Dr. Vasudharani Devanathan.

## Foundation Day

March 28, 2018

The Third Foundation Day of the Institute took place on March 28, 2018. Prof. Ajay Sood, Honorary Professor, Department of Physics, IISc, Bengaluru delivered the foundation day lecture. The third edition of student magazine "Dhwani" and also a video on the institute were released on this occasion. Dhwani was entirely conceptualized, edited and designed by the students of the Institute. Prizes were given to students for their academic performance and for extra-curricular activities. Staff members were also recognized for their contributions. Ms. Riya P. Mamachan of 2016 batch was awarded CNR Rao Education Foundation Award for attaining highest CGPA in Semester 1 and 2. Mr. Ranadeep Roy and Mr. Aditya Kulkarni from 2015 batch, Ms. V.C. Thamarai Valli and Ms. Akshara Vincent from 2016 batch and Ms. Deevitha Balasubramanian and Ms. T.V. Geetanjali from 2017 batch were given academic excellence award. Ms. Thamarai Valli and Mr. Karthick Srivatsan were also recognized for their contributions in extracurricular activities.



## Vivante 2017

7-9 April 2017

Vivante 2017 is an undergraduate run cultural festival which brought forth scientific, cultural and artistic talents of the students. It was filled with exciting events such as singing, dancing and showcases like art exhibitions where students' talents and abilities outside the classroom were under test. This was also accompanied by events like quizzes, debates and JAM sessions to stimulate the intellect.



## MoU with University of New Castle

Institute has signed Memorandum of Understanding with University of New Castle, Australia to cooperate on the "Design and development of advanced materials for energy and environmental application". Cooperation shall include:

- Exchange of researchers or students to execute the research
- Exchange of information through joint seminars and joint publication on the research
- Joint supervision of PhD students
- Joint Research program
- Implementation of cooperative research.



## Organizing Theme Days

### International Yoga Day

June 21, 2017

Mr. Shiva kumar, a renowned yoga practitioner from Tirupati was invited on this day. He gave a talk on the usefulness of yoga in physical and mental wellbeing. This was followed by demonstration of various yoga postures. Staff and students of the institute participated in the yoga practice session.



### Vigilance Awareness Week

October 30-November 4, 2017

Vigilance Awareness Week was observed by displaying banners at prominent locations regarding observance of the Vigilance Awareness. Mass pledge was taken all faculty / Non-teaching Officers / Staff of IISER Tirupati. An essay writing competition was conducted for Staff on the topic "My Vision – Corruption free India" on 04.11.2017.

### Ek Bharat Shreshtha Bharat Program

Under this MHRD flagship program, IISER Tirupati is partnered with University of Punjab, Bhatinda.

The nodal officer of this program at IISER Tirupati is Dr. Vasudharani Devanathan. A program has been organised within the institute on November 15, 2017 to give opportunity to students from different states to tell something about their culture. A team of students visited Bhatinda during December 23-26, 2017.

### National Integration Week

November 24, 2017

Quami Ekta week (National Integration week) was observed on the campus, with the staff and students attending to the institute in their traditional dress.

## Republic Day

January 26, 2018

Flag hoisting was done by Prof. K.N. Ganesh, Director and he addressed the gathering. This was followed by a cultural program by the students.



## Visitors

Shri Satyapal Singh MoS HRD visited IISER Tirupati on March 6, 2018 as a part of his two day visit to Tirupati to interact with the faculty of the institute. He emphasized mainly on the research highlights taking place at the institute.



Collector of Chittoor District, Shri P.S. Pradyumna IAS, visited the institute on November 22, 2017. He assured full support of the state administration for setting up the permanent campus.



# Scientific Report

## 1.0 Physical Sciences

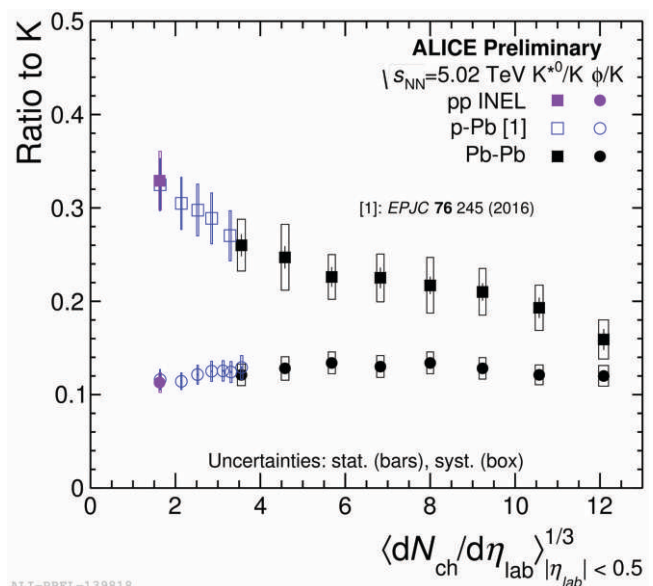
The Department of Physical Sciences at IISER Tiurpati, started in Aug 2015, is committed to nurture talents and bring in excellence in various areas of Physics. The courses taught form part of a comprehensive program, meant for students who pursue BS MS, iPhD and PhD degrees. The Physics program aims to teach the students the basic laws of Nature and impart training in applying them to other areas and disciplines, thus preparing them for challenges and opportunities of the coming era.

Currently, high level research is being carried out in areas like Experimental High Energy Physics, Theoretical Condensed Matter Physics, Soft Matter and Microfluidics, Nonlinear Dynamics, Complex dynamical systems, Astrophysics, Atomic and Molecular Physics.

### 1.1 Experimental High Energy Physics

Ultra-relativistic heavy-ion collisions at the Large Hadron collider (LHC) are expected to produce a hot and dense state of matter called the Quark-Gluon Plasma (QGP). This new state of matter is believed to have existed in the first few microseconds after the Big Bang. The study of resonance production being studied by **Dr. Chitrasen Jena** plays an important role both in elementary and in heavy-ion collisions. The hadronic resonances play an important role to the study of particle production mechanisms and the characterisation of the dynamic evolution of the system formed in heavy-ion collisions. Due to their short lifetime (a few fm/c), a significant fraction of resonances decay during the evolution of the system from chemical to kinetic freeze-out and their hadronic daughters interact with the medium. The final reconstructable resonance yields depend on the particle lifetime, the particle density, the scattering cross section of its decay products and the timescale during which rescattering and regeneration are active in the hadronic phase, i.e., the timespan between chemical and kinetic freeze-out. Therefore, the effect of rescattering and regeneration can be studied by comparing the production of resonances with different lifetimes such as  $K^*0$  and  $\phi$  whose lifetimes are  $4.16 \pm 0.05$  fm/c and  $46.3 \pm 0.4$  fm/c, respectively.

**Fig 1.**  $K^*0/K$  and  $\phi/K$  ratios as a function of  $\langle dN_{ch}/d\eta \rangle^{1/3}$  for pp, p-Pb and Pb-Pb collisions at  $\sqrt{s_{NN}}=5.02$  TeV. (Chitrasen Jena group)





## 1.2 Theoretical Condensed Matter Physics

**Dr. Sudipta Dutta's** group has studied layer-by-layer oxidation of layered transition-metal-dichalcogenides (TMD) using density functional theory. The observation of hole-conductivity in oxidized TMDs shows good agreement with experiment. Further observations of indirect to direct band gap transition, unprecedented semi-metallic behavior and charge-transfer metallicity show novel ways of designing electronic and opto-electronic devices. In addition, in-plane heterostructures of zigzag-edge graphene and BC<sub>3</sub> honeycomb lattices within ab-initio level of theory were studied. The results show spin filtering and rectification behavior in presence of external cross-ribbon electric field in these heterostructures. The studies show unprecedented anti-ferromagnetic ordering of spins in hole doped monolayer blue phosphorene system. This is perhaps the first observation of defect-free and metal-free magnetism. The effect of interacting spins of zigzag edge honeycomb nanoribbon has been studied with cyclic and Möbius boundary conditions. The spin frustration, originating from bipartite symmetry breaking, leads to peculiar spin-excitation behavior. The study shows topological phase transition introduced by magnetic frustration.

**Dr. Sasmita Mohakud's** group has investigated potassium (K) atom intercalated naphthalene and perylene crystals. Both the pristine system show semiconducting behavior. Intercalating K atoms donate electrons to the neighboring organic molecules and consequent upward shift of Fermi energy induces metallicity by aligning with the conduction band. However, the conduction of electrons is anisotropic along different crystallographic directions. For a specific intercalation geometry, the system shows half-metallic behavior with potential application possibilities in spin-filtering devices. Owing to larger molecular surface area, one perylene molecule can accommodate more than one K atom and consequent higher electron transfer shifts the Fermi energy further up. In this case, Fermi energy lies in a gap between higher conduction bands and therefore results in semiconducting behavior. This class of intercalated organic semiconductors would find huge potential application in organic electronic industry.

## 1.3 Nonlinear Dynamics

**Dr. Soloman Raju's** research has been focused on exploring analytically and numerically the existence of exact asymptotic spatiotemporal optical self-similar light bullets to the nonlinear Schrödinger equation with gain in the presence of an external source in  $(3+1)$ -dimensions. This model appertains to the description of self-similar wave propagation through asymmetric planar dual-core waveguide (DWG) amplifiers. The asymmetric DWG is composed of two adjoining, closely spaced, upper and lower waveguides, in which the lower one acts as a passive waveguide while the upper waveguide is an active one. Due to the linear coupling between them, one can control the dynamical behaviors of the wave propagating through the passive waveguide by controlling the wave in active waveguide. We explicate the mechanism to control the dynamical behaviors of these self-similar waves for two specific cases: (i) when the gain and width are hyperbolic functions and (ii) when the gain and width are periodic functions.

With the aid of multivariate transformation technique, periodic and rational solutions for variable-coefficient modified Korteweg-de Vries (vc-mKdV) equation were obtained. The rational solutions can

be obtained as limiting cases of periodic solutions in analogy with the rational solutions of nonlinear Schrödinger equation (NLSE). Further, the effect of variation of parameters on solutions is studied for physically relevant periodic form. Unlike the effect of variation of parameters on solutions of NLSE, where both amplitude and width can be controlled, only path or trajectory of solutions of vc-mKdV equation can be modulated.

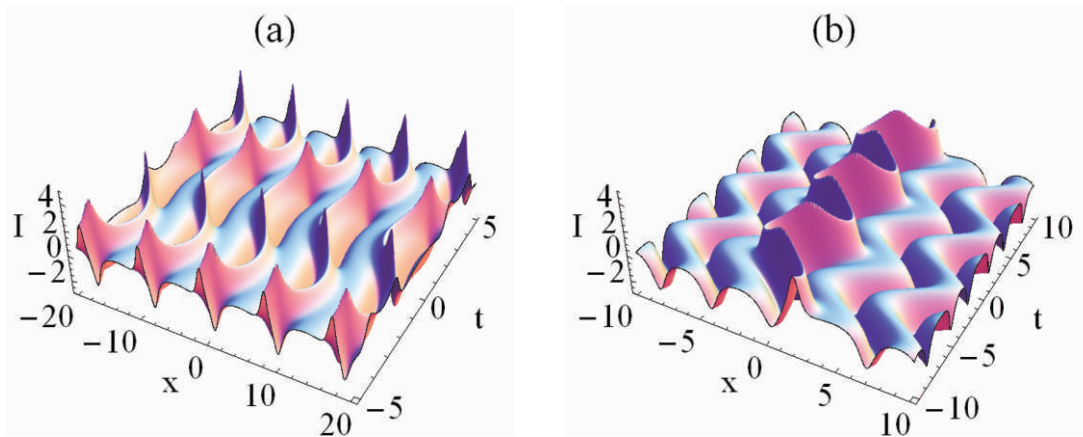


Fig. 2 Second-order (a) periodic and (b) rational solutions of vc-mKdV equation for  $h_1(t)=h_2(t)=\sin(t)$ . (Soloman Raju group)

In another pedagogical article, a simple numerical simulation of the general theory of relativity (GTR) advance of the perihelion of planetary motion about the sun has been presented, by retracing some of the major milestones that led to the GTR.

## 1.4 Astrophysics

**Dr. Arunima Banerjee** focuses her research on understanding the structure and dynamics of galaxies and the role of the dark matter halo, with an emphasis on low surface brightness galaxies including superthin galaxies, and, of late, gas-rich lenticulars, mostly by modelling/using HI 21cm radio-synthesis observations. In the past one year, her group has focussed on the following topics (i) constraining the vertical stellar dispersion in a sample of superthin galaxies using observed scaleheight data for stars and gas using Markov Chain Monte Carlo (MCMC) method, (ii) absence of local spiral features in low surface brightness galaxies (iii) mass-modelling of gas-rich lenticular galaxies using HI rotation curve and (iv) the specific angular momentum of superthin galaxies: Cue to their origin?

Star formation is a fundamental astrophysical process, and yet we still lack a quantitative and predictive theory for how stars and clusters form. **Dr. Jessy Jose** has been working on star forming regions which are under diverse environmental conditions, in order to analyze the form of initial mass function (IMF) in large mass ranges from very low to high. Along with national and international collaborators and using state-of-the-art observing facilities around the world, Dr. Jose worked on a few specific star forming regions in the Milkyway, to understand how the feedback from massive stars and metallicity of the environment affect the circumstellar disk evolution of pre-main sequence stars and IMF. Dr. Jose is also involved in an international project to search and characterize the low mass brown dwarfs and free-floating planetary mass objects around solar neighborhood.

## 1.5 Atomic and Molecular Physics

**Dr. Sunil Kumar's** research has a special emphasis on the experimental laboratory astrophysics, laboratory astrochemistry, and molecular biophysics. The objective of the present research is the first measurement of the absolute photodetachment cross sections of molecular ions of biological interest. Towards this goal, the primary task is to design and construct a radio-frequency-ion-trap-based setup at IISER Tirupati. Towards this goal, the design of the complete experimental set up is in progress. In addition, simulations of ion trajectory through the experimental set up and quantum chemical calculations that will complement the results obtained from the experiment are under progress.

A related project that addresses the issue of formation of gas-phase water in the interstellar medium (ISM) is in progress in collaboration with chemistry faculty. The formation of gas-phase water involves reactions of hydroxy ions or water molecular ions with hydrogen molecule in the ISM and calculating the rate coefficients of the relevant reactions. This work has a great astrophysical relevance corroborated by results from experimental measurement of these reaction rate coefficients. The results suggest that the water formation in the interstellar medium proceeds at higher rates than assumed so far.

## 1.6 Soft Matter and Microfluidics

**Dr. Dileep Mampallil's** group works in the area of Microfluidics and Soft Matter. The group is interested in the dynamics of droplets and their interaction with layered matter (say, powders). They also look into biological applications of Microfluidics, such as single cell studies. Necessary laboratory facilities have been set up which include microscopes, high speed camera, plasma cleaner etc. Currently, one project student is working on a research problem of spreading liquid drops on powder layers. The spreading produced rearrangement of the powder particles forming concentric ring-like patterns. The study involves how dynamics of spreading, imbibition and stick-slip motion of the drop-edge could produce such patterns. These findings have been reported in Physical Review E.

## 2.0 Chemical Sciences

Research in Chemistry department/discipline covers a whole gamut of research areas which include Biomolecular Chemistry of nucleic acids, peptides and lipids, Bio-Organic Chemistry and Bio-Nanotechnology, Catalysis, Asymmetric Synthesis, Synthetic Organic Chemistry, Bio-Inorganic Chemistry, Computational Organic/Inorganic Chemistry. Quantum Chemistry, Main Group Chemistry, Mass Spectrometry Applications in Chemistry and Biology, Bio-Physical Chemistry, Electrochemistry, Li-Ion Batteries and Capacitors.

### 2.1 Chemical Biology

Research interests of **Dr. Ashwani Sharma's** group are: (a) Development of novel strategies utilizing nucleic acid based nanoparticles for targeted drug delivery to different cancers, (b) In vitro selection of target specific DNA/RNA aptamers using SELEX and their application in diagnostics as well as therapeutics, (c) DNA/RNA based biosensors for detection of small molecules, and (d) target-dependent nucleic acid based molecular devices.

Work on the selection of aptamer against Her2 (human epidermal growth factor receptor 2) protein was started which will help to achieve the goal of targeted drug delivery to breast cancer. *In vitro* selection for RNA aptamer against selected target HER2 was done using 14 rounds of selection using, binding assay, PCR, transcription and RT-PCR reactions. Cloning of selected sequences was done for sequencing to yield 35 clones. Further work on checking binding of aptamer with cells and with recombinant protein is in progress.

Continuing his group's research being done at IISER Pune, **Prof Krishna Ganesh's** group has studied the stereochemical effect of 4R/S -hydroxyl and amino substituents on D/L-prolyl residues in polyprolyl peptides. The correlation of molecular conformation to the nano morphological structures has been the main outcome of this research.

**Dr. Soumit Kumar Mandal's** group is interested in investigating the dynamics of multidomain proteins at the level of single molecule. Heat shock proteins were selected as a model for these studies. Heat shock protein, DnaK was expressed and purified. Circular dichroism (CD) spectroscopy was used to check the secondary and tertiary structure of the DnaK to confirm the purity of the expressed protein. Melting temperature of the protein was also checked. The protein was modified with DNA to make it suitable for single molecule measurements using protocols reported in the literature. Single molecule measurements were undertaken using Optical tweezers at RRI, Bengaluru. This was carried out to optimize the assay for measurement. Initially, constant velocity measurements were performed to check if the unfolding length arising from the amino acid sequence matches with its crystal structure. This would serve as a starting point for future measurements and further understanding of the protein dynamics.

## 2.2 Synthetic Organic Chemistry and Catalysis

The central theme of research group of **Dr. Gopinath Purushothaman** is developing new synthetic methods using catalysis as the main tool. Main focus is on visible light photoredox catalysis and transition metal mediated C-H activation. One specific area Dr. Gopinath's group is interested is the generation of acyl radicals using photoredox catalysis. Acyloxyphosphonium salts prepared *in situ* from carboxylic acids, triphenyl phosphine and bromine/NBS, are well known reactive intermediates in organic chemistry. They are generally used as acyl transfer reagents. Several reaction conditions such as changing the photocatalyst, solvents, light source, catalyst loadings etc. were screened for generating the acyl radicals using acyloxyphosphonium intermediates in the presence of a variety of alkene partners. Simultaneously, alternative strategies are being

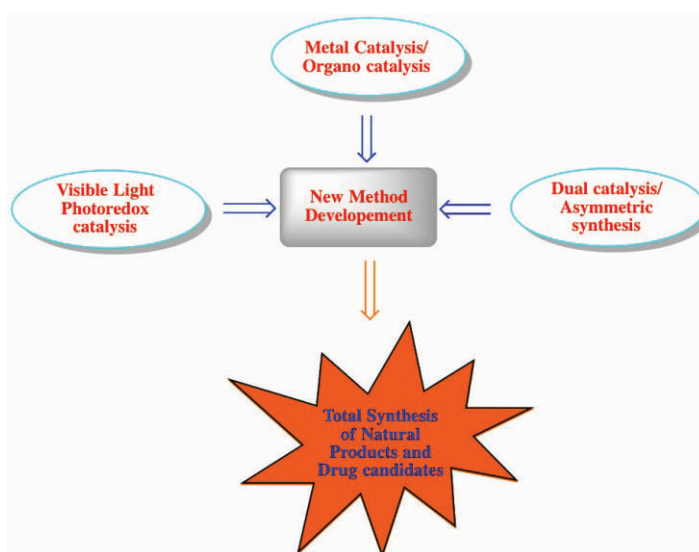


Fig. 3 Research Project (Gopinath P. group)

implemented for the generation of acyl radicals from other reactive carboxylic acid intermediates that can again be synthesized *in situ* from carboxylic acids

Other problem, which the group is interested, is remote C-H activation of aldehydes, carboxylic acids, anilines and phenyl urea derivatives. Herein the group has synthesized different templates for the meta C-H functionalization and right now focusing on the meta C-H arylation, olefination and borylation etc.

### 2.3 Bio-inorganic Chemistry

The focus of research in this area from **Dr. Pankaj Kumar's** group is on nitric oxide dioxygenase, nitrite reductase, nitric oxide sensing etc. In addition, work is in progress to develop a probe for the early stage detection of cancer by inorganic metal complexes.

### 2.4 Mass Spectrometry Imaging

A collaborative research for analyzing scorpion venom components for developing new drugs has been conducted. This involved a highly interdisciplinary team comprised of chemists, biologist and toxicologists from the laboratories of Prof. Lourival Domingos Possani, Universidad Nacional Autonoma de Mexico, Mexico, Prof. Richard N. Zare, Stanford University, USA, and **Dr. Shibdas Banerjee's** laboratory at IISER Tirupati. The summary of the research result is discussed below.

While most scorpion venom components identified in the past are peptidic or proteinic in nature, a new alkaloid was isolated from the venom of the Mexican scorpion *Megacormus gertschi*. Nuclear magnetic resonance and mass spectrometric investigations elucidated the structure of the alkaloid as (Z)-N-(2-(1H-imidazol-4-yl)ethyl)-3-(4-hydroxy-3-methoxyphenyl)-2-methoxyacrylamide. A chemical method of synthesizing this alkaloid was also developed. Although abundant in venom, the above alkaloid was not found to have insecticidal activity. Structural analysis suggested that this venom alkaloid might be of potential interest for evaluating its medicinal effect.

### 2.5 Main group chemistry and catalysis

**Dr. Sudipta Roy's** group has been working on stabilization and syntheses of heterodiatomic (0) compounds of main group elements / mixed main group element(0)-transition metal(0) and their applications in homogeneous catalysis. During this year, towards this end, 1,4-Diazadiene, Imidazolium Chloride and various N-Heterocyclic Carbenes were synthesized in good quantities, purified and characterized for the subsequent steps.

In order to understand the feasibility of stabilizing the proposed molecules, theoretical calculations were done to theoretically optimize the heterodiatomic system consisting of a main group element (Si) and a 3d transition metal (Ni), stabilized by one unit of cyclic alkyl amino carbene (cAAC) each (at the BP86/def2-SVP and BP86/def2-TZVPP level of theory). These resulted in a geometry "similar" to a 4 membered heterocycle, which could be due to favourable orbital interactions between the atoms (CSicAAC, NSicAAC, Si and Ni). To gain further insight of the bonding scenario, NBO calculations on this geometry using M06/def2-SVP level of theory were carried out. They revealed the orbital interactions and the shapes of frontier molecular orbitals (FMOs). As predicted, some of the FMOs are the fully filled

'd' orbitals of Ni. As in some cases, the 'd' orbitals have significant overlap with the orbitals on the carbene carbon (CSicAAC) and nitrogen atom (NSicAAC) [HOMO-3 and HOMO-2]. The Si atom has retained its lone pair (HOMO-1; typical of silylones) whereas HOMO has a significant contribution from the CSicAAC - Si and CNicAAC - Ni moieties.

The Natural Population Analysis (NPA) charge on Ni is -0.09 a.u. (-0.11 a.u. in case of TZVPP geometry) while Si has a charge of 0.66 a.u. This can be attributed to the partially higher electronegativity of Ni than Si and less significant backdonation by Ni.

## 2.6 Energy Storage

Dr. Aravindan Vanchiappan's group is engaged in developing novel energy storage materials. Li-ion batteries (LIBs) are ubiquitous electrochemical energy storage systems used in multifarious applications. Li-ion chemistry is bounded with fascinating and favorable features like Li is the lightest metal (equivalent weight  $M = 6.94 \text{ g mol}^{-1}$  and specific gravity of  $0.534 \text{ g cm}^{-3}$ ), most electropositive element ( $-3.04 \text{ V vs. SHE}$ ), high theoretical capacity ( $\sim 3862 \text{ mAh g}^{-1}$ ), high gravimetric and volumetric energy density, less self-discharge, most abundant and no memory effect compared to other contemporaries like Na, K, Mg, Ca and Al. In 1990, Sony Inc. introduced the LIB in "rocking-chair" configuration for consumer applications which composed of graphite as anode and  $\text{LiCoO}_2$  as cathode. Due to the intense R & D leads to the exploration of several cathodes like layered ( $\text{LiCoO}_2$ ,  $\text{Li}(\text{CoNiMn})\text{O}_2$ ) or olivine-phase ( $\text{LiFePO}_4$ ) are developed and commercialized along with graphitic anode in the presence of  $\text{LiPF}_6$  dissolved in aprotic organic solvents. Contrast to cathodes, no other negative electrodes exhibiting similar properties like graphite or Li are commercialized. On the other hand, the poor rate capability and subsequent Li-plating of these graphitic anodes prevent their practical use in high power LIBs. This has inspired the exploration of various kind of intercalation anodes like  $\text{TiO}_2$  polymorphs,  $\text{Li}_4\text{Ti}_5\text{O}_{12}$ ,  $\text{LiTi}_2(\text{PO}_4)_3$ ,  $\text{Nb}_2\text{O}_5$ ,  $\text{TiNb}_2\text{O}_7$ ,  $\text{TiP}_2\text{O}_7$ ,  $\text{FeOOH}$  etc., Unfortunately, the reversible capacity ( $< 250 \text{ mAh g}^{-1}$ ) and insertion potential is too high ( $> 1.5 \text{ V vs. Li}$ ) for those anode which eventually dilutes the net energy density of the full-cells.

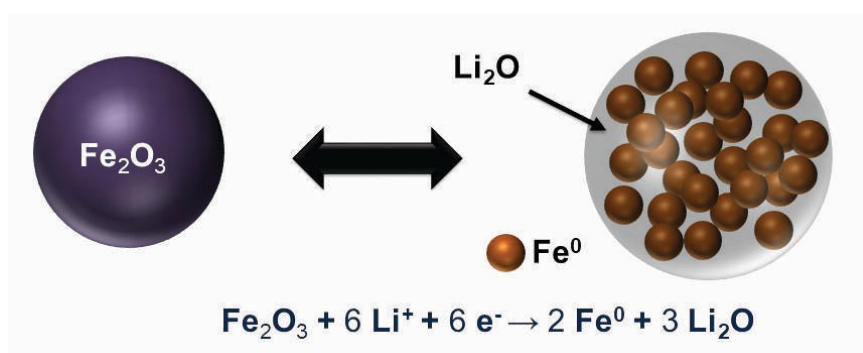


Fig. 4 Schematic representation of conversion reaction

The discovery of sustained Li storage in nanoscale metal oxides *via* conversion pathways,  $\alpha\text{-Fe}_2\text{O}_3$  was extensively investigated as a promising anode for LIB applications because it has a high theoretical capacity for six-electron reactions ( $\sim 1008 \text{ mAh g}^{-1}$ ), high inherent density ( $5.24 \text{ g cm}^{-3}$ ), low cost, easy preparation, and eco-friendliness. According to the conversion (or displacement) reaction of  $\alpha\text{-Fe}_2\text{O}_3$

with Li, the reduction potential is observed at  $\sim 0.7$  V vs. Li. This working potential certainly avoids the risk of Li-plating during the high current operation compared to the well-established graphitic anodes. Nevertheless, among the numerous conversion-type anodes like metal oxides, sulfides, chlorides, fluorides, hydroxides etc., explored, iron (III) oxide or  $\text{Fe}_2\text{O}_3$  as an important oxide of iron, as are FeO and  $\text{Fe}_3\text{O}_4$ . Generally,  $\text{Fe}_2\text{O}_3$  crystallizes as one of two polymorphs, *i.e.*, the predominant rhombohedral  $\alpha$ - $\text{Fe}_2\text{O}_3$  ore called hematite and the cubic  $\gamma$ - $\text{Fe}_2\text{O}_3$ , which naturally occurs as maghemite. Different crystalline phases exist, but hematite-phase  $\alpha$ - $\text{Fe}_2\text{O}_3$  has been predominantly investigated as a negative electrode for LIB applications

## 2.7 Computational and Quantum Chemistry

Dr. Raghunath Ramabadrán and his group has focused on the key prebiotic weak interactions in the interstellar medium. Further, to shed light on the role of solvent in prebiotic chemistry, density functional theory for open-shell systems was employed using implicit solvation model. Besides, several research collaborations with experimentalists were also established.

## 3.0 Biological Sciences

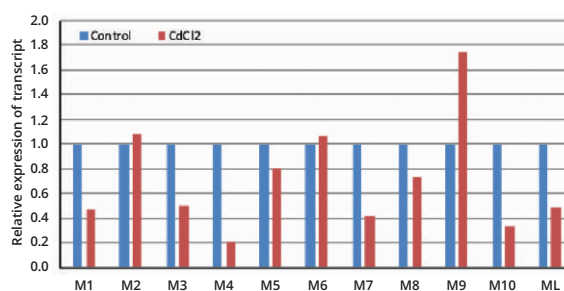
Research in Biology department centers around understanding of molecular mechanisms leading to disease condition which will give insights to target the treatment of the disease. Research has also been initiated on plant molecular biology to devise strategies for improvement of economic traits. The group is contributing towards the impact of development on flora and fauna and advise the developmental agencies. To meet the diverse requirements for cutting edge research, sophisticated instrumental facilities have been developed. The facilities include confocal microscope, FACS, Ultracentrifuges, cell culture facility and growth chambers. Common facility of mass spectroscopy is also being used by the faculty.

### 3.1 Plant Biology

Dr. Eswarayya Ramireddy's group is working on (i) unravelling the role of root cap-specific mannose-binding lectin proteins and LEA proteins in root development and their implications in shaping the plant response to environmental cues and (ii) enhancement of blast resistance in rice (*Oryza sativa* L.) by employing CRISPR/Cas9 based genome editing. In the first project several tests have



**Fig. 5** Effect of  $\text{CdCl}_2$  on root growth in Arabidopsis (Eswarayya Ramireddy group)



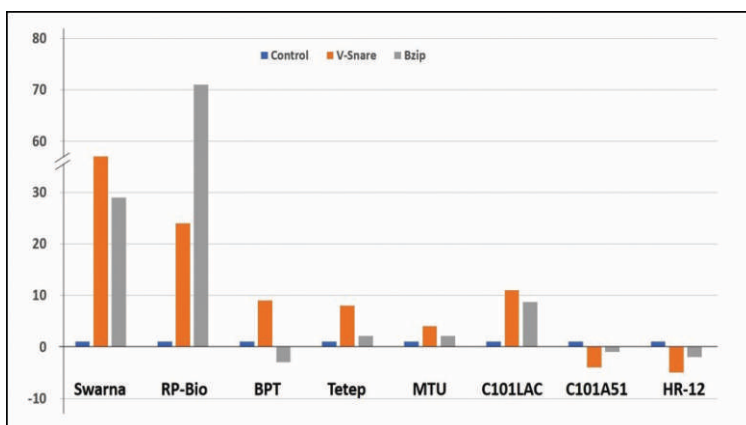
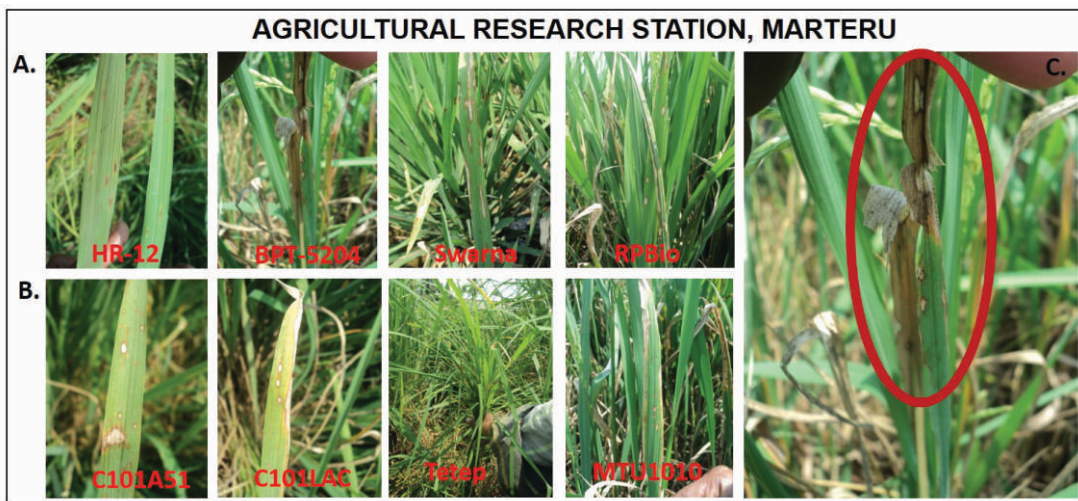
been done to elucidate the stress-responsiveness of root cap-specific *JRLs* (labeled as M1-M10 for simplicity purpose).

**Down-regulation of root cap-specific *JRLs* to cadmium stress.** Three-day old-*Arabidopsis* seedlings were transferred to plates containing 75µM CdCl<sub>2</sub> and control plate and further grown for 5 more days. *AtUBQ10* was used as reference control and expression of *JRLs* under control conditions was set to 1.

In one example *Arabidopsis* seedling were exposed to cadmium (Cd) stress (75 µM CdCl<sub>2</sub>) and several other stresses lead to observing differential expression of *JRLs*. This observation will help in elucidating the signaling cascade involved in the perception and transduction of stress perceived by the rootcap.

In the second project, it is proposed to employ CRISPR/Cas9 based genome editing to increase the blast resistance in rice. Rice blast caused by filamentous ascomycetes fungus, *Magnaporthe oryzae*, is one of the most destructive disease throughout the world.

The main objective of the present study is to identify the target genes that are affected by the blast pathogen infection in plants by using the publicly available transcriptomic data sets across different platforms. Selected candidates from this analysis will be validated for their role in blast disease tolerance or susceptibility. Further, by using CRISPR/Cas9 system effector-binding sites from these genes will be knocked out.



**Fig 6.** The leaf samples from the blast disease susceptible and resistant varieties were grown under natural field conditions. **A.** Susceptible plants, **B.** Resistant plants and **C.** Blast disease affected leaf. **D.** The results from RT-qPCR analysis suggested that the expression of *V-Snare* and *BZIP* transcript levels are very high in susceptible varieties like Swarna and RP-Bio and very minimal expression towards blast disease incidence was observed in resistant varieties like Tetep, MTU1010 and C101LAC. (Eswarayya Ramireddy group)



### 3.2 Ecology

**Dr. Nandini Rajamani's** research focuses on understanding broad-scale patterns of ecology, evolution, and behaviour in wild populations, with a special focus on individual variation and local adaptations, using model systems like small mammals, particularly sciurids. Animals living exclusively in high altitudes on mountains are typically specialized to extreme local climatic and environmental conditions. Nandini and her group members surveyed the regions of Kashmir and Ladakh to determine presence and genetic connectivity of populations of two species of marmots – ground-dwelling cold-adapted species. The surveys yielded new records for species occurrence and behaviour. Factors determining current distribution as well as range shifts in the light of changing climate will be studied in the coming years. A second project examines distributional shifts and adaptations in three species of striped palm squirrels in the Western Ghats. These species, which typically occur in the forest understory, have shown rapid response to changing environments and climates, adapting to local conditions possibly through commensalism (focus on nest use). Future work will examine adaptations, behaviour and changing life-history strategies in both study systems.

**Dr. Robin Vijayan's** research is on the birds and their interactions with the habitats they occupy. Most research falls under three thematic categories:

*Acoustics:* Work with automated recorders has been expanded during the year. In a collaborative research project on bioacoustics, automatic recorders were used to detect bird species, probably for the first time in India. The results have been submitted as a manuscript for publication, which has come out of a collaboration with Colorado University and IISc Bengaluru scientists. As a result of this collaboration, some advanced techniques in analyses of data have been developed and have since been incorporated into our research.

*Phylogenetics & biogeography:* This year, research on Forest owl has been expanded that resulted in the first genetic data from this species (Koparde et al. 2018). It appears that this critically endangered species may not belong to the genus it was previously thought to be, raising several conservation concerns. A short project on the affinities of Sri Lankan birds – White Eyes, with Western Ghat birds (Wickramasinghe et al 2017) was also completed.

*Landscape change:* Using field & computer-based techniques (GIS & Remote Sensing) an effort to assess change in the Palani Hills landscape was made. Using this data, it has been possible to report a drastic reduction in native grasslands due to the spread of invasive timber plantations. This study largely provides a background for the group to conduct future research on biogeography and genetic changes. This research was covered widely by the media. PLoS also commissioned a blog piece on the process of this group's research, intrigued by multidisciplinary collaborators (which included naturalists, school teachers and NGOs).

### 3.3 Cancer Biology and Immunology

Anoikis is a form of death induced by cellular detachment from the surface. This process is mediated by induction of a pro-apoptotic molecule called BMF. When normal cells undergo detachment from the surface, BMF causes anoikis death of cells. However, when metastatic cancer cells undergo detachment,

anoikis death does not happen. How metastatic cancers escape anoikis death and how BMF gene is regulated in metastatic cancer cells is not very clear. To gain mechanistic insight into the regulation of BMF gene during detachment of normal vs. metastatic cancer cells, the group of **Dr. Sivakumar Vallabhapurapu** cloned different parts of BMF gene promoter and identified different transcription factors that can potentially bind to BMF promoter. Further analysis of the cloned promoter regions would help in understanding of BMF gene regulation.

### 3.4 Cell biology and Molecular Oncology

**Suresh Pakala's** group has identified the global network map of PAK1 to understand its role and regulatory mechanism based on its significant molecular interacting partners. Based on the STRING and Cytoscape, it was seen that the STAT3 is one of the interacting partners of PAK1. Further, the molecular modeling studies of PAK1 and STAT3 helped to explore the key interactive residues of PAK1 structure.

Although PAK1 and STAT3 expression is intimately connected with the cancer invasion, migration and metastasis, the relationship between PAK1 and STAT3 and the molecular mechanism that controls these functions remains unclear. In the current study, it is proposed to explore if STAT3 is a substrate of PAK1 and identify the site of phosphorylation on STAT3 by mass spectrometry and site directed mutagenesis. Further, attempt will be made to delineate the functional significance of this phosphorylation on STAT3 by PAK1 in radioresistance of Glioblastoma Multiforme (GBM).

### 3.5 Molecular Microbiology

**Dr. Raju Mukherjee's** group is working on understanding small molecule permeation in *Mycobacterium tuberculosis* that will be useful for rational design of drugs with penetrating scaffolds.

Despite originating from different chemical classes, "New Chemical Entities" under development for tuberculosis (TB) are characterized by a few common features. These include their high hydrophobicity and the fact that they are active against a common set of "promiscuous targets", which are either located in the periplasmic space or in the mycobacterial inner membrane. The bias towards the identification of hydrophobic molecules through phenotypic screening can be rationalized in terms of the ability of such molecules to diffuse across the lipid rich outer membrane of mycobacteria (Mycocombrane). It is this lipid layer that confers intrinsic resistance to *Mycobacterium tuberculosis* against drugs by providing a permeability barrier for both hydrophilic and hydrophobic compounds. Transport of nutrients and small molecules across the bacterial inner membrane and the processes mediating transport have been extensively studied. However, the mechanism by which nutrients permeate across the extraordinarily thick mycomembrane is poorly understood. The group proposes to identify and characterize the key outer membrane proteins including 'porins' located in the mycomembrane that are essential for nutrient and antibiotic uptake employing two screens involving both high density transposon mediated mutagenesis followed by massively parallel sequencing and mass spectrometry based proteomics.

A method has been developed for generating a high titre of a mycobacteriophage (1x10<sup>11</sup>). This phage was later utilized to develop a method of creating a high density mutant library in *Mycobacterium*

*smegmatis* and this process is still under development. In the meantime, this library was used to generate a mutant library in *M. tuberculosis*. The library is being characterized to map the position of Tn insertions to quantify the density of the mutant library.

In a parallel approach, protocols are being developed for identifying outer membrane proteins using the method of detergent extraction followed by mass spectrometry based proteomics. Using Octyl beta D-glucoside it was possible to extract more number of outer membrane proteins from *M. smegmatis* compared with other non-ionic detergents Triton-X 100, Triton-X114 and Octy-POE through a gel based assay. In future this procedure will be employed for *M. tuberculosis*.

### 3.6 Cellular and Molecular Parasitology

Malaria is one of the major infectious diseases in India. In order to ensure proper transmission from human to mosquito for completion of its life cycle, the early stages of parasite gametocytes hide in bone marrow and only mature gametocytes are found in peripheral blood. Thus, research from Dr. Suchi Goel's laboratory mostly focuses to understand the molecular mechanism of adherence to bone marrow cells. Therefore, the interest is to look for parasite genes that specifically express at gametocyte early stages and mediate binding of gametocytes to bone marrow stromal cells. For this, protocols for invitro lab culture of gametocytes were standardized and are in process of submitting the samples for RNA seq analysis to identify upregulated multigene family members (PfEMP1, RIFIN, STEVOR) important for sequestration. However, in parallel, the group focused more on identifying transcription factors that lead to upregulation of multigene family members that mediate gametocyte adherence. As parasites possess only one transcription factor family (PfAP2), thus using available genomic and transcriptomic data, 8 PfAP2 genes were identified that are highly expressed in the early developmental stages of malaria parasite. After recombinant purification of DNA binding domains of these 8 PfAP2s, it was observed that 3 AP2 proteins are able to specifically bind parasite DNA. Experiments are in progress to identify target genes that could affect gametocyte sequestration to stromal cells.

### 3.7 Neuroscience

The research group of **Dr. Vasudharani Devanathan**, focusses on (i) cell Adhesion Molecules (CAMs) in regulating neurogenesis, neurite outgrowth and degeneration; specific interactions among CAMs and their downstream signaling mechanisms, (ii) molecular mechanism of neuronal dysfunction in diabetic retinopathy and (iii) G-protein signaling in platelets and neutrophils. During the year, work was initiated on Cell adhesion molecules in the central nervous system, i.e, brain and eye. Standardisation of protocols was done using goat brain-biochemical and cell biological techniques.

## 4.0 Mathematical Sciences

The mathematics department at IISER Tirupati mostly consists of very young mathematicians who are very enthusiastic about teaching and research in mathematics. Some of the main topics of interest of the faculty are Algebraic Geometry, Automorphic forms, Complex Geometry, Differential Geometry,

Harmonic Analysis, Representation Theory and Topology. We would like to grow, so as to represent other areas of mathematics and to enhance research collaborations and training of young mathematicians to cater to the needs of the country.

#### 4.1 Number Theory

**Dr. Anilatmaja Aryasomayajula** in collaboration with Dr. Baskar Balasubramanyam (IISER Pune), has been working on deriving optimal qualitative and quantitative estimates of automorphic cusp forms defined over quaternion algebras, using techniques coming from heat kernel theory and geometric analysis. This work has been submitted for publication in International Journal of Number Theory.

In another project, **Dr. Aryasomayajula** derived off-diagonal quantitative estimates of the Bergman kernel associated to tensor-powers of the cotangent bundle defined on a hyperbolic Riemann surface of finite volume. This is an extension of the work done earlier, which had a restriction on the distance between the two points, where the Bergman kernel is evaluated at. This restriction is now removed. As done earlier, our estimates are optimally derived, and depend only on the injectivity radius of the hyperbolic Riemann surface, and the tensor-power of the cotangent bundle.

In yet another project, Symmetric products of Riemann surfaces are the moduli spaces of certain vortex equations coming from theoretical physics. In [5], we have explored different Kahler metrics on the symmetric products of hyperbolic Riemann surfaces. We also derived optimal estimates of Bergman metric on hyperbolic Riemann surfaces.

#### 4.2 Harmonic Analysis

In 2009, S. Alesker et al (Amer. Math. Soc. Transl.(2) 226 (2009), 11-26.) characterised the Euclidean Fourier transform as essentially the only bijection on the class of tempered distributions onto itself which interchanges the convolution and pointwise products. **Dr. Lakshmi Lavanya** is interested in checking if the hypotheses involving the class of tempered distributions could be replaced with those involving only the Schwartz class functions. Last year she obtained such a characterisation of the Fourier transform on  $\mathbb{R}^n$  and then on the more general class of locally compact Abelian groups. Later similar results were obtained for a more general class of pairs of algebras of functions on locally compact Abelian groups, which we call Fourier twins. This work has been published by the journal Monatshefte für Mathematik.

The study of the minimally character-invariant Segal algebra on any locally compact Abelian group was initiated in by Feichtinger (Monatsh. Math. 92 (1981), 269-289). Since then, this algebra, now called the Feichtinger algebra has been studied extensively. **Dr. Lakshmi Lavanya** studied the maps which interchange the convolution and pointwise product on the Banach Gelfand triples. These results have been submitted for publication to an international journal.

#### 4.3 Differential Geometry

During the year under report, **Dr. H.A. Gururaja** continued to study the conjugacy rigidity problem with his collaborator Prof. C. S. Aravinda from TIFR, Bengaluru. In particular, efforts were made to prove the

rigidity of flat cylinders in complete generality. Some special cases of this problem have been resolved. In collaboration with Dr. B. Subhash, an expository article, *On the orientability of compact hypersurfaces in  $R^n$* , has been completed. It is submitted for publication.

#### 4.4 Algebra and Geometry

**Dr. Girja Shankar Tripathi** has been working on three projects. One of those concerns product structures on certain quotients of algebraic cobordism that includes Morava K-theories, another one is about computations of Witt groups of toric varieties. The third project is centered around describing Witt groups of perverse sheaves as constructible Witt groups.

**Dr. Venkatesubramanian C.G.** is working on Theta correspondence for complex representations of general linear groups over local non-archimedean fields have been studied in the past. Structure of the full theta lifting has been obtained by different authors for certain complex representations of  $p$ -adic  $GL(n)$ . Certain results on the structure of small theta lifting have been obtained also for both complex and  $l$ -modular representations of  $GL(n)$ . We are in the course of obtaining the structure of full theta lifting of certain irreducible smooth representations of the general linear group over a non-archimedean local field. Though, certain properties such that finite length is known, we have arrived at alternate proofs (motivated by proofs given in Type-1 (orthogonal symplectic) situation) which offers a different picture about the structure of the full theta lifting. The structure of full theta lifting is known to shed light on, and in some cases crucial, to understanding distinction of certain representations of  $p$ -adic groups.

**Dr. Souradeep Majumder's** work involves parabolic bundles in positive characteristic have been my main research interest during this period. In a joint work with Dr. Manish Kumar we have suitably constructed these objects and proved many properties which we expected to hold. The results have been published in JRMS. We are now trying to construct the moduli space of such bundles. As a first step towards that we have constructed the moduli stack of parabolic bundles. Also in collaboration with Dr. Ronnie Sebastian I am working on the real rationality of moduli space of bundles with fixed determinant. We have already made significant progress in this project as well. In fact we have proved that when the base curve has a rational point, the moduli space is indeed real rational.

## 5.0 Earth and Climate sciences

### 5.1 Geochemistry

The rocks of the Sushina Hill Peralkaline Complex of West Bengal is unique as they host exotic Nb-REE-Zr bearing minerals such as eudialyte, rinkite-(Ce), nacareniobsite-(Ce) and by far the only known peralkaline complex (*sensu stricto*) reported from the Indian subcontinent. Recently, three new minerals were found for the first time from this complex, and these are the only second global occurrences. In

the present work, **Dr. Aniket Chakraborty** and his group have demonstrated the mineralogical evolution of the entire complex and established spatial relationship of the individual lithologies with regional scale tectono-thermal events. This work has successfully demonstrated the overlapping relation between various post intrusive tectono-thermal events consanguineous with magma evolution.

### 5.2 Climate studies

**Sai Kranti** studied variability of occurrence and vertical structure of precipitation with sea surface temperature over the Arabian Sea and the Bay of Bengal as inferred by TRMM PR measurements

The association between SST and different types of precipitating systems over Arabian Sea (AS) and Bay of Bengal (BOB) has been revealed utilizing TRMM data during 1998 – 2013 (16 years). The occurrence of deeper systems increases with SST over both the seas up to 30°C and decreases from 30°C to 31°C. The occurrence of shallow systems is independent of SST over BOB while it decreases with rise in SST over AS. The variation of reflectivity with SST is remarkable over AS but not substantial over BOB. The observed negative slopes below melting layer indicate the predominance of collision-coalescence process than breakup and evaporation over both seas.

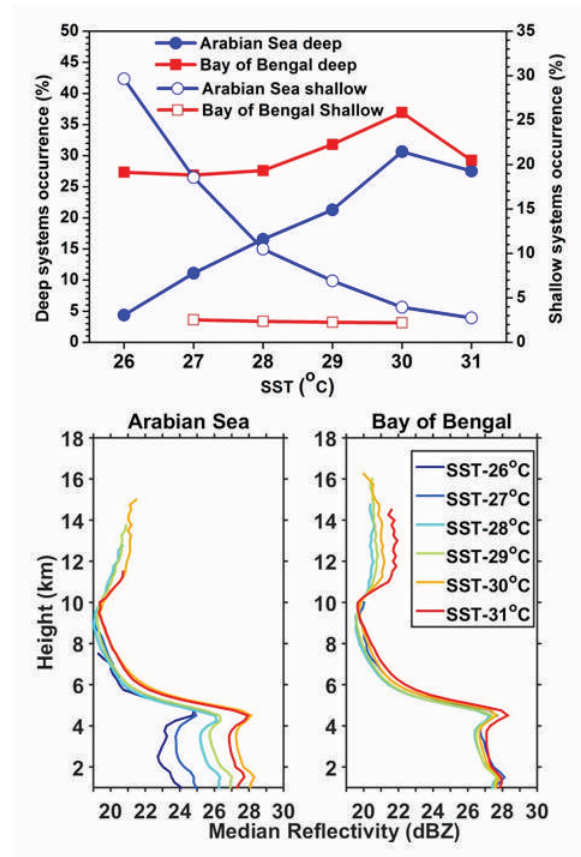


Fig. 7 Top Panel shows the occurrence of deep and shallow precipitating systems with sea surface temperature (SST) over the Arabian Sea and the Bay of Bengal during southwest monsoon season. Bottom panels indicate the vertical structure of median reflectivity (in dBZ) profiles with SST.

# Personnel (as on 31-03-2018)

MHRD has sanctioned 30 faculty positions with flexibility of cadre and 35 non-teaching staff positions. The following positions have been filled so far.

## Faculty

### Professor and Director

K.N. Ganesh

### Associate Professor

Sivakumar Vallabhapurapu

### Assistant Professor

K.P. Yogendran (on deputation)

Raghunathan O. Ramabhadran

Sudipta Roy

R. Lakshmi Lavanya

Sudipta Dutta

Dileep Mampallil

Girja Shanker Tripathi

H.A. Gururaja

Ashwani Sharma

N.V. Anilatmaja Aryasomayajula

Chitrasen Jena

Gopinath Purushottaman

C.G. Venketasubramanian

Raju Mukherjee

Nandini Rajamani

Vasudharani Devanathan

Eswarayya Ramireddy

Arunima Banerjee

Suchi Goel

Aniket Chakrabarty

Pankaj Kumar

Souradeep Majumdar

S. Sunil Kumar

Robin V. Vijayan

Shibdas Banerjee

Jessy Jose

Soumit Shankar Mandal

### Assistant Professor (contractual)

Suresh Babu Pakala

Thokala Soloman Raju

B. Subash

### Visiting Faculty

Prof. P.C. Deshmukh

<b>Professor</b>	<b>1</b>	<b>Associate Professor</b>	<b>1</b>	<b>Assistant Professor</b>	<b>30</b>	<b>Total</b>	<b>32</b>
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## Non-teaching staff

### Administration staff

D. Srikrishna (Dy. Registrar, F &A)

C. Chaman Mehta (Asst. Registrar)

Inderpreet Singh Kohli (Asst. Registrar)

Datta Prasad Ganesh Gavde (Office Superintendent)

Mahesh Karigani (Office Assistant Multi-skill)

N. Dileep Kumar ( Office Assistant Multi-skill)

Rajesh Anupoju (Office Assistant Multi-skill)

Meesala Vamsidhar (Office Assistant Multi-skill)

Palagiri Maulana Azad (Office Assistant Multi-skill)

Kedarnath Meduri (Office Assistant Multi-skill)

Suresh Kumar Chekkala (Office Assistant Multi-skill)

Bharathi Kalakota (Office Assistant Multi skill)

### Technical staff & Support staff

Srikant Varma (Technical Officer)  
 Konagari Ranjith Kumar (Technical Assistant) (on deputation)  
 Anup Chandra Pal (Technical Assistant)  
 C. Geetha (Technical Assistant)  
 Satish Mutyam (Technical Assistant)  
 Kolli V.V. Nagarjun (Technical Assistant)  
 Royya Anil Kumar (Technical Assistant)  
 Mohan Mukesh Malviya (Technical Assistant)  
 Jadhav Satish Ramdas (Technical Assistant)  
 K. Murugaraj (Library Information Assistant)  
 Nimmy Prasad (Nurse)  
 Kuna Sivakumar (Assistant Engineer Electrical)  
 Antony Joe C.V. (Assistant Engineer Civil)  
 Purushottam Mabbu (Laboratory Technician)  
 P. Veena (Laboratory Technician)  
 B. Tirupataiah (Laboratory Technician)

### Non-Technical staff

Dy. Registrar (F & A)	1
Assistant Registrar	2
Assistant Engineer	2
Office Superintendent	1
Library and Information Assistant	1
Nurse	1
Technical Officer	1
Technical Assistant	8
Laboratory Technician	3
Office Assistant (multi-skill)	8
<b>Total</b>	<b>28</b>

### Project Scientists

Sasmita Mohakud (INSPIRE Faculty)  
 K. Saikranti (INSPIRE Faculty)  
 V. Aravindan (DST Ramanujan Fellow)  
 Deepti Sharma (SERB-NPDF)

### Post-doctoral Fellows

Dr. Harshini Chakravarthy  
 Dr. Sudhakar Rao V. Kola  
 Dr. Pranava Shankar Mishra  
 Dr. Ankur Mandal  
 Dr. Shelke Ganesh Mahaodeorao  
 Dr. Palande Aseem Sanjay  
 Dr. Shyam Kumar Madhusudhana  
 Dr. A. Prasanna Kumar

### Project Staff

Priyanka Majumder  
 Soumya Ranjan Das  
 Meenakshi Sharma  
 N. Ganesh  
 Viral Joshi  
 Tejan Harsukhbhai Lodhiya



# Accounts at a Glance

## Indian Institute of Science Education & Research - Tirupati

Balance Sheet as at 31<sup>st</sup> March 2018

Amount in Rupees

SOURCES OF FUNDS	Schedule	Current Year 2017-18	Previous Year 2016-17
CORPUS/CAPITAL FUND	1	33,80,21,788	21,03,94,994
DESIGNATED/ EARMARKED / ENDOWMENT FUNDS	2	-	-
CURRENT LIABILITIES & PROVISIONS	3	33,39,51,009	24,22,09,202
<b>TOTAL</b>		<b>67,19,72,797</b>	<b>45,26,04,196</b>

APPLICATION OF FUNDS	Schedule	Current Year 2017-18	Previous Year 2016-17
FIXED ASSETS	4		
Tangible Assets		26,42,79,543	11,59,98,516
Intangible Assets		60,29,288	53,99,572
Capital Works-In-Progress		5,13,83,196	8,49,07,341
INVESTMENTS FROM EARMARKED / ENDOWMENT FUNDS	5		
Long Term		-	-
Short Term			
INVESTMENTS - OTHERS	6	-	-
CURRENT ASSETS	7	24,16,14,725	14,49,60,712
LOANS, ADVANCES & DEPOSITS	8	10,86,66,045	10,13,38,055
<b>TOTAL</b>		<b>67,19,72,797</b>	<b>45,26,04,196</b>
SIGNIFICANT ACCOUNTING POLICIES	23	-	
CONTINGENT LIABILITIES AND NOTES TO ACCOUNTS	24		

FOR AND ON BEHALF OF I I S E R, TIRUPATI

sd/-  
D Sri Krishna  
Deputy Registrar (F&A)

sd/-  
Col.G Raja Sekhar (Retd.)  
Registrar

sd/-  
Prof. K. N. Ganesh  
Director

Place: Tirupati

Date:

## Indian Institute of Science Education & Research - Tirupati

Income & Expenditure Statement for the Period Ended 31<sup>st</sup> March 2018

Amount in Rupees

SOURCES OF FUNDS	Schedule	Current Year 2017-18	Previous Year 2016-17
<b>INCOME</b>			
Academic Receipts	9	1,01,29,832	35,08,295
Grants / Subsidies	10	15,66,00,000	13,00,00,000
Income from investments	11	72,18,081	34,79,805
Interest earned	12	2,57,459	29,122
Other Income	13	21,10,364	26,270
Prior Period Income	14	-	-
<b>TOTAL (A)</b>		<b>17,63,15,736</b>	<b>13,70,43,492</b>
<b>EXPENDITURE</b>			
Staff Payments & Benefits (Establishment expenses)	15	7,68,46,197	3,51,19,705
Academic Expenses	16	5,05,93,264	69,10,793
Administrative and General Expenses	17	7,92,01,378	4,44,76,661
Transportation Expenses	18	27,71,589	19,31,835
Repairs & Maintenance	19	2,57,01,646	74,64,418
Finance costs	20	1,87,077	12,257
Depreciation	4	3,32,33,400	1,41,83,301
Other Expenses	21	71,712	-
Prior Period Expenses	22	6,27,794	-
<b>TOTAL (B)</b>		<b>26,92,34,057</b>	<b>11,00,98,970</b>
<b>Balance being excess of Income over Expenditure (A-B)</b>		<b>(9,29,18,321)</b>	<b>2,69,44,522</b>
<b>Less: Transfer to / from Designated Fund</b>			
Others - Institute Reserve Fund (Sch 9+Sch 13)		(1,22,40,196)	(35,34,565)
Transfer to Capital Fund		3,32,33,400	1,41,83,301
Over Utilization of Grant in Aid for Revenue Exps (Schedule 3C)		(7,19,25,117)	
Under Utilization of Grant in Aid for Revenue Exps (Schedule 3C)			3,75,93,258

FOR AND ON BEHALF OF I I S E R, TIRUPATI

sd/-  
**D Sri Krishna**  
Deputy Registrar (F&A)

sd/-  
**Col.G Raja Sekhar (Retd.)**  
Registrar

sd/-  
**Prof. K. N. Ganesh**  
Director

Place: Tirupati

Date:



Proposed Master Plan of IISER Tirupati Campus



### **Transit Campus**

Sree Rama Engineering College, Rami Reddy Nagar  
Karkambadi Road, Mangalam (B.O), Tirupati 517507 (Andhra Pradesh)  
Tel +91 877 250 0400 Website: [www.iisertirupati.ac.in](http://www.iisertirupati.ac.in)