THE INSTITUTE OF MATHEMATICAL SCIENCES

ANNUAL REPORT
AND AUDITED STATEMENT OF ACCOUNTS

April 2017 - March 2018

Telephone: +91-44-2254 3100, 2254 1856
Fax: +91-44-2254 1586

DID No.: +91-44-2254 3xxx(xxx=extension)
Website: http://www.imsc.res.in/

Foreword

I am very pleased to present the annual report of the Institute for 2017-2018 and put forth the distinctive achievements of its members during the year along with a perspective for the future.

During April 2017 - March 2018, there were 148 students pursuing their PhD and 43 scholars pursuing their post-doctoral programme at IMSc.

Through the year the Institute conducted a number of workshops and conferences. Specifically, the International workshop on "Economy as a complex system" was a workshop focusing on statistical physics as a tool in economics. There was a research school on "Mechanical properties of complex solids" focusing on bringing together a wide range of physics in the field to share techniques and recent developments. There was a conference on the broad topic of "disorder and interaction" in both classical and quantum systems. In the field of mathematical modeling of diseases, the computational biology group conducted a mini-workshop on tuberculosis research. An international conference on number theory, bringing together several leading number theorists, was organized by the Institute this year. A conference on "recent advances in parameterized complexity" which included a school for graduate students was also conducted this year. One off-campus meeting on 'Logic and Automata Theory : A tribute to Zoltan Esik' was organized by IMSc faculty during this period.

We are very pleased to note that our outreach programmes like 'Teachers' Enrichment Workshop', 'Summer School Students Workshop', 'Facets', 'kaNita-kAnakam", 'Foldscope Workshop', 'Nag Memorial Endowment Lecture', 'Student Talks on Trending Topics in Theory 2017', 'Enriching Mathematics Education', 'Science Fun, Science Toys', 'Scientists and school education : A discussion', 'Indian Women in Science' and 'Science at the Sabha' are increasingly popular. These programmes have been attracting more and more students and teachers, mainly from nearby regions, but some from other parts of the country. The outreach related activity in the Institute is the initiative of several faculty members. Their untiring efforts, enthusiastically supported by the IMSc administration, PhD students and postdoctoral fellows, to make scientific research accessible and exciting to students and teachers at various levels, deserves all praise.

Academic research productivity of the members of the Institute has been excellent this year as well. Several significant publications have been reported in national and international journals. Our faculty have edited a few books as well.

10 students were awarded PhD, and 7 students have submitted their PhD theses. 3 students were awarded MSc by Research, and a student has submitted her Master's thesis under the supervision of our faculty.

There was, as usual, a lot of participation of IMSc members in international conferences, in the form of invited talks, paper presentations etc. Among several such we highlight a few: Prof. Sitabhra Sinha was an invited speaker at the joint conference Econophysics Colloquium (EC) 2017 and Polish Symposium on Econo- and Sociophysics (FENS) 2017, during 5-7 July 2017, and Prof. Meena Mahajan was an invited speaker at the CSL 2017 (Computer Science Logic conference) held during Aug 20-24, 2017 and at STACS

2018 (Symposium on Theoretical Aspects of Computer Science) held during Feb 2018.

There are several ongoing collaborations, both national and international, with research groups IMSc. Some of these collaborations are as formal agreements and MoUs. In the last year there are two such collaborative projects on "Precision physics for the large hadron collider" with Universite de Louvain, Belgium and Universita de Milano, Italy. There is a collaborative project on "modeling soft glass flow" with Universite Grenoble, France. An international joint research unit (UMI) RELAX, (which stands for Research Lab in Computer Science), has been set up (based in Chennai Mathematical Institute) to facilitate bringing together research institutions/universities in France and India, including IMSc.

There were 44 lecture courses conducted at the Institute during the reporting period. Additionally, 2 lecture courses were given at Chennai Mathematical Institute for its National Undergraduate Programme.

We are proud to note the awards and honors bestowed on our faculty for their contributions.

Dishant M Pancholi was awarded 'B M Birla Science Prize' jointly with Neena Gupta of ISI. Parthasarathi Chakraborty was elected as a Fellow of the Indian Academy of Sciences, Bangalore. Gautam I. Menon was awarded Shasgtri Mobility Program Fellowship, for 2018, by the Shastri Indo-Canadian Institute. Prasad, Amritanshu was awarded Srinivasa Ramanujan Memorial Award Lecture, for 2017, by the Indian Mathematical Society.

This report was compiled through the efforts of the IMSc Annual Report Committee comprising of Drs. C. R. Subramanian, Shrihari Gopalakrishna, Sankaran Viswanath, Paul Pandian and Usha Devi. I owe my gratitude to all of them.

June, 2018 **V. Arvind**

Contents

1 The Institute

The Institute of Mathematical Sciences (IMSc), founded in 1962, is a national institution for fundamental research in the mathematical and physical sciences.

The Institute is funded by the Department of Atomic Energy of the Government of India. Institute members work primarily in the areas of Mathematics, Theoretical Computer Science, Theoretical Physics and Computational Biology.

The Institute is governed by a Governing Board and an Executive Council. Academic personnel at the Institute are grouped as Faculty, Post-Doctoral Fellows, Junior Research Fellows and Senior Research Fellows. The academic programmes are ably supported by an administrative set-up. The Director is assisted by the Faculty in academic matters and by the Registrar in financial and administrative matters.

Out of a sanctioned strength of 61 at present 55 faculty members are in position. This year there were 43 post-doctoral fellows from all over the world pursuing research at IMSc. In addition there are about 61 scientific personnel at various levels working here on different projects. The number of doctoral students (JRFs & SRFs) is 148 this year. The Institute has 37 members of non-academic staff which include staff of Scientific, Administrative and Accounts.

IMSc has an outstanding scientific library, an excellent computing environment including a tera-flop class cluster computer and a dedicated high-speed network. The Institute hosts several national and international scientific / academic conferences / workshops and meetings every year.

This report briefly describes the programmes and activities of the Institute as well as its achievements in the past year. More details are available in the detailed annual report.

1.1 Governing Board

Thiru. **K.P. Anbalagan**,
Hon'ble Minister for Higher Education,
Government of Tamil Nadu, Chennai
(**Chairman**)

Dr. **Sekhar Basu**,
Chairman, Atomic Energy Commission & Secretary to Government of India,
Department of Atomic Energy, Mumbai
(**Vice-Chairman**)

Prof. **S. K. Joshi**,
Honorary Scientist Emeritus, CSIR
Vikram Sarabhai Professor,
National Physical Laboratory, New Delhi
(**Member**)

Prof. **Amitava Raychaudhuri**,
Sir Tarak Nath Palit Professor of Physics,
University of Calcutta, Kolkata
(**Member**)

Prof. **Mustansir Barma**,
Former Director, TIFR, Professor Emeritus,
TIFR Center for interdisciplinary Science,
Hyderabad
(**Member**)

Prof. **Sudhanshu Jha**,
Former Director, TIFR, 402 Vigyanshila,
Juhu-Version Link Road, Seven Bungalow,
Andheri(W), Mumbai
(**Member**)

Shri. **A.R. Sule**,
Joint Secretary(R&D),
Department of Atomic Energy, Mumbai
(**Member**)

Shri. **C.M. Sane**,
IA&AS Joint Secretary(Finance),
Department of Atomic Energy, Mumbai
(**Member**)

Prof. **P. Duraisamy**,
Vice Chancellor,
University of Madras, Chennai
(**Member**)

Shri **Sunil Paliwal**, IAS,
Principal Secretary to Government,
Secretariat, Higher Education Department,
Govt of Tamil Nadu, Chennai
(**Member**)

Prof. **V. Arvind**,
Director,
The Institute of Mathematical Sciences, Chennai
(**Member Secretary**)

1.2 Executive Council

Prof. **S.K. Joshi**,
Honorary Scientist Emeritus,
CSIR Vikram Sarabhai Professor,
National Physical Laboratory,
New Delhi
(**Chairman**)

Prof. **Mustansir Barma**,
Former Director,
Professor Emeritus,
TIFR Center for interdisciplinary Science,
Hyderabad
(**Member**)

Prof. **Amitava Raychaudhuri**,
Sir Tarak Nath Palit Professor of Physics,
University of Calcutta, Kolkata
(**Member**)

Shri. **A.R. Sule**,
Joint Secretary (R&D),
Department of Atomic Energy, Mumbai
(**Member**)

Shri. **C.M. Sane**,
IA&AS, Joint Secretary (Finance),
Department of Atomic Energy, Mumbai
(**Member**)

Shri. **Sunil Paliwal**, IAS,
Principal Secretary to Government,
Secretariat, Higher Education Department,
Govt of Tamil Nadu, Chennai
(**Member**)

Prof. **V. Arvind**,
Director,
The Institute of Mathematical Sciences, Chennai
(**Member Secretary**)

1.2.1 Profiles of Governing Board and Executive Council Members

Thiru **K.P. Anbalagan**, Hon'ble Minister for Higher Education, Government of Tamilnadu, Chennai
(**Chairman**, *Governing Board*)
He was previously the Information Minister of Government of Tamilnadu.

Dr. Sekhar Basu, Chairman, Atomic Energy Commission & Secretary to Govt. of India, Department of Atomic Energy, CSM Marg, Mumbai
(**Vice-Chairman**, *Governing Board*)
Dr. Sekhar Basu, a renowned nuclear scientist, was the Director of Bhabha Atomic Research Centre (BARC) before taking over as Chairman, Atomic Energy Commission & Secretary Department of Atomic Energy, Govt. of India. Dr. Basu was awarded "Padma Shri" by the Government of India in 2014.

Prof. S. K. Joshi, Honorary Scientist Emeritus CSIR Vikram Sarabhai Professor National Physical Laboratory Dr. K.S. Krishnan Road New Delhi 110 012.
(**Member**, *Governing Board*) & (**Chairman**, *Executive Council*)
Prof. Joshi has held numerous important positions in the field of science in India, including Director General CSIR, and Director, National Physical Laboratory. He is member of several national and international academies, including the Indian National Science Academy and the Third World Academy of Sciences. For his work in physics Prof. Joshi is the recipient of numerous national and international awards, including the Won Watumull memorial Prize and the Bhatnagar Prize. He is recipient of the Padma Shri and the Padma Bhushan for his contributions.

Prof. Mustansir Barma Professor Emeritus, TIFR Center for interdisciplinary Science, No.36/P, Gopanapally Village, Serilingampally Mandal, Ranga Reddy - Dist Hyderabad 500107..
(**Member**, *Governing Board & Executive Council*)
Prof. Barma was a faculty member at TIFR Mumbai and was Director, TIFR Mumbai. For his contributions to physics Prof. Barma has received numerous awards, including the Bhatnagar prize and the "S.N. Bose Birth Centenary Award". Prof. Barma is member of many national and international science academies including the Indian National Science Academy. For his contributions he was awarded "Padma Shri" by Government of India.

Prof. Amitava Raychaudhuri Sir Tarak Nath Palit Professor of Physics, University of Calcutta, Kolkata.
(**Member**, *Governing Board & Executive Council*)
Prof. Raychaudhuri has held numerous academic positions in India and abroad. He was the 'Sir Tarak Nath Palit Professor' at Calcutta University, and he was Director HRI, Allahabad. For his research contributions in physics, Prof. Raychaudhuri has received several awards, including the Bhatnagar Prize and the J.C. Bose fellowship. He is member of several science academies, including the Indian National Science Academy. Prof. Raychaudhuri was conferred the honour of International Alumnus of the Year by the University of Maryland.

P. Duraisamy, Vice Chancellor, University of Madras, Chennai
(**Member**, *Governing Board*)
Duraisamy is a former HOD of econometrics department in University of Madras and has a PhD from Paris University

Prof. Sudhanshu Jha, 402, Vigyanshila, Juhu-Versova Link Road, Seven Bungalows, Andheri (W) Mumbai.
(**Member**, *Governing Board*)
Prof. Sudhanshu Jha was faculty member at TIFR, Mumbai and is a former Director, TIFR, Mumbai. For his contributions in physics, Prof. Jha has received many awards including the Bhatnagar Prize and the S.N. Bose Medal. He is a member of several national and international academies, including the Indian National Science Academy and the Third World Academy of Sciences.

Shri A.R. Sule Joint Secretary (R & D), Department of Atomic Energy, CSM Marg, Mumbai.
(**Member**, *Governing Board & Executive Council*)

Shri. Sunil Paliwal, IAS, Principal Secretary to Government Secretariat, Higher Education Department, Government of Tamilnadu, Chennai
(**Member**, *Governing Board & Executive Council*)

Prof. V. Arvind, Director, IMSc Chennai
(**Member Secretary**, *Governing Board & Executive Council*)
Prof. V. Arvind was a faculty member at IIT, Madras and IIT, Delhi prior to joining IMSc as a faculty member

1.2.2 Director's Advisory Committee

Academic Programme Coordinators

Dr. **V.S. Nemani**	Physics
Dr. **Indrava Roy**	Mathematics
Dr. **Vikram Sharma**	TCS

Annual Report

Prof. **C. R. Subramanian**	Chair
Prof. **S. Viswanath**	
Prof. **Shrihari Gopalakrishna**	
Dr. **Paul Pandian**	(Library)

Approval Coordinators

Prof. **Sitabhra Sinha**	Physics
Prof. **K.N. Raghavan**	Mathematics
Prof. **Meena Mahajan**	TCS
Prof. **Gautam Menon**	Computational Biology

Associates Programme

Prof. **V. Arvind**	Chair
Prof. **Venkatesh Raman**	TCS
Profs. **K. Srinivas & Partha Sarathi**	Maths
Prof. **Mukul Laad**	Physics

Colloquium & Seminar

Dr. **Ganesh Ramachandran**	Physics
Prof. **Jaya N. Iyer**	Mathematics
Dr. **Vikram Sharma**	TCS

Computer Media & Web

Dr. **Pinaki Choudhuri**	Chair
Prof. **Venkatesh Raman**	
Prof. **K.N. Raghavan**	
Prof. **Rahul Siddarthan**	
Prof. **Satyavani Vemparala**	
Dr. **Areejit Samal**	
Dr. **G. Subramoniam,**	SO'F'(Systems)
Shri. **B. Raveendra Reddy,**	SO'F'(Systems)
Mr. **Vigneshwar Narayanan,**	(Student Member)

Events / Outreach

Prof. **R. Ramanujam**	Chair
Prof. **K.N. Raghavan**	
Dr. **Areejit Samal**	
Dr. **Ganesh Ramachandran**	

Gender Bias Redressal

Prof. **D. Indumathi**	Chair
Prof. **Satyavani Vemparala**	
Prof. **Rahul Siddarthan**	
Prof. **Sanoli Gun**	
Smt. **E. Gayatri,**	(Accounts Officer)
Smt. **V. Geetha,**	(External Member)
Shri. **S. Vishnu Prasad,**	Registrar

Grievance Redressal

Prof. **Meena Mahajan**	Chair
Prof. **Amritanshu Prasad**	
Prof. **Sanatan Digal**	
Prof. **Sujay Ashok**	

Guest House Advisory

Prof. **Parameswaran Sankaran**	
Prof. **Pralay Chatterjee**	Chair
Prof. **V. Ravindran**	
Dr. **Indrava Roy**	
Shri. **S. Vishnu Prasad,**	Registrar
Mr. **Prasanna Kumar Dhani,**	(Student Member)

HBNI Coordinators

Prof. **Rahul Sinha**	Physics	Dean, Physical Sciences
Prof. **Sibasish Ghosh**	Physics	Associate Dean, Physical Sciences
Prof. **Vijay Kodiyalam**	Mathematics	Dean, Mathematical Sciences
Prof. **Gautam Menon**	Computational Biology	Dean, Life Sciences

Hostel Faculty Counselor
(This Committee will also serve as the Anti-Ragging Committee)

Prof. **Saket Saurabh**
Dr. **Manjari Bagchi**
Dr. **Ganesh Ramachandran**

Housing & Up-Keep

Prof. **V. Ravindran**	Chair
Dr. **Pinaki Chaudhuri**	
Dr. **C.M. Chandrashekar**	
Shri. **S. Vishnu Prasad**	Registrar
Smt. **R. Indra**	Administrative Officer

JEST Coordinators

Prof. **D. Indumathi**
Prof. **Pralay Chatterjee**
Prof. **Kamal Lodaya**

Library

Prof. **Gautam Menon**	Chair
Prof. **C. R. Subramanian**	
Prof. **Amritanshu Prasad**	
Prof. **Sitabhra Sinha**	
Dr. **Manjari Bagchi**	
Dr. **Paul Pandian**	S/O 'F' (Library)
Mr. **K. Chandrashekhar**	(Student Member)

National Science Day

Prof. **K.N. Raghavan**
Prof. **V. Ravindran**
Dr. **Vikram Sharma**

Official Language Implementation

Prof. **V. Arvind**	Chair
Prof. **Saket Saurabh**	
Prof. **Mukul Laad**	
Prof. **Syed Raghib Hassan**	
Shri. **S. Vishnu Prasad,**	Registrar
Mr. **Vinay Vaibhav,**	(Student Member)

Maths PDF Committee

Prof. **K. Srinivas**
Prof. **Parthasarathi Chakraborty**

Physics PDF Committee

Prof. **V. Ravindran**	Chair
Prof. **Sitabhra Sinha**	

Prof. **Mukul Laad**
Prof. **Sibasish Ghosh**
Dr. **Partha Mukhopadhyay**
Prof. **Shrihari Gopalakrishna**

Refurbishment

Prof. **Syed Raghib Hassan**	Chair	
Prof. **Saket Saurabh**		
Dr. **Anirban Mukhopadhyay**		
Shri. **K. Chandrasekar,**	Ex-Chief Architect,	IGCAR
Shri. **S. Vishnu Prasad,**	Registrar	
Shri. **Sunder,**	S/O 'C' (Civil)	
Shri. **S. Mohan,**	S/O 'E'(Electrical)	

Right To Information Act [RTI]

Prof. **Bala Sathiapalan**	Appellate Authority
Shri. **S. Vishnu Prasad**	Public Information Officer

Space Planning & Allocation

Prof. **V. Arvind**	Chair
Prof. **Indumathi**	
Prof. **Pralay Chatterjee**	
Dr. **C.M. Chandrashekar**	
Shri. **S. Vishnu Prasad**	Registrar

Summer Programme

Prof. **Ramanujam**	TCS
Prof. **Sanoli Gun**	Maths
Prof. **Pinaki Chaudhuri**	Physics

Tender

Prof. **Ramanujam**	Chair

Prof. **Parthasarathi Chakraborty**

The Chair of the Committee may always co-opt any other member of IMSc when required.

1.3 Faculty

Computational Biology

Menon, Gautam I.	menon
Samal, Areejit	asamal
Siddharthan, Rahul	rsidd
Sinha, Sitabhra	sitabhra

Mathematics

Chakraborty, Partha Sarathi	parthac
Chatterjee, Pralay	pralay
Gun, Sanoli	sanoli
Iyer, Jaya N.	jniyer
Kodiyalam, Vijay	vijay
Mohari, Anilesh	anilesh
Mukhopadhyay, Anirban	anirban
Nagaraj, D. S.	dsn
Pancholi, Dishant Mayurbhai	dishant
Prasad, Amritanshu	amri
Raghavan, K. N.	knr
Roy, Indrava	indrava
Sankaran, P.	sankaran
Srinivas, K.	srini
Sunder, V. S.	sunder
Sushmita Venugopalan	sushmita
Viswanath, S.	svis

Physics

Adhikari, Ronojoy	rjoy
Ashok, Sujay K.	sashok
Bagchi, Manjari	manjari
Chandrashekar, C.M.	chandru
Chaudhuri, Pinaki	pinakic

Date, G.	shyam
Digal, Sanatan	digal
Ghosh, Sibasish	sibasish
Gopalakrishna, Shrihari	shri
Hassan, Syed Raghib	shassan
Indumathi, D.	indu
Kaul, Romesh K.	kaul
Laad, Mukul S.	mslaad
Menon, Gautam I.	menon
Mukhopadhyay, Partha	parthamu
Nemani, Venkata Suryanarayana	nemani
Rajesh, Ravindran	rrajesh
Rama, S. Kalyana	krama
Ramachandran, Ganesh	ganesh
Ravindran, V.	ravindra
Ray, Purusattam	ray
Sathiapalan, Balachandran	bala
Sayantan Sharma	sayantans
Shankar, R.	shankar
Siddharthan, Rahul	rsidd
Sinha, Nita	nita
Sinha, Rahul	sinha
Sinha, Sitabhra	sitabhra
Vemparala, Satyavani	vani

Theoretical Computer Science

Arvind, V.	arvind
Lodaya, Kamal	kamal
Mahajan, Meena	meena
Raman, Venkatesh	vraman
Ramanujam, R.	jam
Saurabh, Saket	saket
Sharma, Vikram	vikram
Subramanian, C.R.	crs

1.4 Honorary Senior Academic Members

Balasubramanian, R.	balu
Baskaran, G.	baskaran
Rajasekaran, G.	graj
Simon, R.	simon

1.5 Scientific Staff

Subramoniam G.	gsmoni
Raveendra Reddy B.	ravi
Paul Pandian M.	pandian
Mohan S.	smohan
Usha Devi P.	usha
Sundar M.	msundar
Maruthu Pandiyan B.	maruthu

1.6 Administrative & Accounts Staff members

Vishnu Prasad S.
Registrar

Gayatri E.
Accounts Officer

Indra R.
Administrative Officer

Amulraj, D.
Ashfack Ahmed, G.
Balakrishnan, J.
Geetha, M.
Janakiraman, J.
Johnson, P.
Munuswamy, N.
Padmanabhan, T.
Parthiban, V.
Archana Shukla
Babu, B.
Baskaran, R.
Gopinath, S.
Jayanthi, S.
Moorthy, E.
Otheeswaran Usha
Parijatham, S.M.
Prema, P.

Radhakrishnan, M. G.
Rajendran, C.
Ravichandran, N.
Seenivasa Raghavan N.
Vasudevan, T.V.
Rajasekaran, N.
Ramesh, M.
Shankaran, K.P.
Tamil Mani, M.

1.7 Project Staff

1.7.1 Project Staff [Non Academic]

Aiswaryalakshmi PL	lakshmipl
Balachander M.	mbchander
Gayathri S.	gayathris
Harikrishnan B.	hkrishnan
Hari Priya T. V.	tvhpriya
Jahir Hussain M.	jahir
Jayakumar P.	jayakumarp
Jegannathan J.	jjegan
Karthik M.	mkarthik
Karthikeyan B.S.	bskarthi
Keerthana	keerthana
Kirubananth P	kirubananth
Krishna Balaji R.	rkbalaji
Madhura Nithiya J.	jmnithiya
Mangala Pandi P.	mangal
Moovendan M.	moovendan
Nambirajan E	nambirajan
Parthasarathi N.	npsarathi
Rajkumar S.	srajkumar
Ramakrishnan S.	skrishnan
Rethinasamy D.	drsamy
Revathi J.	jrevathi
Sadhana R.	sadhana
Sakthivel Murugan E.	esakthi
Sathishkumar	sathishka
Sinnakaruppan S.	sskp
Sivasubbu Raj B.	sivaraj
Sivathanu Pillai	csp
Sreelakshmi P.K	lakshmipk

Srinivasan G.	gsvasan
Srinithi Varsha S.	varsha
Vaideeswaran	mveswaran
Vignesh Kumar T	vignesh
Vijay S	vijays
Vimalraj J.	vimalraj

1.7.2 Project Staff [Scientific/Academic]

Able E Alias	ableea
Amruta Sahoo	amrutasah
Archana Mishra	amishra
Arya S	aryas
Ashwij Mayya	ashwij
Bharath Chand R.P	bharathc
Eleonora Dell' Aquila	edellaquila
Gajendra Singh Badwal	
Janaki Raghavan	rjanaki
Karthikeyan B.S	bskarthi
Karthikeyan M	mkarthikeyan
Krishanu Deyasi	krishanud
Md. Izhar Ashraf	ashraf
Nadeesh Garg	nadeeshg
Parveena Shamim A	parveenasa
Pradeep Kumar N	pradeepnpk
Saveetha H.	saveetha
Shakthi N. Menon	shakthi
Snehal V Sambare	snehalvs
Soumya Easwaran	soumyae
Surendra Singh Badwal	
Theerthagiri L.	ltgiri
Vandanashree M.	vandanashree
Varuni Prabhakar	varuni
Vinod Kumar T.	tvinodkumar

1.8 Post-Doctoral Fellows

Computational Biology

Anupama Sharma	anupama

Mathematics

Antony Selvam A.	antonya
Bidyut Sanki	bidyuts
Karimilla Bi N.	karimilla
Narasimha Chary B.	nchary
Nirupama Mallick	nirupamam
Rohit Varma	rvarma
Kasi Viswanadham	viswanadh
Prathamesh T.V.H.	prathamesh
Divakaran D	divakaran
Akhilesh P	akhi
Bipul Saurabh	saurabhb
Sarita Agrawal	saritaa
Pranabesh Das	pranabesh
Arideep Saha	arideep
Poornapushkala Narayanan	porrnap

Physics

Aradhana Singh	aradhanas
Arpita Choudary	arpitac
Aravinda S	aravinda
Avijit Mishra	avijitm
Balesh Kumar	baleshk
Debabrata Sinha	debabratas
Goutam Das	goutam
Jayaprasath, E.	jayaprasath
Sreeraj T. P.	sreerajtp
Bimla	bimladanu
Prasad V V	prasadvv

Manik Banik	manikbanik
Himadri Barman	hbar
Suman Ganguli	sganguli
George Thomas	georget
Bijoy Daga	bijoydaga
Asutosh Kumar	asutoshk
Suratno Basu	suratnob
Rahul Dandekar	rsdandekar
Arunprasath V	arunprasath
Amit Mukherjee	amitm

Theoretical Computer Science

Abhisekh Sankaran	abhisekhs
Krithika R	Krithikaraman
Pallavi Jain	pallavij
Pradeesha Ashok	pradeesha
Ragukumar P.	ragukumar
Srinivasa Murthy T	tsmurthy
Suresh Dara V.V.P.R.V.B.	sureshdara
Vibha Sahlot	vibhasahlot

1.9 Ph.D. Students

Name	*Userid*

Computational Biology

Ankit Agrawal	aagrawal
Bodhayan Prasad	bodhayanp
Chandrani Kumari	chandranik
Chandrashekar K. A.	kachandra
Devanand T.	devanandt
Deepika Choubey	cdeepika
Farhina Mozaffer	farihinam
Janani R.	jananir
Pavitra S	spavitra

Reshma M	reshmam
Ria Ghosh	riaghosh
Sreevidya T.S	tssreevidya
Vadnala Rakesh Netha	rakeshnetha
Vivek Ananth R. P.	vivekananth

Mathematics

Arghya Sadhukan	arghyas
Arun G. Kumar	gakumar
Avijit Nath	avijitnath
Biplab Paul	biplabpaul
Chayan Karmakar	chayank
Digjoy Paul	digjoypaul
Jayakumar R.	rjayakumar
Jyothsnaa S.	jyothsnaa
Karthick Babu C G	cgkbabu
Keshab Chandra Bakshi	keshabcb
Krishanu Roy	krishanur
Mita Banik	mitabanik
Mrigendra Singh Kushwaha	mrigendra
Nabanita Roy	nabanitar
Narayanan P. A.	panarayanan
Neelam	neelam
Oorna Mitra	oornamitra
Piyasa Sarkar	psarkar
Pranendu Darbar	dpranendu
Priyamvad Srivastav	priyamvads
Ratheesh T.V	ratheeshtv
Rupam Karmakar	rupamk
Snehajit Misra	snehajitm
Sohan Lal Saini	slsaini
Sridhar P. Narayanan	sridharn
Sruthy Murali	sruthym
Surajit Biswas	surajitb
Uday Bhaskar Sharma	udaybs
Ujjal Das	ujjaldas
Vaibhav Krushankant Dimble	vaibhavkd

Physics

Abinash Kumar Nayak	abinashkn
Ajjath A.H.	ajjathah
Akhil Antony	akhilantony
Amir Suhail	amirs
Amit Kumar	kamit
Amlan Chakraborty	amlanchak
Anand Pathak	anandb
Anirban Karan	kanirban
Ankit Aggarwal	aankita
Ankit Dhanuka	ankitdhanuka
Ankita Chakrabarti	ankitac
Anupam A. H.	anupam
Anupam Sarkar	asarkar
Anvy Moly Tom	anvym
Aparna Sankar	aparnas
Apurba Dutta	dapurba
Arindam Mallick	marindam
Arindam Mitra	amitra
Arjun Hariharan	arjunh
Arkajyoti Manna	arkajyotim
Arnab Priya Saha	arnabps
Arpan Kundu	akundu
Atanu Bhatta	batanu
Bhargava B.A.	bhargavaba
Dhargyal	dhargyal
Dheeraj Kumar Mishra	dkmishra
Dhruv Pathak	dhruvpathak
Dipanjan Mandal	mdipanjan
Garima Rani	grani
Gopal Prakash	gopalp
Jilmy P. Joy	jilmyo
Kamal Tripathi	kamalt
Madhusudhan Raman	madhur
Mahaveer Prasad	mahaveerp
Minati Biswal	mbiswal
Mohammad Shabbir	mshabbir
Nana Siddarth	nanasid
Pavan Dharanipragada	pavand

Pinaki Banerjee	pinakib
Pooja Mukherjee	poojamukherjee
Prafulla Oak	prafullao
Prasanna Kumar Dhani	prasannakd
Prashanth Raman	prashanthr
Prathik Cherian J.	prathikcj
Pritam Sen	pritamsen
Prosenjit Haldar	prosenjit
Pulak Banerjee	bpulak
Raghvendra Singh	raghvendra
Rajesh Singh	rsingh
Rathul Nath	rathulnr
Ravi T	travi
Renjan Rajan John	renjan
Ria Sain	riasain
Rishu Kumar Singh	rksingh
Rusa Mandal	rusam
Sabiar Shaikh	sabiarshaikh
Sagnik Chakraborty	csagnik
Sahil	sahilmd
Sanjoy Mandal	smandal
Saroj Prasad Chhatoi	sarojpc
Sayantan Ghosh	sayantang
Semanti Dutta	semantid
Shanu Karmakar	shanuk
Shibasis Roy	shibasisr
Shilpa Kastha	shilpakastha
Shivam Gola	shivamg
Shivani Singh	shivanis
SK Jahanur Hoque	jahanur
Soumya Sur	soumyasur
Sourav Ballav	sballav
Srivatsa N. S.	srivatsans
Subhankar Khatua	shubankark
Sujoy Mahato	sujoymahato
Surabhi Tiwari	surabhit
Tanmay Mitra	tmitra
Thiru Senthil R.	rtsenthil
Umang A. Dattani	umangad
Varun Gupta	varungupta

Varun Sethi	varunsethi
Vigneshwar N.	vigneshwarn
Vigneshwaran K.	vigneshwaran
Vinay Vaibhav	vinayv

Theoretical Computer Science

Abhishek Sahu	asahu
Abhranil Chatterjee	abhranilc
Aditi Dudeja	aditid
Anantha Padmanabha M.S.	ananthap
Anuj Vijay Tawari	anujvt
Anup Basil Mathew	anupbasil
Arindam Biswas	barindam
Ashwin Jacob	ajacob
Diptapriyo Majumdar	diptapriyam
Gaurav Sood	gauravs
Jayakrishnan M.	jayakrishnan
Lawqueen Kanesh	lawqueen
Niranka Banerjee	nirankab
Prafullakumar Prabhakar Tale	pptale
Ramanathan Thinniyam Srinivasan	thinniyam
Ramit Das	ramitd
Roohani Sharma	roohani
Sanjukta Roy	sanjukta
Sankar Deep Chakraborty	sankardeep
Swaroop N.P.	npswaroop
Syed Mohhammad Meesum	meesum

1.10 Summer Students

Every summer, a small number of students from various institutes/universities come to our institute and work on some learning/research projects with some faculty member for a period of four to six weeks. The following students visited the institute during Apr, 2017 - Mar, 2018.

Student	Faculty

Mathematics

Chirantan Mukherjee	Pralay Chatterjee
Deepak Bakal	Sanoli Gun
Ankit Sahu, IIT Ropar	Sanoli Gun
Neethi Konar	Sanoli Gun
Kumar, Naman , IIT Kanpur	Sanoli Gun
Roy, Arnab, IISERBPR	Sanoli Gun
Saha, Subham, CMI	Sanoli Gun
Sayan Kundu	Srinivas, K.
Gaurish Korpal	Srinivas, K.
Rahul Ghosh	Raghavan, K.N.
Debmalya Basak	Anirban Mukhopadhyay
Bidesh Das	Anirban Mukhopadhyay
Jomin K. J.	Sanoli Gun
Arnab Dey Sarkar	Sanoli Gun
Ipsit Chopra	Sanoli Gun
Ravi Dwivedi	Sanoli Gun
Mithun P. V	Pralay Chatterjee
Aarthi S	Sanoli Gun
Krithika Manogaran	Sanoli Gun
Deshmukh Yash, CMI	Sushmita, V
Sabyasachi Mukherjee	Anirban Mukhopadhyay
Sahil Singhal	Raghavan, K.N.
Kabeer M.R.	Sanoli Gun
Chitra Venugopal	Sanoli Gun
Aditya Kumar Shukla	Raghavan, K.N.
Aritra Mishra	Sitabhra Sinha
George Pauly	Nagaraj, D.S.
Subham Bhakta	Srinivas, K.

Physics

Sindhana Selvi, IISc Bangalore	Rajesh Ravindran
Aldric Anto Rosario, IIT Madras	Rajesh Ravindran
Darsa N, Kerala	Satyavani, V.
Aswathi, K., Kerala	Gautam I. Menon
Monira Fatma, Bihar	Sitabhra Sinha

Prantar Dutta	Sitabhra Sinha
Sagar Bildani, BITS Goa Campus	Sitabhra Sinha
Manish Yadav, IISER Mohali	Sitabhra Sinha
Rohit Goswami, IIT Kanpur	Sibasish Ghosh
Abhishek Roy, Bose Institute, Darjeeling	Sibasish Ghosh
Durgabatee Rout	Sanatan Digal
Roopini V.	Sibasish Ghosh
Bohnishikha Ghosh, IISER Kolkata	Chandrashekar C.M.
Nikhil Ramesh	Sitabhra Sinha
Mishra, Aritra, IISER, Bhopal	Sitabhra Sinha
Jayanth Kumar,	Sitabhra Sinha
Yalamarthy, Krishna Praveen, IIT, Guwahati	Sitabhra Sinha
Arkalekha Neogi	Manjari Bagchi
Vishnu Narayanan Nampoothiri, IISER Mohali	Gautam I. Menon
Muthusamy R.	Rahul Sinha
Suresh, Namitha, BITS Philani	Rahul Sinha

Theoretical Computer Science

Bisht Harshit, IIT Kanpur	Kamal Lodaya
Purohit, Nidhi, Delhi University	Saurabh, Saket

Computational Biology

Prakruthi Burra, BITS Pilani	Areejit Samal
Mishra, Richa, BITS Philani	Areejit Samal
Aparna, S.R., Stella Maris College	Areejit Samal
Revathy Menon, IISER Tirupati	Gautam I. Menon
Akhil Babu, IISER Pune	Sitabhra Sinha
Sarangthem Dinamani Singh, Manipur	Rahul Siddharthan
Janavi M.	Rahul Siddharthan
Anushree Dhar, Kolkata	Areejit Samal
Priyadharshini Lingesan	Rahul Siddharthan
Aniket Kulkarni	Rahul Siddharthan
Rajalaxmi Saha	Vani, Vemparala

2 Academic Activities and Programmes

2.1 Research Activities

Faculty members at IMSc carry out research in their areas of interests in a self-directed manner, often in collaboration with doctoral students, post-doctoral fellows and researchers from elsewhere. Research output is disseminated primarily as refereed journal articles as well as articles in conference proceedings. The expertise available at the institute is organized below according to the areas of specialization.

2.1.1 Computational Biology

Computational Biology: The field of computational biology lies at the intersection of biological phenomena and measurements, physics, applied mathematics and large-scale computation. The interests of the Computational Biology group at the Institute encompass computational genomics, networks in biology, biophysics, systems biology, infectious disease modelling, computational neuroscience and large-scale molecular dynamics simulations of biologically relevant phenomena.
[**Gautam I. Menon, Rahul Siddharthan, Sitabhra Sinha, Areejit Samal**]

In 2017-2018, 11 articles were published in journals.

2.1.2 Mathematics

The Mathematics group has wide ranging interests. These specializations are conveniently grouped together under broad headings. A very brief description is provided followed by the names of faculty members currently working in these areas.

In 2017-2018, 15 articles were published in journals.

- **Algebra:** Algebra is the study of the properties of mathematical structures involving "algebraic" operations such as addition and multiplication. One of the main motivations to study algebraic structures is to analyze geometric objects such as curves and surfaces via the algebra of functions defined on them. Aspects of algebra being studied at IMSc involve algebraic geometry (study of loci of solutions of polynomial equations), algebraic groups (groups of matrices), and the theory of knots.

  [**Vijay Kodiyalam, D. S. Nagaraj, K. N. Raghavan.**]

- **Algebraic Geometry:** This branch of mathematics is a study of the solution set of a finite set of polynomials in several variables. The total degrees of the polynomials and the number of polynomials play an important role in determining the geometry of the solution set. This subject has rich interactions with mathematical physics and other areas.

[**Jaya Iyer, D. S. Nagaraj**]

- **Lie Groups:**

  The theory of Lie groups deals with the groups of symmetries of continuous mathematical objects. It is one of the most important areas of Mathematics. It is used widely in almost all major branches in Mathematics and in many branches in Physics.

  [**Pralay Chatterjee**]

- **Number Theory:**

  Number theory is concerned mainly with the way prime numbers are distributed in the set of natural numbers. This area has rich interactions with many other branches of mathematics including algebra, complex analysis and geometry. There are also applications to cryptography.

  [**K. Srinivas, Anirban Mukhopadhyay, Sanoli Gun**]

- **Operator algebras:**

  This subject may loosely be described as the study of 'infinite-dimensional matrices'. It was introduced by von Neumann in order to address some problems arising from quantum mechanics. Even today, it is intimately tied to various branches of physics as well as to other areas of pure mathematics, such as knot theory.

  [**Vijay Kodiyalam, V. S. Sunder, Partha Sarathi Chakraborty**]

- **Non-commutative Geometry:**

  Geometry can be loosely defined as the study of cycles and their intersection properties in some suitable homology theory. Noncommutative geometry of Alain Connes is no exception. It is the study of some special cycles in the unbounded picture of Kasparov's K-homology. This subject tries to extend the reach of differential geometry in the setting of operator algebras. Noncommutative geometry interacts with various branches of Mathematics like discrete groups, topology etc. It also interacts with mathematical physics.

  [**Partha Sarathi Chakraborty, Indrava Roy**]

- **C^*-dynamical systems and non-commutative probability theory:**

The subject studies an automorphism group action on C^* algebras and its asymptotic behaviour of stationary states with additional symmetries that arise naturally in a given mathematical or physical problems of interest. It uses intuition of non-commutative probability theory and powerful methods of functional analysis to study various ergodic properties of the automorphism group action.

[**Anilesh Mohari**]

- **Representation theory:**

  Groups are algebraic structures that arise as symmetries of physical or mathematical objects. Representation theory studies properties of abstract groups via their matrix representations. Representation theory enables many group-theoretic problems to be reduced to problems in matrix algebra, which is very well-understood.

  [**A. Prasad, K. N. Raghavan, P. Sankaran, S. Viswanath**]

- **Topology:**

  Topology may be described as geometry with or without a notion of distance. It aims to study properties of these objects, of which curves and surfaces are well-known examples, which are invariant under deformations. The subject has wide applications within mathematics as well as in physics.

  [**P. Sankaran, Sushmita Venugopalan, Dishant Pancholi**]

2.1.3 Theoretical Physics

The Theoretical Physics group subsumes a very broad spectrum of specializations. These are conveniently grouped under a smaller number of headings. A very brief description is provided followed by the names of faculty members currently working in these areas.
In 2017-2018, 29 articles were published in journals and conference proceedings.

- **High Energy Physics:** Sub-nuclear constituents of nature and their properties is well summarized by the *Standard Model*. This model describes the strong and electro-weak interactions. The research involves both elaboration of the model as well as constructing theories that go beyond it.

  The following grouping refers to different aspects that are being pursued at IMSc.

  - **Particle Physics Phenomenology:** The phenomenological aspects of physics at existing and future colliders are studied with a view to test the Standard Model and seek possible signals of New Physics (or Physics beyond the Standard Model), a particular focus being data and results currently coming out of the Large Hadron Collider (LHC) at CERN in Geneva
    [**Shrihari Gopalakrishna, V. Ravindran and Rahul Sinha**]

Predictions of various scattering processes at colliders are being calculated using perturbative QCD, which deals with the strong forces in the standard model. Quantum loop contributions to multileg processes are being included to improve the accuracy of the predictions.

[**D. Indumathi and V. Ravindran**]

Several experiments worldwide are studying the physics of "beauty mesons" (B-physics) in order to explain the observed CP-violation (the dominance of matter over antimatter). Such studies are also important in the search for physics beyond the Standard Model.

[**Rahul Sinha**]

Neutrinos are very weakly interacting particles which have recently been found to possess a mass. There is involvement in the national proposal to build a *Indian Neutrino Observatory* (INO), and in global efforts using *neutrino factories* to elucidate the possibility of CP violation in neutrinos, and determining the mass ordering. Theoretical studies of neutrino masses and mixings are pursued.

[**D. Indumathi, M.V.N. Murthy, Nita Sinha, G. Rajasekaran (Professor Emeritus)**]

Most of the matter in the Universe is "dark". Beyond the standard model candidates for this dark matter are being investigated. Experiments are going-on world-wide to detect this dark matter. IMSc group has interpreted the unexplained Kolar events seen in the Kolar experiments 50 years ago as due to dark matter particles.

[**Shrihari Gopalakrishna, M. V. N. Murthy, G. Rajasekaran (Professor Emeritus)**]

– **Non-Perturbative QCD:** This deals with widely believed properties of strong forces such as "color confinement", "color superconductivity" and "chiral symmetry breaking". The main themes of research are the QCD phase diagram and exotic transport properties of QCD matter far away from equilibrium. In particular we are looking for signals of QCD (chiral) critical point from first principles lattice gauge theory calculations and understanding the degrees of freedom and the symmetries across the deconfinement transition. Moreover the effects of topological transitions in QCD matter both in and away from equilibrium is studied using lattice techniques which can provide us with crucial insights about the mechanism of deconfinement and chiral symmetry breaking. Exotic phases of QCD matter at very high baryon densities like color superconducting phases and its properties are also another theme of research within our group.

[**Sanatan Digal, Sayantan Sharma**]

– **Gravitational Physics:** Einstein's theory of gravity has a bearing on the theory of our cosmos and also predicts exotic objects such as neutron stars and black holes. Rotating neutron stars (pulsars) constitute important observational probes of the strong gravity regime. Astrophysics of pulsars, classical general relativity and one of its quantum versions namely, loop quantum gravity are pursued at IMSc. IMSc members are also interested in the theory and observations of gravitational waves.

[**Manjari Bagchi, Ghanashyam Date, Romesh Kaul**]

– **Astrophysics:** Astrophysics is in one sense an inter-disciplinary science, where the knowledge in various other areas of physics including particle physics, gravitational physics, statistical physics,

etc can be tested and enhanced. IMSc has recently expanded its area of research in astrophysics. So far only pulsar astrophysics is being pursued at IMSc. In addition to gravitational physics, pulsars are also useful to understand the state of matter at extreme densities, evolution of stars, properties of interstellar medium, etc.
[**Manjari Bagchi**]

- **Quantum Field Theory:** This provides a general theoretical framework for the quantum theory of fields. Apart from the perturbative analyses of quantum field theories used in the theory of scattering processes, their non-perturbative aspects are crucial for a more complete understanding. There are many different types of quantum field theories such as Conformal Field Theories, Topological Field Theories, Non-commutative Field Theories, Lattice Gauge Theories etc.
[**Sanatan Digal, Romesh Kaul**]
- **String Theory:** In the quest for a unified framework to understand and unify all interactions, string theory is the leading candidate. At IMSc the focus has been on the loop variables approach, dualities in string theory and supersymmetric gauge theory, the AdS/CFT correspondence, brane physics including cosmology and black hole entropy.
[**Sujay K. Ashok, S. Kalyana Rama, Partha Mukhopadhyay, Balachandran Sathiapalan, Nemani V. Suryanarayana**]

- **Condensed Matter Physics:** Condensed matter physics deals with the understanding of the diverse properties exhibited by the materials in nature; for example, the resistivity of materials can vary over about 20 orders of magnitude depending on the material. Condensed matter physics attempts to understand these behaviour in terms of simpler models which can then be studied using a variety of theoretical and computational tools.

  - **High Temperature Superconductivity:** At very low temperatures, several materials undergo a transition into a superconducting state, in which an electrical current flows without resistance. The properties of materials which superconduct at somewhat higher temperatures, the high-temperature superconductors, is one of the most active areas of research today, since it raises many theoretical questions of principle and has important implications for technology.
  [**Mukul Laad, Gautam I. Menon, G. Baskaran (Raja Ramanna Fellow)**]
  - **Correlated Electronic Systems, Magnetism and the Quantum Hall Effect:** The interactions between electrons is responsible for magnetism. Such interactions are key to several unusual electronic states. Understanding this problem better would impact our understanding of a host of recently discovered materials with unusual properties.
  [**R. Ganesh, Syed Raghib Hassan, Mukul Laad, A. K. Mishra, R. Shankar and G. Baskaran (Raja Ramanna Fellow)**]
  - **Soft Condensed Matter Physics:**

    Soft condensed matter refers to physical systems in which the energy scales required to create sizeable deformations are comparable to temperature. Thus, such systems can exhibit a remarkable

variety of complex flow behaviour as well as equilibrium phases under relatively modest perturbations. The physics of glasses is also an active area of research.
[**Gautam I. Menon, Pinaki Chaudhuri, Satyavani Vemparala**]

- **Statistical Mechanics:** Statistical mechanics provides a foundation for thinking about the collective behaviour of large numbers of interacting particles. The behaviour of systems out of thermal equilibrium is of particular interest, featuring problems such as fracture in disordered materials, hysteresis in magnets and surface growth, shock propagation in granular systems, earthquake dynamics and stability of masonry wall. Given the generality of the approach of statistical mechanics, it finds application in a huge range of fields, including study of phase transition and critical phenomena, statistical physics of spin systems, disordered systems such as percolation problem, spin glass and glass, statistical physics of surfaces and networks, granular systems, statistical mechanics of fracture in materials and breakdown in threshold activated systems, turbulence in liquids, the modeling of biological systems and even explaining socio-economic distributions such as that of income or stock price fluctuations. Cold fermionic atoms at unitarity and their equation of state leading to universal thermodynamics is a field of active study in recent years.
[**Purusattam Ray, R. Rajesh, Gautam I. Menon, M. V. N. Murthy, Sitabhra Sinha, Satyavani Vemparala**]

- **Quantum Statistics:** A theory of generalized Fock spaces is formulated. This theory underlies the different forms of quantum statistics such as "infinite", Bose-Einstein and Fermi-Dirac statistics. The theory is based on a three-tiered structure consisting of Fock space, statistics and algebra. This generalized formalism not only unifies the various forms of statistics and algebras, but also allows the construction of new forms of quantum statistics as well as many algebras of creation and destruction operators. Some of these are new algebras for infinite statistics, q-statistics and its many avatars, a consistent algebra for fractional statistics, null statistics or statistics of frozen order, 'doubly-infinite statistics, many representations of Orthostatistics, Hubbard statistics and its variations.
[**A. K. Mishra and G Rajasekaran (Professor Emeritus)**]

- **Theoretical fluid mechanics:** The theoretical study of the mechanics and statistical mechanics of fluids using classical field theories is an area of research that has been revitalised by the necessity to understand fluid flows at scales that span a few microns (as in biofluids and in microfluidic devices) to few thousands of kilometers (as in geophysical flows). Intelligent numerical approximations to the nonlinear governing equations, combined with their computational solutions, are able to shed insight into this fascinating area of theoretical physics. Research from IMSc in the area has appeared in prestigous international journals, including Physical Review Letters and PNAS, been featured in numerous news items, and has led to the establishment of a start-up company for commercializing computational models of fluid flow.
[**Ronojoy Adhikari**]

- **Non-linear Dynamics and Complex Systems:** Nonlinear phenomena is ubiquitous in complex systems all around us - e.g., from the cell to society - which are characterized by a large number of

interacting elements exhibiting emergence of surprising systems-level behavior that is absent in any of its components. The richness of the collective behavior could come about either through strong nonlinearity in the local dynamics of the elements and/or from the non-trivial topology of the network connecting them. Nonlinear systems exhibit surprising and complex effects that would never be anticipated by a scientist trained only in linear techniques. Prominent examples of these include bifurcation, chaos, and solitons. Surprisingly, diverse non-linear dynamical systems exhibit remarkably similar, sometimes even universal behaviour. Nonlinear science has applications to a wide variety of fields, from mathematics, physics, biology, and chemistry, to engineering, economics, and medicine.
[**Sitabhra Sinha**]

- **Quantum Physics:** This is a grouping of areas not subsumed under the above headings and contains the following specializations.
  - **Quantum Optics:** Broadly, this area refers to the study of quantum states of light. At IMSc, the focus in this area has been on specifically non-classical (quantum) aspects of radiation. Other related interests are geometric phases, Wigner distribution functions for finite dimensional Hilbert spaces etc.
    [**Sibasish Ghosh, R. Simon**]
  - **Quantum Entanglement, Quantum Information Theory:** Classical states have definite attributes while quantum states can exist as "superpositions" and have non-classical (probabilistic) attributes. This feature affects aspects of information science such as coding/decoding, transmission, computing etc. Aspects of quantum information theory in the context of finite dimensional as well as infinite dimensional quantum state spaces are being studied.
    [**V. Arvind, C. M. Chandrashekar, Sibasish Ghosh, R. Simon**]
- **Interdisciplinary research:** There is an ongoing effort, not belonging to any of the areas above, of an interdisciplinary nature in such diverse areas like the study of indus script and seals, historical monsoon shifts, modeling of tsunamis, movement of Himalayan glaciers, modeling Indian musical instruments, etc.
  [**M V N Murthy, R Shankar, Sitabhra Sinha**]

2.1.4 Theoretical Computer Science

Theoretical computer science is mainly concerned with the mathematical structure of computations (as distinct from software development). Various aspects of computation are studied by the group at IMSc. A very brief description of these specializations is provided followed by the names of faculty members currently working in these areas.
In 2017-2018, a total of 77 articles were published in journals and conference proceedings, and also two books were edited.

- **Parameterized and Exact Computation :**

Parameterized Computation is the study of computational problems based on the feasibility of designing algorithms for problems where one allows the dependence of running time on the size of a *small* part of the input to be arbitrary but require the dependence on the remaining large part be polynomially bounded. It also involves designing such algorithms. Exact computation is the study of computational problems based on the feasibility of designing algorithms within various degrees of even exponential dependence of the running time on the size of the input.

[**V. Arvind, Meena Mahajan, Saket Saurabh, Venkatesh Raman, C.R. Subramanian**]

- **Design of Efficient and Succinct Data Structures :**

  Succinct storage and efficient access and update of data that are supplied to and/or generated by an algorithm plays an important role in making it more efficient. This calls for developing means for designing and analyzing tools for succinct storage and efficient access of information.

  [**Venkatesh Raman**]

- **Computational Algebra and Geometry**

  This area is the study of designing algorithms for various fundamental algebraic and geometric problems. Implementing such algorithms has always been challenging due to robustness issues. One aim is to overcome this issue as efficiently as possible.

  [**Vikram Sharma**]

- **Computational Complexity**

  Broadly speaking, computational complexity theory is the study of bounds on resources such as time and space required for solving computational problems. The theory aims at a classification of problems into various complexity classes defined by resource bounds and seeks to separate them by proving lower bounds and upper bounds on resources required by the problems.

  [**V. Arvind, Meena Mahajan**]

- **Probabilistic Combinatorics**

  This is the study of analyzing random discrete structures for their *typical* properties. It also involves applying this paradigm to resolve existential questions related to discrete structures like graphs. It also involves designing and analyzing algorithms with respect to their typical performance when applied to random structures.

  [**C.R. Subramanian**]

- **Logic and Formal Models of Computation :**

  This area is concerned with three main aspects: developing and comparing different mathematical models of computation, developing and analyzing different tools for logical reasoning as well as applying them to computational processes and the connection between automata, Petri nets and algebras on the one hand and logic and program expressions on the other.

[**Kamal Lodaya, R. Ramanujam**]

- **Game Theory and Security :**

  With the advent of the worldwide web as a platform of computation, traditional models of distributed systems are being re-examined, incorporating not only co-operation but conflict as well. This brings in game theoretic considerations and information security aspects, raising new questions of interest.

  [**R. Ramanujam**]

2.2 Research Highlights

In recent papers, Rahul Sinha and students Anirban Karan, Rusa Mandal and Abinash Kumar Nayak have addressed the possibility of New Physics (N) beyond the Standard Model of particle physics in rare decays of beauty quarks to strange quarks and pairs of leptons.

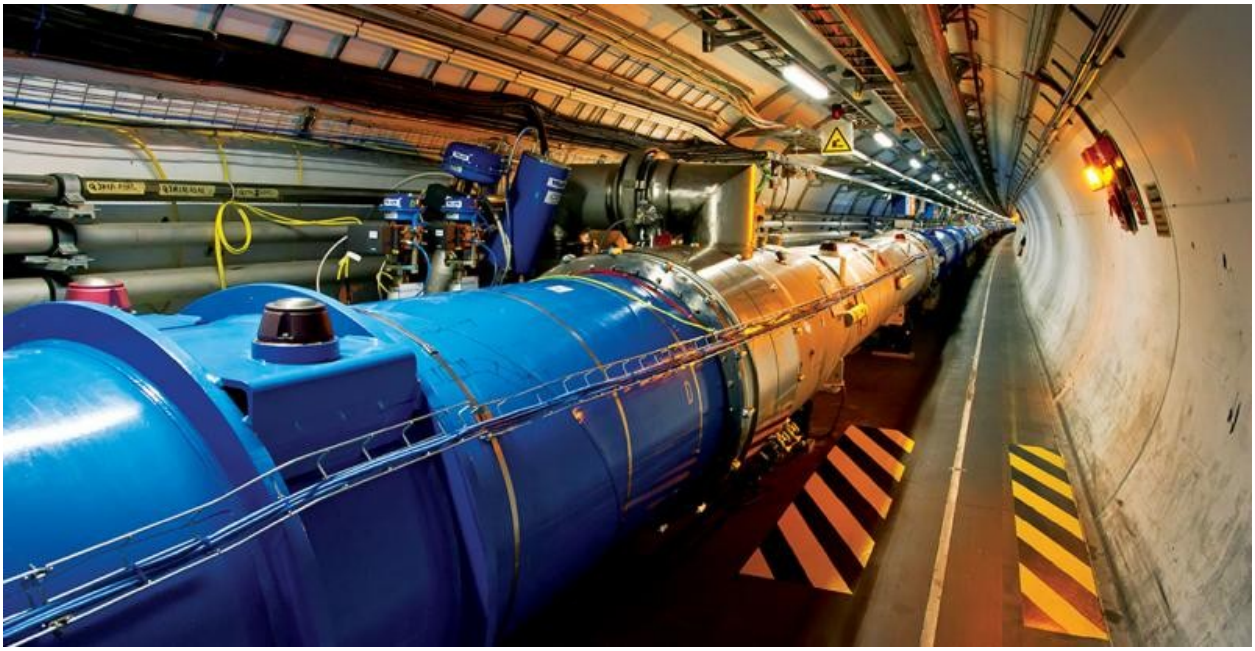

Figure 1: Large Hardon Collider

Gautam Menon and his students P. Varuni and Shakti Menon have initiated a new study on application of active matter ideas to the problem of collective phototaxis and it is believed to stimulate research along similar lines into other problems involving the physics of collective bacterial motion.

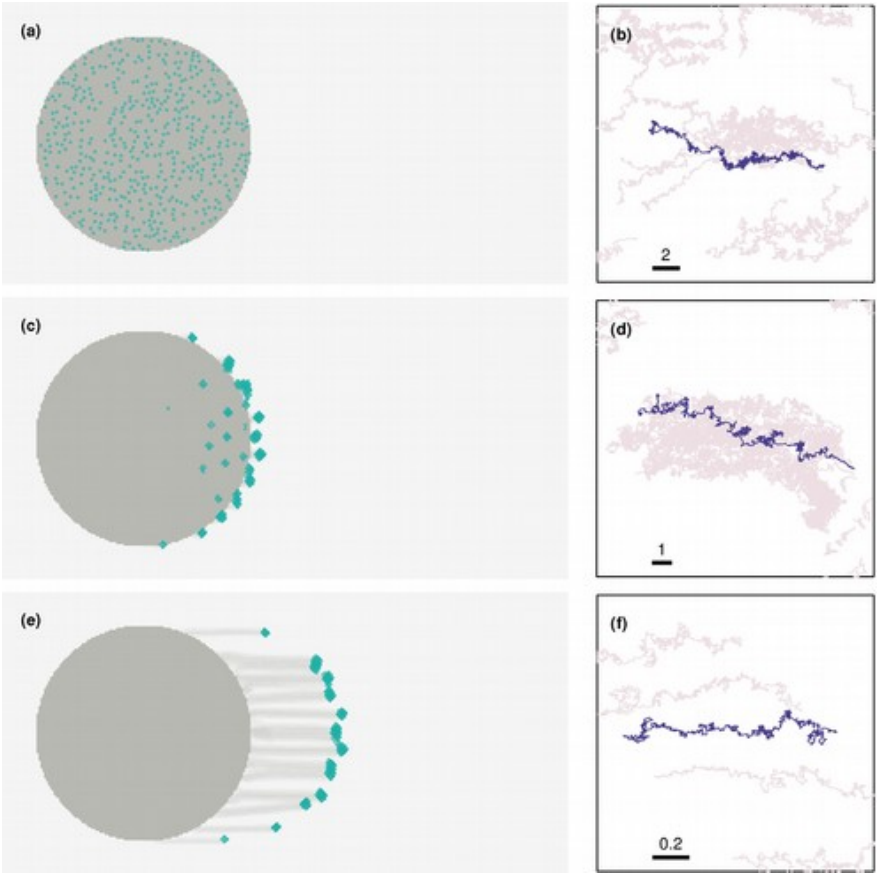

Figure 2: Seeing the Light

P. Sankaran and Avijit Nath have introduced and studied a new class of smooth manifolds, which are higher dimensional analogues of curves and surfaces, that generalize the classical manifolds introduced by Albrecht Dold.

K.N. Raghavan, B. Ravinder and S. Viswanath obtained a new comprehension of certain distinguished bases for representations of the Lie algebras of traceless matrices.

R. Rajesh, Ashwij Mayya and Anuradha Banerjee developed and tested a discrete porosity based model that captures the physics of the fracture process of the bone and reproduces well the macroscopic response and qualitative features of experimentally obtained fracture paths, as well as avalanche statistics seen in experiments on porcine bone.

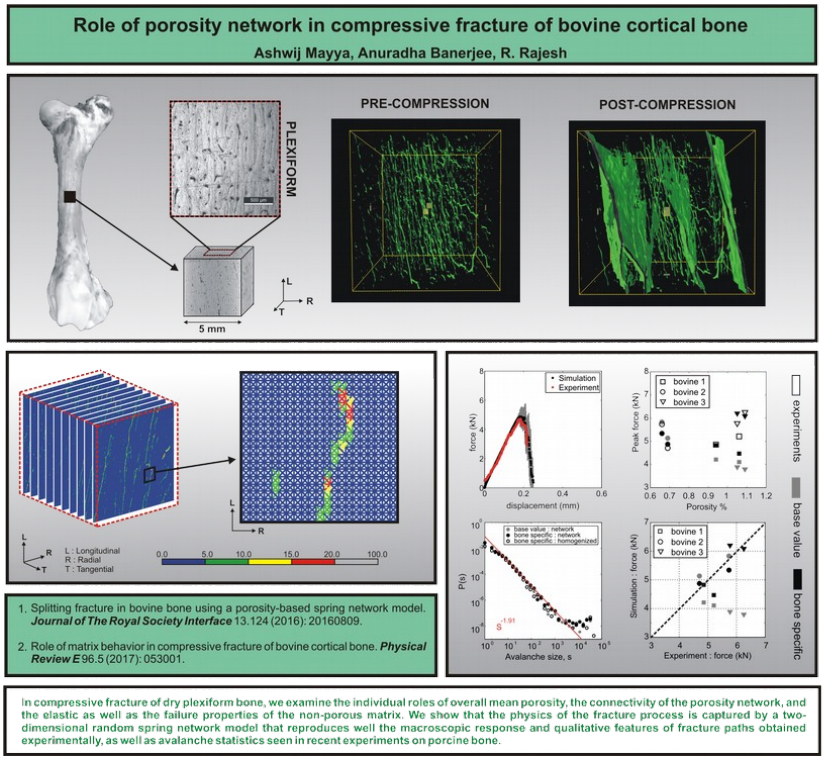

Figure 3: Role of porosity network in compressive fracture of bovine cortical bone

S. Vemparala, R. Rajesh and students and collaborators studied the precise role of electric charge in determining the conformational properties of charged polymers through a combination of large scale simulations and theoretical modeling.

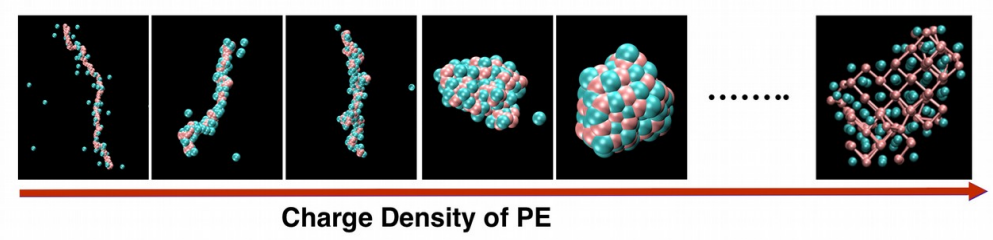

Figure 4: Charge Density of PE

Knowledge base on phytochemicals of Indian medicinal plants: Areejit Samal and his students have built an open access digital knowledge base, IMPPAT, which compiles 1742 Indian Medicinal Plants, 9596 Phytochemicals, and 1124 Therapeutic uses. Notably, IMPPAT has generated a small molecule library of 9596 phytochemicals which can be derived from Indian medicinal plants with 2D and 3D structures and this

library can be used for virtual screening and drug discovery. In addition, IMPPAT provides the computed physicochemical properties, predicted ADMET properties, drug-likeliness scores and predicted human gene targets for the phytochemicals in the database. Druggability analysis led to a subset of 960 phytochemicals which pass multiple standard scores used by pharma companies in drug discovery pipeline. Furthermore, among the 960 druggable phytochemicals, only 28 are existing approved drugs and 369 share chemical similarity with approved drugs.

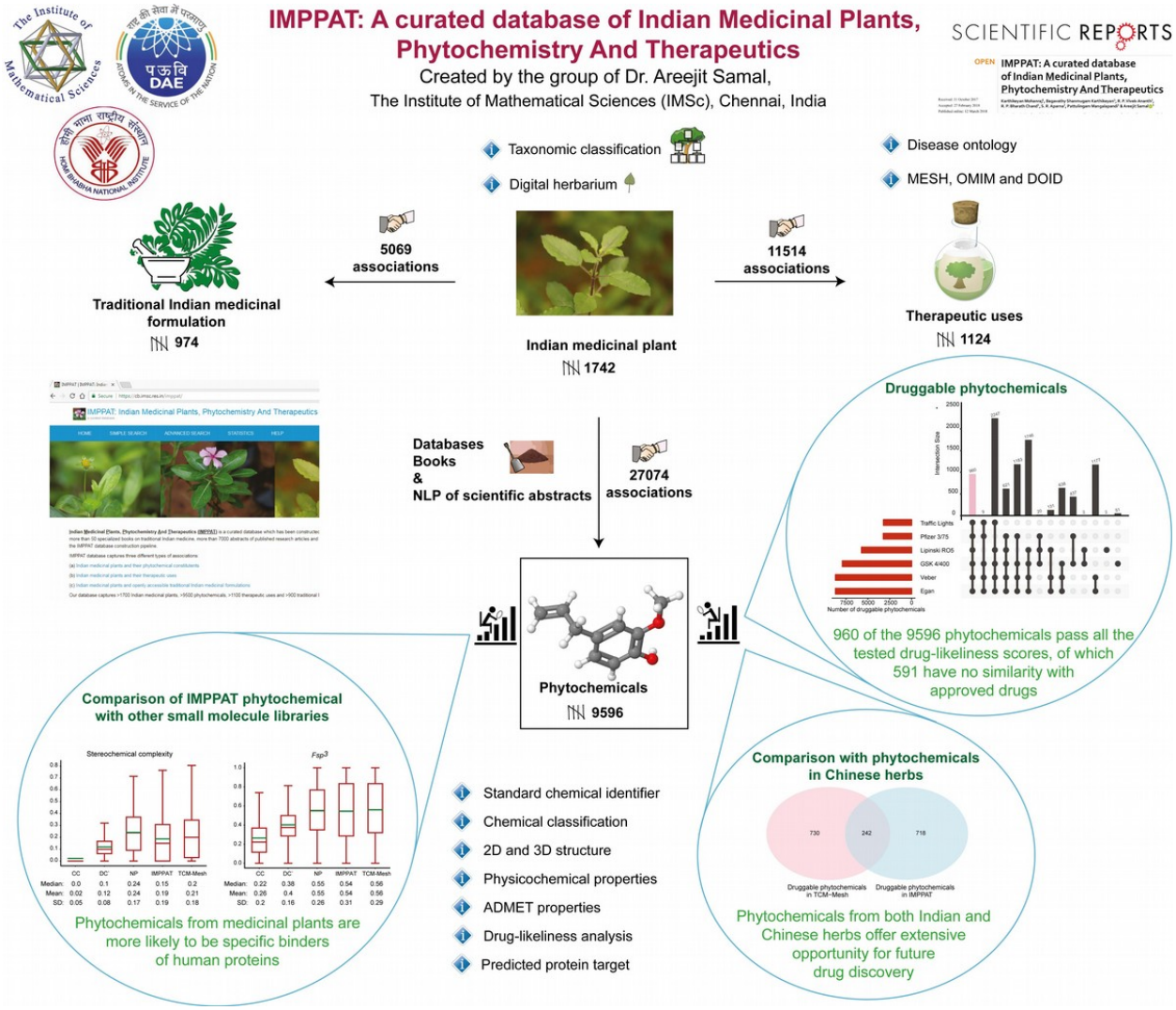

Figure 5: IMPPAT: A curated database of Indian Medicinal Plants, Phytochemistry and Therapeutics

IMPPAT is freely accessible at: https://cb.imsc.res.in/imppat This work was published in the journal Scientific Reports on March 12. Subsequently, the work has received coverage in print and online media such

as Hindustan Times, Nature India, Hindu, Indian Science Wire, Down to Earth, Research Stash, Biotech News, BioVoice News and Dinamalar.

Handedness of Language : There have been many attempts at inferring unifying patterns that may underlie the extraordinary diversity of human languages. The few common features of language that are well-known, e.g., Zipf's law, generally concern the distribution of words. However, words are themselves composed of signs (e.g., letters). Traditional linguistic investigations have tended to focus on the language-specific combinations of consonants and vowels allowed in syllables.

In a recently published paper (Md Izhar Ashraf and Sitabhra Sinha. 'The "handedness" of language: Directional symmetry breaking of sign usage in words'.
PloS One 13.1 (2018): e0190735, http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0190735)

we have shown the existence of a remarkable universality in the distinct heterogeneous nature of the frequency distributions of signs that occur at the beginning (and end) of a word. Using quantitative measures of inequality on large written corpora of languages belonging to diverse linguistic families, and expressed in different types of writing systems, we have characterized this asymmetry between the probability distributions of graphemes which occur as the initial character and that for the final character. Our results show that the beginning of a word is less restrictive in sign usage than the end, a phenomenon that we also observe in undeciphered inscriptions from the Indus Valley Civilization (2500-1900 BCE) and which has been used by us to infer the direction of writing that agrees with the archaeological evidence. Our results strongly suggest that this observed "handedness" of words may be a universal property of language, reflecting an innate feature of the human cognitive phenomenon.

This work has attracted media attention with stories about it appearing in:

The Telegraph (Jan 29,2018): Hidden pattern of sound in languages found
https://www.telegraphindia.com/india/hidden-pattern-of-sounds-in-languages-found-204379

The Hindu (Feb 1,2018): Indus script was written from right to left, says computation
http://www.thehindu.com/news/national/indus-script-was-written-from-right-to-left/article22613418.ece

The Wire (Feb 26, 2018): Scientists Elicit Universal Pattern of Sound Use in Languages
https://thewire.in/227572/scientists-elicit-hidden-universal-pattern-sound-use-languages/

Awards

D.M. Pancholi has been awarded the B M Birla Science Prize for his work on "Almost contact 5-manifolds are contact" and this work appeared in "Annals of Mathematics", Volume 182 (2015), Issue 2, Pages 429-490.

Menon, Gautam I. was awarded Shastri Mobility Program Fellowship, for 2018, by the Shastri Indo-Canadian Institute for The programme provides an opportunity for personal enrichment and professional development for senior academicians/educational administrators.

Prasad, Amritanshu was awarded Srinivasa Ramanujan Memorial Award Lecture, for 2017, by the Indian Mathematical Society for On the Timed Plactic Monoid.

Prof. Parthasarathi Chakraborty has been elected as Fellow of the Indian Academy of Sciences.

..

2.3 Publications

The list of publications follows the following conventions: firstly, names of (co)authors who are not IMSc members are marked with a superscript ; secondly, the citation labels used for cross-referencing with the research summary are constructed from the last name of the first IMSc author and finally the list is ordered alphabetically according to the labels.
Mo

Ankit Agrawal, Nirmalendu Ganai*, Surajit Sengupta*, and Gautam I. Menon.
A first-principles approach to large-scale nuclear architecture.
2018.
(Submitted).

Ankit Agrawal, Snehal V Sambare, Leelavati Narlikar*, and Rahul Siddharthan.
Thicweed: fast, sensitive detection of sequence features by clustering big datasets.
Nucleic Acids Research, **0(doi:10.1093/nar/gkx1251)**, gkx1251, 2017.

Chloe-Agathe Azencott*, Tero Aittokallio*, Sushmita Roy*, Thea Norman *, Stephen Friend *, Gustavo Stolovitzky*, Anna Goldenberg*, Ankit Agrawal, Emmanuel Barillot*, Nikolai Bessonov*, Deborah Chasman*, Urszula Czerwinska*, Alireza Fotuhi Siahpirani*, Jan Greenberg*, Manuel Huber*, Samuel Kaski*, Christoph Kurz*, Marsha Mailick*, Michael Merzenich*, Nadya Morozova*, Arezoo Movaghar*, Mor Nahum*, Torbjorn E M Nordling*, Robert Penner*, Krishanu Saha*, Asif Salim*, Siamak Sorooshyari*, Vassili Soumelis*, Alit Stark-Inbar*, Audra Sterling*, S S Shiju*, Jing Tang*, Alen Tosenberger*, Thomas Van Vieet *, Krister Wennerberg*, and Andrey Zinovyev*.
The inconvenience of data of convenience: computational research beyond post-mortem analyses.
Nature Methods, **14(10)**, 937, 2017.

Madhuparna Karmakar, Gautam I. Menon, and R. Ganesh.
Vortex core order and field-driven phase coexistence in the attractive hubbard model.
Physical Review B, **96**, 174501, 2017.

Parul Sood*, Kausalya Murthy*, Vinod Kumar, Michael Nonet*, Gautam I. Menon, and Sandhya Koushika*.
Cargo crowding at actin-rich regions along axons causes local traffic jams in neurons.
Traffic, **19**, 166, 2018.

Renu Mann*, Gautam I. Menon, and Pramod Pullarkat*.
Modeling Cell-substrate De-adhesion Dynamics under Fluid Shear.
2017.
https://doi.org/10.1101/166371 (Submitted).

Gautam I. Menon.
Yes, indian science does need a revamp, but how should we go about it?
Current Science, **113(1)**, 17, 2017.

Narmada Sambaturu*, Sumanta Mukherjee*, Martin Lopez-Garcia*, Carmen Molina-Paris*, Gautam I. Menon, and Nagasuma Chandra*.
Evaluating epidemiological impact of genetic heterogeneity using multi-compartment sir models for h1n1 influenza.
PLoS Computational Biology, **14(3)**, e1006069, 2018.

Karthikeyan Mohanraj, Bagavathy S. Karthikeyan, R.P. Vivek-Ananth, R.P. Bharath Chand, S.R. Aparna*, Pattulingam Mangalapandi, and Areejit Samal.
IMPPAT: A curated database of indian medicinal plants, phytochemistry and therapeutics.
Scientific Reports, **8**, 4329, 2018.

Varuni Prabhakar, Shakti N. Menon, and Gautam I. Menon.
Modelling Phototaxis as a Collective Phenomenon in Cyanobacterial colonies.
Scientific Reports, **7**, 17799, 2017.

Areejit Samal, James P. Craig*, Samuel T. Coradetti*, J. P. Benz*, James A. Eddy*, Nathan D. Price*, and N. L. Glass*.
Network reconstruction and systems analysis of plant cell wall deconstruction by Neurospora crassa.
Biotechnology for Biofuels, **10**, 225, 2017.

Areejit Samal and Olivier C. Martin*.
Haldane, Waddington and recombinant inbred lines: extension of their work to any number of genes.
Journal of Genetics, **96(5)**, 795, 2017.

Areejit Samal, R.P. Sreejith, Jiao Gu*, Shiping Liu*, Emil Saucan*, and Jürgen Jost*.
Comparative analysis of two discretizations of Ricci curvature for complex networks.
2017.
arxiv:1712.07600 (Submitted).

Emil Saucan*, Areejit Samal, Melanie Weber*, and Jürgen Jost*.
Discrete curvatures and network analysis.
MATCH Communications in Mathematical and in Computer Chemistry, 2017.
(To be published).

R.P. Sreejith, Jürgen Jost*, Emil Saucan*, and Areejit Samal.
Systematic evaluation of a new combinatorial curvature for complex networks.
Chaos, Solitons Fractals, **101**, 50, 2017.

Sudarkodi Venkatesan, R.P. Vivek-Ananth, R.P. Sreejith, Pattulingam Mangalapandi, Ali A. Hassanali*, and Areejit Samal.
Network approach towards understanding the crazing in glassy amorphous polymers, to appear in journal of statistical mechanics: Theory and experiment.
Journal of Statistical Mechanics: Theory and Experiment, 2018.
(To be published).

R.P. Vivek-Ananth, Karthikeyan Mohanraj, M. Vandanashree, Anupam Jhingran*, James P. Craig, and Areejit Samal.
Comparative systems analysis of the secretome of the opportunistic pathogen Aspergillus fumigatus and other Aspergillus species.
2017.
bioRxiv 230953 (Submitted).
Sn2

Arvind Ayyer*, Amritanshu Prasad, and Steven Spallone*.
Representations of symmetric groups with non-trivial determinant.
Journal of Combinatorial Theory. Series A, **150**, 208–232, 2017.

T.Geetha and Amritanshu Prasad.
Comparison of Gelfand-Tsetlin bases for alternating and symmetric groups.
Algebr. Represent. Theory, **21(1)**, 131–143, 2018.

Keshab Chandra Bakshi, Sayan Das*, Zhengwei Liu*, and Yunxiang Ren*.
An angle between intermediate subfactors and its rigidity.
2017.
arXiv:1710.00285 (Submitted).

S. Gun and W. Kohnen*.
On the Ramanujan-Petersson conjecture for modular forms of half-integral weight.
2018.
(Submitted).

S. Gun, B. Kumar, and B. Paul.
The first simultaneous sign change and non-vanishing of Hecke eigenvalues of newforms.
2018.
(Submitted).

S. Gun, M. R. Murty*, and P. Rath*.
Transcendental sums related to the zeros of zeta functions.
2017.
(Submitted).

S. Gun, B. Paul, and J. Sengupta*.
On Hecke eigenvalues of Siegel modular forms in the Maass space.
Forum Mathematicum, **30(3)**, 775–783, 2017.

S. Gun and B. Saha*.
Multiple Lerch zeta functions and an idea of Ramanujan.
Michigan Math J., **67(2)**, 267–287, 2018.

S. Gun and J. Sengupta*.
Sign changes of Fourier coefficients of Siegel cusp forms of degree two on Hecke congruence subgroups.
Int. J. Number Theory, **13(10)**, 2597, 2017.

Jaban Meher*, Sudhir Pujahari*, and Srinivas Kotyada.
Zeros of l functions attached to modular forms of half-integral weight.
Bull. London Math. Soc., **49**, 926, 2017.

Ram Murty M*, Srinivas K, and Subramani M*.
Admissible primes and euclidean quadratic fields.
Journal of Ramanujan Mathematical Society, 2018.
505 (To be published).

Balesh Kumar and M. Manickam*.
On Doi-Naganuma and Shimura liftings.
The Ramanujan Journal, 2017.
(To be published).

Avijit Nath and Parameswaran Sankaran.
On Generalized Dold Manifolds.
2017.
arXiv:1708.02418 (Submitted).

S. D. Adhikari*, Anirban Mukhopadhyay, and M. Ram Murty*.

The analog of the Erdös distance problem in finite fields.
International Journal of Number Theory, **13(9)**, 2319–2333, 2017.

K.N. Raghavan, B. Ravinder*, and Sankaran Viswanath.
Comparison of Gelfand-Tsetlin bases for alternating and symmetric groups.
Journal of Combinatorial Theory. Series A, **154**, 77–113, 2018.

Sandipan De and Vijay Kodiyalam.
Planar algebras, cabling and the Drinfeld double.
Quantum Topology, **9(1)**, 141–165, 2018.

T. Mubeena* and P. Sankaran.
Twisted conjugacy and quasi-isometric rigidity of irreducible lattices in semisimple lie groups.
2018.
arxiv:1801.02105 (Submitted).

El Mazouni A* and Nagaraj D. S.
Tangent bundle of $\mathbb{P}^2$ and morphism from $\mathbb{P}^2$ to $\mathrm{gr}(2, \mathbb{C}^4)$.
In Anilatmaja Aryasomayajula et all, editor, *Analytic and algebraic geometry*, page 117. Hindustan Book Agency, New Delhi., Jul 2017.

Indranil Biswas*, Subramaniam Senthamarai Kannan*, and D. S. Nagaraj.
The full automorphism group of $\overline{T}$.
C. R. Math. Acad. Sci. Paris, **355(4)**, 452–454, 2017.

R. Balasubramanian, Sumit Giri*, and Priyamvad Srivastav.
On correlations of certain multiplicative functions.
J. Number Theory, **174**, 221, 2017.

R. Balasubramanian and Priyamvad Srivastav.
On selberg's approximation to the twin prime problem.
Acta Arithmetica, **179**, 335, 2017.

R. Balasubramanian and Priyamvad Srivastav.
On the number of factorizations of an integer.
J. Ramanujan Math. Soc., **32**, 417, 2017.

Olivier Ramarè* and Priyamvad Srivastav.

Product of primes in arithmetic progressions.
2017.
(Submitted).

Sushmita Venugopalan and Guangbo Xu*.
Local model for the moduli space of affine vortices.
International Journal of Mathematics, **29(3)**, 1850020, 54pp., 2018.
Me4

Sujay K. Ashok, Marco Billo*, **Eleonora DellAquila***, **Marialuisa Frau***, **Varun Gupta, Renjan R. John, and Alberto Lerda***.
Surface operators, chiral rings and localization in n=2 gauge theories.
Journal of High Energy Physics, **11(1711)**, 137, 2017.

Sujay K. Ashok, Marco Billo*, **Eleonora DellAquila, Marialuisa Frau***, **Varun Gupta, Renjan R. John***, **and Alberto Lerda***.
Surface operators in 5d gauge theories and duality relations.
Journal of High Energy Physics, 2017.
1712.06946 (Submitted).

Md Izhar Ashraf and Sitabhra Sinha.
The handedness of language: Directional symmetry breaking of sign usage in words.
PLOS ONE, **13(1)**, e0190735, 2018.

J. Martinez*, **K. Stovall***, **P. Freire***, **J. Deneva***, **T. Tauris***, **A. Ridolfi***, **N. Wex***, **F. Jenet***, **M. McLaughlin***, **and M. Bagchi**.
Pulsar J1411+2551: A low-mass double neutron star system.
The Astrophysical Journal Letters, **851(2)**, L29, 2017.

Manjari Bagchi.
Prospects of constraining the dense matter equation of state from the timing analysis of pulsars in double neutron star binaries: the cases of PSR J0737-3039A and PSR J1757-1854.
In Alexandra Friesen David Blaschke, Alexander Ayriyan and Hovik Grigorian, editors, *Universe, 2018, 4(2); dedicated to the conference: "Compact Stars in the QCD Phase Diagram VI" held at The Joint Institute for Nuclear Research (JINR), Dubna, Russia; during 26 - 29 September, 2017*, page 36. MDPI, Feb 2018.

Manjari Bagchi.

A unified model for repeating and non-repeating Fast Radio Bursts.
The Astrophysical Journal Letter, **838**, L16, 2017.

Minati M. Biswal, Mridupawan D. Deka*, Sanatan D. Digal, and P.S. D. Saumia.
Confinement-deconfinement transition in su(2) higgs theory.
Phys. ReV. D, **96(1)**, 014503, 2017.

Pinaki Chaudhuri and Ludovic Berthier*.
Ultra-long-range dynamic correlations in a microscopic model for aging gels.
Physical Review E, **95**, 060601, 2017.

Rituparno Mandal*, Pranab J. Bhuyan*, Pinaki Chaudhuri, Madan Rao*, and Chandan Dasgupta*.
Glassy swirls of active dumbbells.
Phys. Rev. E, **96**, 042605, 2017.

Tanmoy Sarkar*, Santidan Biswas*, Pinaki Chaudhuri, and Anirban Sain*.
Grain size distribution in sheared polycrystals.
Physical Review Materials, **1**, 070601, 2017.

Ghanashyam Date and Sk. Jahanur Hoque.
Cosmological horizon and the quadrupole formula in de sitter background.
Phys. Rev. D, **96**, 044026, 2017.

C. Connaughton*, A. Dutta, R. Rajesh, N. Siddharth, and O. Zaboronski*.
Stationary mass distribution and non-locality in models of coalescence and shattering.
Physical Review E, **97**, 022137, 2018.

J. Joy, S. N. Pathak*, D. Das*, and R. Rajesh.
Shock propagation in locally driven granular systems.
Physical Review E, **96**, 032908, 2017.

D. Mandal, T. Nath*, and R. Rajesh.
Phase transitions in a system of hard y-shaped particles on the triangular lattice.
Physical Review E, **97**, 032131, 2018.

D. Mandal and R. Rajesh.
The columnar-disorder phase boundary in a mixture of hard squares and dimers.
Physical Review E, **96**, 012140, 2017.

Dipanjan Mandal, Trisha Nath*, and R. Rajesh.
Estimating the critical parameters of the hard square lattice gas model.
Journal of Statistical Mechanics, **2017**, 043201, 2017.

Shakti N. Menon, Trilochan Bagarti, and Abhijit Chakraborty.
Jamming in a lattice model of stochastically interacting agents with a field of view.
Europhysics Letters, **117**, 50007, 2017.

Shakti N. Menon, Cameron L. Hall*, Scott W. McCue*, and Sean McElwain*.
A model for one-dimensional morphoelasticity and its application to fibroblast-populated collagen lattices.
Biomechanics and Modeling in Mechanobiology, **16(5)**, 1743, 2017.

Shakti N. Menon, V. Sasidevan*, and Sitabhra Sinha.
Emergence of cooperation as a non-equilibrium transition in noisy spatial games.
Frontiers in Physics, 2018.
(To be published).

Varsha Sreenivasan*, Shakti N. Menon, and Sitabhra Sinha.
Emergence of coupling-induced oscillations and broken symmetries in heterogeneously driven nonlinear reaction networks.
Scientific Reports, **7**, 1594, 2017.

Tanmay Mitra, Shakti N. Menon, and Sitabhra Sinha.
Emergent memory in cell signaling: Persistent adaptive dynamics in cascades can arise from the diversity of relaxation time-scales.
2018.
(Preprint: 1801.04057).

Johann Bartel*, Rajat K. Bhaduri*, Matthias Brack*, and M. Murthy.
On the asymptotic prime partitions of integers.
Physical Review E, **95**, 052108, 2017.

Varuni Prabhakar, Shakti N. Menon, and Gautam I. Menon.
Phototaxis as a collective phenomenon in cyanobacterial colonies.
Scientific Reports, **7**, 17799, 2017.

V. V. Prasad and R. Rajesh.

Asymptotic behavior of the velocity distribution of driven inelastic one-component granular gases: exact results.
Physical Review E, 2018.
arXiv:1803.11031 (Submitted).

A. Mayya*, A. Banerjee*, and R. Rajesh.
On role of matrix behavior in compressive fracture of bovine cortical bone.
Physical Review E, **96**, 053001, 2017.

Ashwij Mayya*, Anuradha Banerjee*, and R. Rajesh.
Role of porosity and matrix behavior on compressive fracture of haversian bone using random spring network model.
Journal of the Mechanical Behavior of Biomedical Materials, 2018.
(To Appear).

S. Patra*, D. Das*, R. Rajesh, and M. K. Mitra*.
Diffusion dynamics and steady states of systems of hard rods on the square lattice.
Physical Review E, **97**, 022108, 2018.

Madhusudhan Raman.
Horizon tunneling revisited: the case of higher dimensional black holes.
Journal of High Energy Physics, **2017(12)**, 144, 2017.

Madhusudhan Raman.
Aspects of Hecke symmetry: Generalized Ramanujan identities and a universal inversion formula.
2018.
(Preprint: arXiv:1803.10224).

B. Sathiapalan and Hidenori Sonoda*.
A holographic form for wilson's rg.
Nucl.Phys. B924 (2017), **B924**, 603, 2017.

Anupama Sharma, Shakti N. Menon, Sasidevan Vijayakumar*, and Sitabhra Sinha.
Epidemic prevalence information on social networks mediates emergent collective outcomes in voluntary vaccine schemes.
2017.
(Preprint: 1709.07674).

Rishu K. Singh* **and Sitabhra Sinha**.
Optimal interdependence enhances the dynamical robustness of complex systems.
Physical Review E, **96(2)**, 020301(R), 2017.

A. M. Tom, R. Rajesh, and Satyavani Vemparala.
Aggregation of flexible polyelectrolytes: Phase diagram and dynamics.
Journal of Chemical Physics, **147**, 144903, 2017.

A. M. Tom, Satyavani Vemparala, R. Rajesh, and N.V. Brilliantov*.
Regimes of strong electrostatic collapse of a highly charged polyelectrolyte in a poor solvent.
Soft Matter, **13**, 1862, 2017.

Upayan Baul* **and Satyavani Vemparala**.
Influence of lipid composition of model membranes on methacrylate antimicrobial polymer - membrane interactions.
Soft Matter, **13**, 7665, 2017.

Haruko Takahashi*, **Gregory Caputo***, **Satyavani Vemparala, and Kenichi Kuroda***.
Synthetic random copolymers as a molecular platform to mimic host-defense antimicrobial peptides.
Bioconjugate Chemistry, **28**, 1340, 2017.

N. Vigneshwar, D. Dhar*, **and R. Rajesh**.
Different phases of a system of hard rods on three dimensional cubic lattice.
Journal of Statistical Mechanics, **2017**, 113304, 2017.
Rama6

V. Arvind, Abhranil Chatterjee, Rajit Datta*, **and Partha Mukhopadhyay***.
Low rank permanents via ideal membership and related results.
Feb 2018.
(Submitted).

V. Arvind, Rajit Datta*, **Partha Mukhopadhyay***, **and S. Raja***.
Efficient identity testing and polynomial factorization in nonassociative free rings.
In Jean-Franois Raskin Kim G. Larsen, Hans L. Bodlaender, editor, *42nd International Symposium on Mathematical Foundations of Computer Science, MFCS 2017*, page 38:1. Springer Verlag, Aug 2017.

V. Arvind, Johannes Koebler*, **Sebastian Kuhnert***, **and Jacobo Toran***.

Finding small weight isomorphisms with additional constraints is fixed-parameter tractable.
In Daniel Lokshtanov and Naomi Nishimura, editors, *12th International Symposium on Parameterized and Exact Computation, IPEC 2017*, page 2:1. Springer Verlag, Sep 2017.

V. Arvind, Pushkar Joglekar*, Partha Mukhopadhyay*, and S. Raja*.
Randomized polynomial time identity testing for noncommutative circuits.
In Valerie King Hamed Hatami, Pierre McKenzie, editor, *Proceedings of the 49th Annual ACM SIGACT Symposium on Theory of Computing, STOC 2017*, page 831. Association for Computing Machinery, Jun 2017.

V. Arvind.
Finding fixed point free elements and small bases in permutation groups.
Theoretical Computer Science, **687**, 70, 2017.

V. Arvind, Johannes Koebler*, Gaurav Rattan, and Oleg Verbitsky*.
Graph isomorphism, color refinement, and compactness.
Computational Complexity, **26(3)**, 627, 2017.

V. Arvind and Meena Mahajan.
A quest for structure in complexity.
In *Bulletin of the EATCS, Vol 123, Oct 2017*. EATCS, 2017.

V. Arvind and Srikanth Srinivasan*.
On the hardness of the noncommutative determinant.
Computational Complexity, **27(1)**, 1, 2018.

Pradeesha Ashok, Fedor Fomin*, Sudeshna Kolay, Saket Saurabh, and Meirav Zehavi*.
Exact algorithms for terrain guarding. symposium on computational geometry.
In *SoCG*, page 11:1. Lipics, Jul 2017.

Pradeesha Ashok, Sudeshna Kolay, Syed M. Meesum, and Saket Saurabh.
Parameterized complexity of strip packing and minimum volume packing.
Theor. Comput. Sci., **661**, 56, 2017.

Pradeesha Ashok, Sudeshna Kolay, and Saket Saurabh.
Multivariate complexity analysis of geometric red blue set cover.
Algorithmica, **79(5)**, 667, 2017.

Arindam Biswas, Varunkumar Jayapaul*, Venkatesh Raman, and Srinivasa R. Satti*.
The complexity of finding (approximate) distance d dominating set in tournaments.
In Xiao M and Rosamond F, editors, *Frontiers in Algorithmics, 11th international workshop (FAW 2017)*, page 22. Springer, Volume 10336, Jun 2017.

Sankardeep Chakraborty, Venkatesh Raman, and Srinivasa R. Satti*.
Biconnectivity, st-numbering and other applications of dfs using o(n) bits.
Journal of Computer and System Sciences (JCSS), **90**, 63, 2017.

Pallavi Jain, Jayakrishnan M., Fahad Panolan*, and Abhishek Sahu.
Mixed dominating set: A parameterized perspective.
In Gerhard J. Woeginger Hans L. Bodlaender, editor, *International Workshop on Graph-Theoretic Concepts in Computer Science (WG 2017)*. Springer, Nov 2017.

Akanksha Agarwal*, Lawqueen Kanesh, Saket Saurabh, and Prafullkumar Tale.
Paths to trees and cacti.
In *Algorithms and Complexity - 10th International Conference, CIAC 2017*, page 31, May 2017.

Sudeshna Kolay, Fahad Panolan, and Saket Saurabh.
Communication complexity of pairs of graph families with applications.
In *MFCS*, page 13:1. Lipics, Aug 2017.

Sudeshna Kolay, Daniel Lokshtanov*, Fahad Panolan*, and Saket Saurabh.
Quick but odd growth of cacti.
Algorithmica, **79(1)**, 271, 2017.

Akanksha Agrawal*, R. Krithika, Daniel Lokshtanov*, Amer E. Mouawad*, and M.S. Ramanujan*.
On the parameterized complexity of simultaneous deletion problems.
In Satya Lokam and R. Ramanujam, editors, *37th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2017)*, page 9:1. Schloss Dagstuhl–Leibniz-Zentrum fuer Informatik, Dec 2017.

R. Krithika, Abhishek Sahu, Saket Saurabh, and Meirav Zehavi*.
The parameterized complexity of cycle packing: Indifference is not an issue.
In *13th Latin American Theoretical Informatics Symposium (LATIN 2018)*, Apr 2018.
(To be published).

R. Krithika, Diptapriyo Majumdar, and Venkatesh Raman.
Revisiting Connected Vertex Cover: FPT Algorithms and Lossy Kernels.
Theory of Computing Systems, 2018.
arXiv:1711.07872 (https://doi.org/10.1007/s00224-017-9837-y)[Available Online.].

R. Krithika, Abhishek Sahu, and Prafullkumar Tale.
Dynamic parameterized problems.
Algorithmica, 2017.
(To be published).

Kamal Lodaya and A. Sreejith*.
Two-variable first-order logic with counting quantifiers: complexity results.
In Julien Leroy Émilie Charlier and Michel Rigo, editors, *Proc. 21st DLT, Liège*, pages 260–271. Springer LNCS 10396, Aug 2017.

Kamal Lodaya and A. Sreejith*.
A note on modulo counting quantifiers and linear arithmetic.
In *Proceedings of the 14th Asian Logic conference, Mumbai.*, Mar 2018.
(Submitted).

Kamal Lodaya.
Via.
Mar 2018.
(Submitted).

Jayakrishnan Madathil, Saket Sarah, and Meirav Zehavi*.
Max-cut above spanning tree is fixed-parameter tractable.
In *Proceedings of the 13th International Computer Science Symposium in Russia*, Mar 2018.
(To be published).

Akanksha Agrawal*, **Grzegorz Guspiel***, **Jayakrishnan Madathil, Saket Saurabh, and Meirav Zehavi***.
On the complexity of crossing minimization.
In *The 45th International Colloquium on Automata, Languages, and Programming (ICALP 2018)*, Feb 2018.
(Submitted).

Jayakrishnan Madathil, Fahad Panolan*, **Abhishek Sahu, and Saket Saurabh**.
On the complexity of mixed dominating set.

In *The 44th International Workshop on Graph-Theoretic Concepts in Computer Science (WG 2018)*, Feb 2018.
(Submitted).

Meena Mahajan, Prajakta Nimbhorkar*, and Anuj Tawari.
Computing the maximum using (min,+) formulas.
In *42nd International Symposium on Mathematical Foundations of Computer Science (MFCS), LIPIcs vol. 83.*, pages 74:1–74:11. LIPIcs, Aug 2017.

Meena Mahajan.
Lower bound techniques for QBF proof systems.
In *35th Symposium on Theoretical Aspects of Computer Science (STACS)*, pages 2:1–2:8. LIPIcs, Mar 2018.

Olaf Beyersdorff*, Leroy Chew*, Meena Mahajan, and Anil Shukla.
Feasible interpolation for QBF resolution calculi.
Logical Methods in Computer Science, **13(2)**, 1, 2017.

Olaf Beyersdorff*, Leroy Chew*, Meena Mahajan, and Anil Shukla.
Are short proofs narrow? QBF is not so simple.
ACM Transactions on Computational Logic, **19(1)**, 1:1–1:26, 2018.

Herve Fournier*, Nutan Limaye*, Meena Mahajan, and Srikanth Srinivasan*.
The shifted partial derivative complexity of elementary symmetric polynomials.
Theory of Computing, **13**, 9:1–34, 2017.

Meena Mahajan and Nitin Saurabh.
Some complete and intermediate polynomials in algebraic complexity theory.
Theory of Computing Systems, **62(3)(622–652)**, dx.doi/10.1007/s00224–016–9740–y, 2018.

Meena Mahajan and Anuj Tawari.
Sums of read-once formulas: how many summands are necessary?
Theoretical Computer Science, **708**, 34–45, 2018.

Diptapriyo Majumdar and Venkatesh Raman.
FPT algorithms for FVS parameterized by split and cluster vertex deletion sets and other parameters.
In Frances Rosamond and Mingyu Xiao, editors, *Frontiers of Algorithmics (FAW 2017)*, page 209. Springer, Cham, Jun 2017.

Akanksha Agrawal*, **Daniel Lokshtanov***, **Diptapriyo Majumdar, Amer E. Mouawad***, **and Saket Saurabh**.
Kernelization of Cycle Packing with Relaxed Disjointness Constraints.
2017.
(Submitted).

Diptapriyo Majumdar and Venkatesh Raman.
Structural Parameterizations of Undirected Feedback Vertex Set: FPT Algorithms and Kernelization.
Algorithmica, 2018.
https://doi.org/10.1007/s00453-018-0419-4(Available Online).

Diptapriyo Majumdar, Venkatesh Raman, and Saket Saurabh.
Polynomial Kernels for Vertex Cover Parameterized by Small Degree Modulators.
Theory of Computing Systems, 2018.
https://doi.org/10.1007/s00224-018-9858-1(Available Online).

Jorgen Bang-Jensen*, **Manu Basavaraju***, **Kristine V. Klinkby***, **Pranabendu Misra, M. S. Ramanujan***, **Saket Saurabh, and Meirav Zehavi***.
Parameterized algorithms for survivable network design with uniform demands.
In *SODA*, page 2838, Jan 2018.

Daniel Lokshtanov*, **Pranabendu Misra, M. S. Ramanujan, and Saket Saurabh**.
Hitting selected (odd) cycles.
SIAM J. Discrete Math., **31(3)**, 1581, 2017.

Swaroop N P and Vikram Sharma.
Improved bounds on the absolute positiveness of polynomials.
In Michael Burr, editor, *Proceedings of the 2017 ACM on International Symposium on Symbolic and Algebraic Computation*, page 381. ACM New York., Jul 2017.

Fedor Fomin*, **Daniel Lokshtanov***, **Fahad Panolan, and Saket Saurabh**.
Representative families of product families.
ACM Trans. Algorithms, **13(3)**, 36:1, 2017.

Fahad Panolan, Geevarghese Philip*, **and Saket Saurabh**.
On the parameterized complexity of b-chromatic number.
J. Comput. Syst. Sci., **84**, 120, 2017.

Swaroop N. Prabhakaran and Vikram Sharma.
Improved bounds on absolute positiveness of multivariate polynomials.
In Michael A. Burr, Chee K. Yap, and Mohab Safey El Din, editors, *International Symposium on Symbolic and Algebraic Computation, ISSAC 2017*, page 381. ACM, Jul 2017.

Swaroop N. Prabhakar and Vikram Sharma.
Improved bounds on absolute positiveness of multivariate polynomials.
2018.
(Submitted).

Ashutosh Rai and Saket Saurabh.
Bivariate complexity analysis of almost forest deletion.
Theor. Comput. Sci., **708**, 18, 2018.

R. Ramanujam, S.P. Suresh*, **and Vaishnavi Sundararajan***.
Existential assertions for voting protocols.
In Vanessa Teague, editor, *Financial Cryptography Workshops*, page 337. International Financial Cryptography Association, Apr 2017.

Sujata Ghosh*, **Neethi Konar***, **and R. Ramanujam**.
Strategy composition in dynamic games with simultaneous moves.
In A.P. Rocha J. van den Herik and J. Filipe, editors, *9th International Conference on Agents and Artificial Intelligence*, page 624. Scitepress, Jun 2017.

Dietmar Berwanger* **and R Ramanujam**.
Deviator detection under imperfect monitoring.
In Aniello Murano Wiebe van der Hoek, Bastien Maubert and Sasha Rubin, editors, *Proceedings of Strategic Reasoning*, Jul 2017.

Mark Jones*, **Daniel Lokshtanov***, **M. S. Ramanujan, Saket Saurabh, and Ondra Suchy***.
Parameterized complexity of directed steiner tree on sparse graphs.
SIAM J. Discrete Math., **31(2)**, 1294, 2017.

M. S. Ramanujan and Saket Saurabh.
Linear-time parameterized algorithms via skew-symmetric multicuts.
ACM Trans. Algorithms, **13(4)**, 46:1, 2017.

Aritra Banik*, **Fahad Panolan***, **Venkatesh Raman, Vibha Sahlot, and Saket Saurabh**.
Parameterized complexity of geometric covering problems with conflicts.
In Antonina Kolokolova Faith Ellen and Jrg-Rdiger Sack, editors, *Workshop on Algorithms and Data Structures (WADS 2017)*, page 61. Springer Verlag, Jul 2017.

Hicham El-Zein*, **Moshe Lewinstein***, **J. I. Munro***, **Venkatesh Raman, and Timothy Chan***.
On the succinct representation of equivalence classes.
Algorithmica, **78(3)**, 1020, 2017.

Varunkumar Jayapaul*, **J. I. Munro***, **Srinivasa R. Satti***, **and Venkatesh Raman**.
Finding modes with equality comparisons.
Theoretical Computer Science, **704**, 28, 2017.

Amer Mouawad*, **Naomi Nishimura***, **Vinayak Pathak***, **and Venkatesh Raman**.
Shortest reconfiguration path in the solution space of boolean formula.
SIAM Journal on Discrete Mathematics, **31(3)**, 2185, 2017.

Amer E. Mouawad*, **Naomi Nishimura***, **Venkatesh Raman, and Sebestian Siebertz***.
Vertex cover reconfiguration and beyond.
Algorithms, **11(2)**, 20, 2018.

Amer E. Mouawad*, **Naomi Nishimura***, **Venkatesh Raman, Narges Simjour***, **and Akira Suzuki***.
On the parameterized complexity of reconfiguration problems.
Algorithmica, **78(1)**, 274, 2017.

Sushmita Gupta*, **Sanjukta Roy, Saket Saurabh, and Meirav Zehavi***.
Group activity selection on graphs: Parameterized analysis.
In *SAGT*, page 106. Springer, Aug 2017.

Sushmita Gupta*, **Sanjukta Roy, Saket Saurabh, and Meirav Zehavi***.
Parameterized algorithms and kernels for rainbow matching.
In 71:1, editor, *MFCS*. Lipics, Aug 2017.

Archontia C. Giannopoulou *, **Bart M. Jansen***, **Daniel Lokshtanov***, **and Saket Saurabh**.
Uniform kernelization complexity of hitting forbidden minors.
ACM Trans. Algorithms, **13(3)**, 35:1, 2017.

Daniel Lokshtanov*, Fahad Panolan*, M. S. Ramanujan*, and Saket Saurabh.
Lossy kernelization.
In *STOC*, page 224, Jun 2017.

Daniel Lokshtanov*, Amer E. Mouawad*, Saket Saurabh, and Meriav Zehavi*.
Packing cycles faster than erdos-posa.
In *ICALP*. Lipics, Jul 2017.

Fedor Fomin*, Daniel Lokshtanov*, Fahad Panoaln*, Saket Saurabh, and Merirav Zehavi*.
Finding, hitting and packing cycles in subexponential time on unit disk graphs.
In *ICALP*, page 65:1. Lipics, Aug 2017.

Daniel Lokshtanov*, M. S. Ramanujan*, and Saket Saurabh.
A linear-time parameterized algorithm for node unique label cover.
In *ESA*, page 57:1. Lipics, Sep 2017.

Daniel Lokshtanov*, Saket Saurabh, Roohani Sharma, and Meirav Zehavi*.
Balanced judicious bipartition is fixed-parameter tractable.
In *FSTTCS*, page 40:1. Lipics, Dec 2017.

Fedor Fomin*, Petr A. Golovach*, Daniel Lokshtanov*, and Saket Saurabh.
Covering vectors by spaces: Regular matroids.
In *ICALP*, page 56:1. Lipics, Jul 2017.

Akanksha Agrawal*, Saket Saurabh, and Prafullkumar Tale.
On the parameterized complexity of contraction to generalization of trees.
In Naomi Nishimura Daniel Lokshtanov, editor, *12th International Symposium on Parameterized and Exact Computation, IPEC 2017*, page 1:1, Sep 2017.

Tien-Nam Le*, Daniel Lokshtanov*, Saket Saurabh, Stephan Thomasse*, and Meirav Zehavi*.
Subquadratic kernels for implicit 3-hitting set and 3-set packing problems.
In *SODA*, page 331, Jan 2018.

Daniel Lokshtanov*, M. S. Ramanujan*, and Saket Saurabh.
When recursion is better than iteration: A linear-time algorithm for acyclicity with few error vertices.
In *SODA*, page 1916, Jan 2018.

Daniel Lokshtanov*, **Fahad Panolan***, **Saket Saurabh, Roohani Sharma, and Meirav Zehavi***.
Covering small independent sets and separators with applications to parameterized algorithms.
In *SODA*, page 2785, Jan 2018.

Akanksha Agrawal*, **Daniel Lokshtanov***, **Pranabendu Misra***, **Saket Saurabh, and Meirav Zehavi***.
Erdos-posa property of obstructions to interval graphs.
In *STACS*, page 7:1. Lipics, Mar 2018.

Daniel Lokshtanov*, **Pranabendu Misra***, **Fahad Panolan***, **Saket Saurabh, and Meirav Zehavi***.
Quasipolynomial representation of transversal matroids with applications in parameterized complexity.
In *ITCS*, page 32:1. Lipics, Jan 2018.

Petr A. Golovach*, **Daniel Lokshtanov***, **Saket Saurabh, and Meirav Zehavi***.
Cliquewidth iii: The odd case of graph coloring parameterized by cliquewidth.
In *SODA*, page 262, Jan 2018.

Akanksha Agrawal*, **Saket Saurabh, Roohani Sharma, and Meirav Zehavi***.
Kernels for deletion to classes of acyclic digraphs.
J. Comput. Syst. Sci., **92**, 9, 2018.

Fedo Fomin*, **Daniel Lokshtanov***, **and Saket Saurabh**.
Excluded grid minors and efficient polynomial-time approximation schemes.
Journal of the ACM, **65(2)**, 10:1, 2018.

Fedor Fomin*, **Daniel Lokshtanov***, **Saket Saurabh, and Dimitrios Thilikos**.
Kernels for (connected) dominating set on graphs with excluded topological minors.
ACM Trans. Algorithms, **14(1)**, 6:1, 2018.

Daniel Lokshtanov*, **Marcin Pilipczuk***, **Michal Pilipczuk***, **and Saket Saurabh**.
Fixed-parameter tractable canonization and isomorphism test for graphs of bounded treewidth.
SIAM J. Comput., **46(1)**, 161, 2017.

Daniel Lokshtanov*, **M. S. Ramanujan***, **and Saket Saurabh**.
Linear time parameterized algorithms for subset feedback vertex set.
ACM Trans. Algorithms, **14(1)**, 7:1, 2018.

Sounaka Mishra*, **Shijin Rajakrishnan***, **and Saket Saurabh**.
On approximability of optimization problems related to red/blue-split graphs.
Theor. Comput. Sci., **690**, 104, 2017.

Ruben Becker*, **Sagraloff***, **Sharma, and Yap***.
A near-optimal subdivision algorithm for complex root isolation based on the pellet test and newton iteration.
J. Symb. Comput., **86**, 51, 2018.

Prashant Batra* **and Vikram Sharma**.
Near optimal subdivision algorithms for real root isolation.
Journal of Symbolic Computation, **83**, 4, 2017.

Vikram Sharma and Chee K. Yap*.
Robust geometric computation.
In Joseph O'Rourke Jacob E. Goodman and Csaba D. Tth, editors, *Handbook of Discrete and Computational Geometry*. CRC Press LLC, 2017.
(Submitted).

Kunal Dutta* **and C.R. Subramanian**.
On induced paths, holes and trees in random graphs.
In Markus Nebel and Stephen Wagner, editors, *Meeting on Analytical Algorithmics and Combinatorics (ANALCO-18)*, pages 168–177. Society for Industrial and Applied Mathematics (SIAM), Jan 2018.

Joydeep Mukherjee* **and C.R. Subramanian**.
Greedy heuristics and stochastic matchings.
Asian Journal of Mathematics and Applications, **2018(ama0452)**, 1–14, 2018.

C.R. Subramanian.
Some observations on exact 3-coloring.
2017.
(Submitted).
R2

Sujata Ghosh* and R Ramanujam, editors.
Proceedings of the Ninth Workshop on Methods for Modalities, volume 243 of *Electronic Proceedings in Theoretical Computer Science*.
Open Publishing Association, University of New South Wales, Sydney, 2017.

Satya Lokam* and R. Ramanujam, editors.
Proceedings of the 37th FST&TCS Conference, volume 93 of *LIPIcs: Leibniz International Proceedings in Informatics*.
Leibniz-Zentrum fuer Informatik, Schloss Dagstuhl, Germanay, 2018.

2.4 Teaching Programmes

An integral part of sustained research activity is training future generations of scientists and mathematicians. At IMSc this is done by supervising postgraduate and doctoral level thesis work. Motivated and bright students at the graduate and post-graduate level are selected every year through a national level Joint Entrance Screening Test followed by an interview. The selected students receive a fellowship throughout their tenure. They undergo one or two years of course-work, followed by doctoral thesis work under the guidance of a faculty member.

During 2017-2018, the student strength was 148 with 30 in Mathematics, 82 in Physics, 21 in Theoretical Computer Science, 15 in Biological Physics and Computational Biology.

10 PhD students obtained their doctoral degree and *3* students obtained their M.Sc., (by Research) degree during this period. *(See Section 2.3 "Degrees Awarded", for list)*

A total of 44 courses in all disciplines were taught at IMSc and 2 lecture courses for the undergraduate programme of CMI, during 2017-2018.
Apart from this main training activity, IMSc also offers the opportunity of learning for a few students during the summer vacation period. These students spend up to 6 weeks doing projects with faculty members. The faculty also supervises short-term projects during other periods. A total of 75 students availed these opportunities during 2017-2018.

2.5 Degrees Awarded

2.5.1 Doctoral Degrees Awarded during 2017 – 2018

Mathematics

Name: **Muthukrishnan, Subramani**
Thesis Title: Euclidean Algorithm for Certain Algebraic Number Fields
Thesis Advisor: Srinivas, K.
University: Chennai Mathematical Institute

Physics

Name: **Mayya, Ashwij**
Thesis Title: Role of Microstructure on Compressive Fracture of Cortical Bone: Experiments and Modeling
Thesis Advisor: Rajesh, R.
University: IIT Madras

Name: **John, Renjan R.**
Thesis Title: Non-perturbative aspects of supersymmetric gauge theories with surface operators
Thesis Advisor: Ashok, Sujay K.
University: HBNI

Theoretical Computer Science

Name: **Mathew, Anup Basil**
Thesis Title: Decidable subclasses of the distributed synthesis problem
Thesis Advisor: Ramanujam, R.
University: HBNI

Name: **Rai, Ashutosh**
Thesis Title: Parameterized Algorithms for Graph Modification Problems
Thesis Advisor: Saurabh, Saket
University: IMSc, HBNI

Name: **Misra, Pranabendu**
Thesis Title: Parameterized Algorithms for Network Design

Thesis Advisor: Saurabh, Saket
University: IMSc, HBNI

Name: **Chakraborty, Sankardeep**
Thesis Title: Space Efficient Graph Algorithms
Thesis Advisor: Raman, Venkatesh
University: HBNI

Name: **Kolay, Sudeshna**
Thesis Title: Parameterized Complexity of Graph Partitioning and Geometric Covering
Thesis Advisor: Saurabh, Saket
University: IMSc, HBNI

Name: **Meesum, Syed M.**
Thesis Title: Matrix Editing via Multivariate Lens
Thesis Advisor: Saurabh, Saket
University: IMSc, HBNI

Name: **Jayapaul, Varunkumar**
Thesis Title: Sorting and Selection in Restricted Models of Computation
Thesis Advisor: Raman, Venkatesh
University: Chennai Mathematical Institute (CMI)

2.5.2 Masters Degrees Awarded during 2017 – 2018

Physics

Name: **Vaibhav, Vinay**
Thesis Title: Heat Transport in Glass forming liquids
Thesis Advisor: Chaudhuri, Pinaki P.
University: Homi Bhaba National Institute

Theoretical Computer Science

Name: **Dudeja, Aditi**
Thesis Title: Pebble Games, Resolution and Some Lower Bounds
Thesis Advisor: Mahajan, Meena B.
University: HBNI

Name: **Arora, Vipul**
Thesis Title: Arithmetic Circuits: A Study
Thesis Advisor: Mahajan, Meena B.
University: CMI

2.6 Other Students

Students also do their projects under the supervision of our faculty during the academic year.The following students visited the institute during Apr, 2017 - Mar, 2018.

Student	Faculty
Mathematics	
Chowdhury, Sulakhana, IISER, Trivendrum	Srinivas, K.
Physics	
Diwakar, Pranav, BITS, Pilani	Ashok, Sujay K.
Ranjan, Mrinalini, Indian Institute of Space Science and Technology, Trivandrum	Sinha, Sitabhra
Theoretical Computer Science	
Neogi, Rian I., NIIT University, Rajasthan	Raman, Venkatesh
Atulya, M. S., PSG College of Technology, Coimbatore	Raman, Venkatesh
Suryanarayanan, Vaishali, PSG College of Technology	Raman, Venkatesh
Krishna, Pooja, PSG College of Technology	Ramanujam, R.
Akshaya, R., PSG College of Technology	Ramanujam, R.
Kabra, Aditya, IISER, Pune	Saurabh, Saket
Computational Biology	
Kumar, Rachita, SASTRA University	Samal, Areejit
Vijayakumar, Subathra, SASTRA University	Samal, Areejit

Burra, Prakruthi, BITS Hyderabad

Samal, Areejit

2.7 Collaborative Projects

Institute members are also involved in joint projects with colleagues from other national and international institutes. The following projects are ongoing:

- **Algorithms and Complexity of Algebraic problems:** The focus of this project is on algorithms and complexity theoretic questions for algebraic problems; more specifically, on identity testing problems, arithmetic circuit lower bounds, and isomorphism problems.

  The project is funded by the Indo Max Planck Centre for Computer Sciences (IMPECS). The principal investigators include V Arvind and Meena Mahajan from IMSc, and Markus Bläser from Saarland University, Germany, and B V Raghavendra Rao (formerly IMSc., later at Saarland University) from IIT-M and runs for a duration of 5 years beginning April 2011.

- **India-based Neutrino Observatory:** During this year INO reached an important stage. The project which had its birth at IMSc exactly 15 years ago in January 2000 got the full approval of the Government of India in January 2015. We have traveled quite far but have many more miles to go.

- **DINO (Darkmatter at INO) :** A multi-institutional collaborative project for the detection of Dark Matter has been initiated. The first meeting on this proposal was held on 24 August 2011 at TIFR, Mumbai and in the second meeting held at SINP, Kolkata, on 23-24 Dec 2011, the project has been given a more concrete form. Since the big Dark Matter detector will be mounted in the INO Cavern, it is to be called DINO (Darkmatter at INO). A MicroDINO to establish the technological feasibilty and a MiniDINO which will be internationally competetive have also been planned. From IMSc, M.V.N. Murthy and G. Rajasekaran are participating in this project.

- **Provably Efficient Pre-processing Algorithms :** This is a joint project with IMSc and Max Planck Institute for Informatik in Germany. The aim of the project is to design new lower and upper bounds for kernelization complexity of parameterized problems. This project is funded by Indo MaxPlanck Center for Computer Science(IMPECS). Venkatesh Raman and Saket Saurabh from IMSc are the Indian investigators in the project.

  From the German side, the investigators are Kurt Mehlhorn, Jiong Guo and Ondra Suchy.

- **Exact Geometry Computation:** The focus of this project was to devise exact algorithms for nonlinear problems in computational geometry, such as finding roots of polynomials and analytic functions, isotopic approximation of curves. The project is funded by the Indo Max Planck Centre for Computer Sciences (IMPECS). The principal investigator from the Indian side is Vikram Sharma, and from the German side Michael Sagraloff.

- **Electron Transport along Monoatomic Electrochemical Wire and chains:** A DST-DAAD project on Electron Transport along Monoatomic Electrochemical Wire and chains, involving IMSc and University of Ulm, Germany. A.K. Mishra and Vallan Bruno Cruz are the project members from Indian side and Prof. W. Schmickler and Ms. Sonja Bartenschlager are German participants.

- **Belle & Belle II Collaboration:** BELLE is an international collaboration of 371 physicists from 14 countries (Australia, Austria, China, Germany, India, Italy, Japan, Korea, Poland, Russia, Slovenia, Switzerland, Taiwan, and USA) and 60 institutions that are invovled in research pertaining to matter-antimatter differences and the study of other phenomenon accessible at the KEK-B collider operated by High Energy Accelerator Research Organization in Tsukuba, Japan. Rahul Sinha of IMSc was invited to join the Belle collaboration and is a member of Belle since July 2008. Belle II is a new collaboration for the upgraded facility which is under construction.

- **Decongesting India's Transportation Network**

  ITRA-Media Lab Asia Project on De-congesting Indias transportation networks using mobile devices. The project envisages the use of mobile phones to estimate congestion and traffic patterns on urban roads. Based on the congestion metrics thus obtained, the project aims to develop algorithms and tools for traffic planning and management, using the mobile phone as a service platform. The proposed solution strategy consists of two distinct focus areas. The first focus area deals with the problem of estimating mobile phone densities to measure prevailing congestion and traffic patterns. The second focus area involves developing algorithms for traffic routing, control and prediction, based on the estimated congestion. The proposed work has enormous potential for applications, such as dynamic route planning, peak hour rush control, routing of emergency vehicles to and from disaster affected areas, evacuation planning, and traffic prediction. In addition, this work is expected to shed new conceptual insights into the general problem of control of complex networks with strategic agents, by bringing together ideas from several technical disciplines.

2.8 Scientific Meetings and Visitor Program

The academic members of the Institute typically participate extensively in a large number of national and international scientific meetings.

An important aspect of research is interaction with peers. IMSc makes it possible for Scientific community of the Country by organising national and international scientific meetings. The Institute contributes towards such activities either by sponsoring them fully or partially. In this year, the following conferences were organized or co-sponsored by the Institute.

- Summer School Students Workshop (29/5/2017 – 2/6/2017)
- International Workshop on the Economy as a Complex System IV: Can economics be a physical science (13/11/2017 – 14/11/2017)

- Nag Memorial Endowment Lecture (22/1/2018)
- Mini-symposium on research in Tuberculosis (9/1/2018)
- Mechanical Properties of Complex Solids (5/9/2018)
- Academies‘ Lecture Workshop on Algebra (2/5/2017 – 4/5/2017)
- Correlation and Disorder in Classical and Quantum Systems (29/5/2017 – 2/6/2017)
- Student Talks on Trending Topics in Theory 2017 (8/5/2017 – 19/5/2017)
- Logic and Automata Theory: A tribute to Zoltan Esik (25/8/2017)
- Enriching Mathematics Education (14/9/2017 – 15/9/2017)
- Recent Advances in Parameterized Complexity (2/12/2017 – 8/12/2017)
- Number Theory: Arithmetic, Diophantine and Transcendence (22/12/2017 – 25/12/2017)

The annual activities included the following:

- Annual K.S. Krishnan Meeting on Quantum Matter and Quantum Entanglement
- Institute Seminar Week

Institute members and visitors discuss their work during weekly seminars. During 2017-2018 around 307 such seminars were held at IMSc.

2.8.1 OutReach Activities

Apart from engaging in high quality research and training activities, the Institute also recognizes its responsibility towards enhancing its interactions with academic colleagues in the university system. Currently, this occurs through two programs:

- **Associateship program:** The Institute has established *short-term associateships* in Mathematics, Theoretical Physics and Theoretical Computer Science to enable teachers from colleges and universities to work at the institute. Under this programme, an associate can visit the institute once or twice a year, up to a total of 90 days per year, with each visit lasting a minimum of three weeks. The tenure of an associate is for a period of three years and (s)he is expected to visit the institute at least twice during this period.

  The associates are given travel allowance and daily allowance to facilitate their visits to IMSc. During their visit, they are accommodated in the institute Guest House.

  The Institute has established short-term associateships in Mathematics, Theoretical Physics, Theoretical Computer Science and Computational Biology to enable teachers from colleges and universities to work at the institute. The programme is envisaged to develop interaction between the members of the faculty of the institute and scientists in the university system. Under this programme, an associate can visit the institute once or twice a year, up to a total of 90 days per year, each visit lasting a minimum of three weeks. The tenure of an associate will be for a period of three years and (s)he is expected to visit the institute at least twice during this period.
  The institute will bear the expenses of round-trip travel (by rail) from the Associate's normal place of work to Chennai and will also pay a daily allowance to cover local expenses at Chennai. During their stay at Chennai, Associates will be accommodated in the institute Guest House.
- **Science Popularization:** The Institute organizes *Popular Science Lectures* from time to time to keep the public informed as well as to enthuse the younger generation. IMSc outreach activities include a range of workshops and programs that bring students and teachers into direct contact with research scientists. Throughout the year, many eminent researchers and educators who visit our campus also give public lectures on various topics. One of our most recent outreach initiatives, "Science at the Sabha", is an annual event for the general public featuring talks on current scientific research.

  Many IMSc members also give talks in schools, colleges, clubs etc in their individual capacities.
  In this year, the following conferences were organized by the Institute, towards outreach activities.
  * *Teachers Enrichment Program (22/5/2017-27/5/2017)*
  * *Facets (3/7/2017 - 4/7/2017)*
  * *kaNita-kAnakam (23/10/2017)*
  * *Science Fun, Science Toys (2/11/2017)*

* *Scientists and School Education: A discussion (24/11/2017)*
* *Teachers Enrichment Workshop (27/11/2017 - 2/12/2017)*
* *Foldscope Workshop (2/1/2018)*
* *Science at the Sabha (11/2/2018)*
* *Indian Women in Science: Exhibition (11/2/2018)*

Details of the event are available at http://www.imsc.res.in/triveni/

The Institute has conducted various Conferences and workshops in addition to regular seminars during the academic year 2017-2018; The list of outreach activities includes the following: IMSc organised two workshops, during April to June, 2017, one for high school students and the other for college teachers in mathematics as part of the outreach activities. The special aspect of the 5 days workshop for high school students was that it was organised fully by IMSc PhD students. The goal of the workshop was to share the curiosity and excitement for mathematics. The students were led through various activities, from making conic sections by cutting clay cones to comparing different infinities. As part of IMSc's Enriching Collegiate Education program, the institute also held a week-long teachers training workshop for mathematics teachers from arts science colleges to bridge the gap between college and research level mathematics.

Teachers Enrichment Program: 22nd May – 27th May 2017 IMSc organised two workshops, one for high school students and the other for college teachers in mathematics as part of the outreach activities. The special aspect of the 5 days workshop for high school students was that it was organised fully by IMSc PhD students. The goal of the workshop was to share the curiosity and excitement for mathematics. The students were led through various activities, from making conic sections by cutting clay cones to comparing diferent infnities. As part of IMSc's Enriching Collegiate Education program, the institute also held a week-long teachers training workshop for mathematics teachers from arts science colleges to bridge the gap between college and research level mathematics.

Teachers Enrichment Program: 27th November – 2nd December 2017 This week-long workshop was aimed at mathematics teachers in Engineering colleges, to enable them to revisit and update content knowledge.

Discussion hours offered opportunities to get doubts cleared and work out exercises (both routine and advanced). About 65 teachers were selected from about 200 applicants. This program was part of IMScs Enriching Collegiate Education (ECE) series of workshops as an effort to facilitate interactions between research mathematicians and college teachers. Teachers routinely report that they find the program very helpful and are eager to participate in more such events. The workshop was held as a Teachers Enrichment Workshop, a series co-sponsored by the National Centre for Mathematics (NCM).

Organizers: Anirban Mukhopadhyay, K. Srinivas Speakers: S. Kesavan (IITM), K. N. Raghavan, P. Sankaran, K. Srinivas

"Facets, a 2 day outreach program was organized for advanced undergraduate and postgradu-

ate mathematics college students by V. Sushmita, IMSc during 3rd to 4th July, 2017. Several lectures on a range of topics from 'Cartography' to 'String theory' were given. The program was attended by about 200 students from various colleges in Chennai. Priyavrat Deshpande (Mathematics, CMI), Gautam Menon (Physics and Computational Biology, IMSc), R. Ramanujam (Theoretical Computer Science, IMSc), Shubashree Desikan (Science Desk, The Hindu) and Alok Laddha (Physics, CMI)) were panelists at this event.

The 6th edition of IMSc's outreach program Enriching Mathematics Education, aimed at secondary school mathematics teachers was organized by S Viswanath, during 14th - 15th of September, 2017. This workshop was hosted by PSBB School, KK Nagar. The program included lectures on topics from high school curriculum as well as several problem solving sessions encouraging students to undertake open-ended explorations of mathematical topics. The workshop was attended by 75 teachers.

Many mathematics teachers around the country have been benefited through visits to IMSc and interactions with academic members here. Recently, Ms.Usha Sangale, assistant professor in the department of mathematics, SRTM University, Nanded, Maharashtra, who has been a regular visitor to IMSc for the past five years, has done excellent work under the informal guidance of one of our faculty member. Her research earned her a Ph D degree which was awarded on 11th July 2017.

DAE/NBHM/NCM runs Advanced Instructional Schools in mathematics in addition to several other programmes. One such programme was held in KIIT, Bhubaneswar during 2015 in Analytic Number Theory. Two participants , Sudhir Pujahari, currently a PDF at HRI, and Jaban Meher, currently a faculty at NISER, Bhubaneswar, took up an open problem discusssed during that programme. That problem has now been solved and was published in the prestigious journal 'Bulletin of London Mathematical Society' Volume 49 (2017) pp 926936, with the title 'Zeros of L-functions attached to modular forms of half-integral weight'. The paper Is jointly authored by Jaban Meher, Sudhir Pujahari and Srinivas Kotyada.

Kanita Kaanakam: 23rd October 2017

This is the 1st edition of IMScs outreach program for school children in Tamil. The workshop is aimed at students of of class VIII - XII. The program included Mathematics activities conducted by IMSc members for students to engage with topics more interactively. About 125 students from various government and corporation schools from the area attended the program.

Organizer: Amritanshu Prasad Activities Handled: Sushmita V, Ramanathan Thinniyam, Janaki Raghavan, Anand Pathak, GArun Kumar, Madhusudhan Raman, Karthick Babu Speakers: Athmaraman Rajaratnam (Retired Headmaster), G. Youvaraj (Ramanujan Institute for Advanced Study in Mathematics, University of Madras), S.P. Suresh (Chennai Mathematical Institute)

Science Fun, Science Toys: 2nd November 2017

Arvind Gupta is a toy inventor and popularizer of science for kids. An IIT-Kanpur graduate,

he has been working since 1975 on innovative ways to teach and learn science. The talk was accompanied by demonstration of simple toys that he moulds out of trash and everyday goods to simplify the complex concepts of gravity, magnetic eld, friction, electricity, Newtonian laws among several other things. The talk was well attended, with students from CMI and IITM as well. The talk was followed by a discussion about how these toys could be used as educational aids with active participation from the audience.

Scientists and school education: A discussion: November 24 2017
Krishna Kumar Visiting Fellow, MIDS, Chennai; Formerly Professor, Delhi University and Director, NCERT. A discussion with Professor Krishna Kumar, an eminent educationist and scholar, will centred around: Can disciplinary researchers contribute meaningfully to school education? Should they? Over the course of the discussion, Prof. Krishna Kumar drew from his experience as the Director of NCERT to elucidate the what scientists can do to contribute to school curriculum and education.

Foldscope workshop: 2nd January, 2018 IMSc hosted a small Foldscope workshop for a diverse group of educators, teachers, students and users from IMSc, TIFR Hyderabad, APU, TNSF and local schools. The aim was to try out new Foldscopes (arranged for by DBT) and discuss curricula that can be designed around Foldscopes. Organizers: Jayashree Ramadas (TIFR Hyderabad), Varuni P
Science at the Sabha: 11th February 2018 "Science at the Sabha" is the flagship outreach event of the Institute of Mathematical Sciences. It connects accomplished mid-career scientists who care deeply about science communication, with the public at large. While IMSc organizes several other programs where scientists interact with those outside their peer group, these are for the most part targeted at specific audiences—usually some section of teachers or students—and are about the nitty-gritty of some slice of science itself (e.g., a school on quantum mechanics for university students, or a workshop for mathematics teachers at higher secondary level). None of these would be appropriate for a member of the lay public such as an IT professional, a business manager, a retired government servant, or an artist, even though they might have an abiding interest in science and a desire to know about the contributions that Indian scientists make. Science at the Sabha attempts to bridge this gap.
The Science at the Sabha event is always held on a Sunday afternoon, between 4 and 8pm, on a date close to the National Science Day. It was started in February 2016, and February 2018 saw the third edition of this program. Every year, there are four talks, of 40 minutes duration, with each followed by a short question-answer session. There is a half an hour refreshment break between the second and the third talks. At the end of the event, all the four speakers collectively field questions from the audience. Both before the event and during the break, IMSc screens videos that feature the institute and its contributions as well as other material relevant to science education and outreach. The event is advertised widely both via traditional media (poster distribution, newspaper articles, TV and radio

announcements) and on Twitter and Facebook. Video recordings of the entire proceedings are freely and perpetually available (for viewing/downloading) on the Science at the Sabha web page: https://www.imsc.res.in/triveni/

The topics featured at the event typically cover all the sciences and mathematics. In the most recent edition, for instance, there was a neuroscientist speaking on brain perception, a statistical physicist on why time goes forward, a chemical engineer speaking about composite materials, and a mathematician who described the basics of the theory of knots. Talks in the previous editions have dealt with the Indian monsoon, with subatomic particles, with insect flight, and with tiger conservation, among other topics. The speakers are chosen from mid-career scientists who enjoy the experience of explaining their work to a large, enthusiastic, but heterogeneous audience of non-experts. The point of the talks is to convey some of the spirit and excitement of recent scientific developments, avoiding technicalities. All editions of the event have featured both men and women speakers, with the cumulative numbers split about evenly.

The venue of this event is always the iconic Music Academy in Chennai, easily the most prominent of the "Sabhas" where music concerts are held, thus explaining the choice of the name. The Music Academy is centrally located and well equipped to accommodate a large gathering, with a total capacity of around 1400. A deliberate part of the design of this event is that scientists are speaking at a venue not usually associated with the sciences. This choice of venue for an outreach event was intended to break down the barriers that would inevitably exist if the audience had to enter a scientific institution to hear these talks.

Participation at the event is free and open to all. Online registration is, however, required, The actual number of people who showed up has been growing. Starting from an estimated 600–700 in the first edition, to about 800 in the second, numbers at the latest edition easily exceeded 1000. The number of registrations was over 1500 for the latest edition.

The day of this year's Science at the Sabha, 11 February 2018, was also the United Nations International Day for Women and Girls in Science. IMSc teamed up with the outreach organization "The Life of Science" to celebrate the occasion with a poster exhibition featuring 13 eminent Indian women scientists. The posters were displayed in the lobby of the Music Academy during the event and have also been borrowed by other institutions for display purposes since then. The event is extensively covered in the press, both before and after. The feedback that has been received has been uniformly positive, with many members of the public urging us to hold it even more regularly and speakers enthused by the opportunity to speak before an engaged audience at such an iconic venue.

Science at the Sabha: 11th February 2018 "Science at the Sabha" is the flagship outreach event of the Institute of Mathematical Sciences. It connects accomplished mid-career scientists who care deeply about science communication, with the public at large. While IMSc organizes several other programs where scientists interact with those outside their peer group, these are for the most part targeted at specific audiences—usually some section of teachers or students—and are about the nitty-gritty of some slice of science itself (e.g., a school on

quantum mechanics for university students, or a workshop for mathematics teachers at higher secondary level). None of these would be appropriate for a member of the lay public such as an IT professional, a business manager, a retired government servant, or an artist, even though they might have an abiding interest in science and a desire to know about the contributions that Indian scientists make. Science at the Sabha attempts to bridge this gap.

The Science at the Sabha event is always held on a Sunday afternoon, between 4 and 8pm, on a date close to the National Science Day. It was started in February 2016, and February 2018 saw the third edition of this program. Every year, there are four talks, of 40 minutes duration, with each followed by a short question-answer session. There is a half an hour refreshment break between the second and the third talks. At the end of the event, all the four speakers collectively field questions from the audience. Both before the event and during the break, IMSc screens videos that feature the institute and its contributions as well as other material relevant to science education and outreach. The event is advertised widely both via traditional media (poster distribution, newspaper articles, TV and radio announcements) and on Twitter and Facebook. Video recordings of the entire proceedings are freely and perpetually available (for viewing/downloading) on the Science at the Sabha web page: https://www.imsc.res.in/triveni/

The topics featured at the event typically cover all the sciences and mathematics. In the most recent edition, for instance, there was a neuroscientist speaking on brain perception, a statistical physicist on why time goes forward, a chemical engineer speaking about composite materials, and a mathematician who described the basics of the theory of knots. Talks in the previous editions have dealt with the Indian monsoon, with subatomic particles, with insect flight, and with tiger conservation, among other topics. The speakers are chosen from mid-career scientists who enjoy the experience of explaining their work to a large, enthusiastic, but heterogeneous audience of non-experts. The point of the talks is to convey some of the spirit and excitement of recent scientific developments, avoiding technicalities. All editions of the event have featured both men and women speakers, with the cumulative numbers split about evenly.

The venue of this event is always the iconic Music Academy in Chennai, easily the most prominent of the "Sabhas" where music concerts are held, thus explaining the choice of the name. The Music Academy is centrally located and well equipped to accommodate a large gathering, with a total capacity of around 1400. A deliberate part of the design of this event is that scientists are speaking at a venue not usually associated with the sciences. This choice of venue for an outreach event was intended to break down the barriers that would inevitably exist if the audience had to enter a scientific institution to hear these talks.

Participation at the event is free and open to all. Online registration is, however, required, The actual number of people who showed up has been growing. Starting from an estimated 600–700 in the first edition, to about 800 in the second, numbers at the latest edition easily exceeded 1000. The number of registrations was over 1500 for the latest edition.

The day of this year's Science at the Sabha, 11 February 2018, was also the United Nations

International Day for Women and Girls in Science. IMSc teamed up with the outreach organization "The Life of Science" to celebrate the occasion with a poster exhibition featuring 13 eminent Indian women scientists. The posters were displayed in the lobby of the Music Academy during the event and have also been borrowed by other institutions for display purposes since then. The event is extensively covered in the press, both before and after. The feedback that has been received has been uniformly positive, with many members of the public urging us to hold it even more regularly and speakers enthused by the opportunity to speak before an engaged audience at such an iconic venue.

Indian Women in Science Exhibition To mark the UN International Day of Women and Girls in Science on 11th February, IMSc partnered with The Life of Science (https://thelifeofscience.com/) to feature 13 Indian Women in Science as a poster exhibition. The posters described the work and the achievements of the scientists in their respective fields. The exhibition was displayed: Science at the Sabha 2018, The Music Academy: 11th February 2018, Chennai Mathematical Institute: 5th to 9th March 2018 We plan to display the poster at various other public places in the coming months.

Collaborators: Aashima Dogra Nandita Jayaraj (TloS) Organizers: Gautam Menon, Varuni P

2.8.2 Visitors from Other Institutions:

Research is often a collaborative activity and is boosted by a vibrant visitor program. The Institute hosts a large number of short term and long term visitors. During the year 2017-18, 260 scientists have visited the Institute. A list of few Distinguished visitors to the Institute during this period is listed below:

Distinguished Visitors to the Institute during the year 2017-18

Jean-Marc Deshouillers	(1.4.17 - 9.4.17) & (12.1.18 - 10.2.18)	University of Bordeaux
Kalyan Bidhan Sinha	22.4.17 - 30.4.17	JNCASR, Bangalore
Muthukumar M.	31.7.17 - 4.8.17	University of Masschussets, USA
Kumar Murty V.	(23.8.17 - 2.9.17) & (21.2.18 - 1.3.18)	University of Toranto
Ashoka Sen	11.10.17 - 17.10.17	HRI, Allahabad
Daniel Lokshtanov	23.10.17 - 28.10.17	University of Bergan, Norway
Phillippon P.	29.10.17 - 11.11.17	CNRS
Xavier Viennot	17.12.17 - 18.3.18	CNRS, Bordeaux
Indranil Biswas	22.1.18 - 23.1.18	TIFR, Mumbai
Nilendra Deshpande	18.2.18 - 23.2.18	Univ. of Oregon, USA
Winfried Kohnan	21.2.18 - 24.2.18	Univ. of Heidelberg
Balachandran A.P.	(4.8.17 - 25.8.17) & 11.3.18 - 10.6.18	Syracuse University
Jacobo Toran	9.3.18 - 23.3.18	University of Ulm, Germany
Srinivasa Varadhan	-	New york University
Hans Van Ditmarsch	-	Loria, Vandoeuure France

Figure 6: Teachers Enrichment Program 22nd May - 27th May 2017.

Figure 7: "Facets", a 2 day outreach program 3rd July 2017 - 4th July 2017.

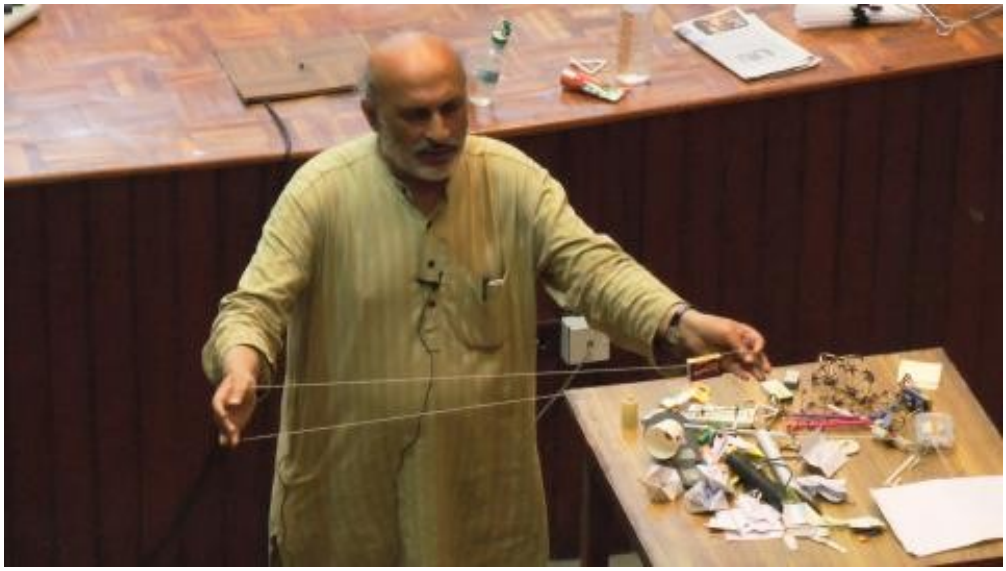

Figure 8: Science Fun, Science Toys: 2nd November 2017.

Figure 9: Foldscope workshop: 2nd January, 2018.

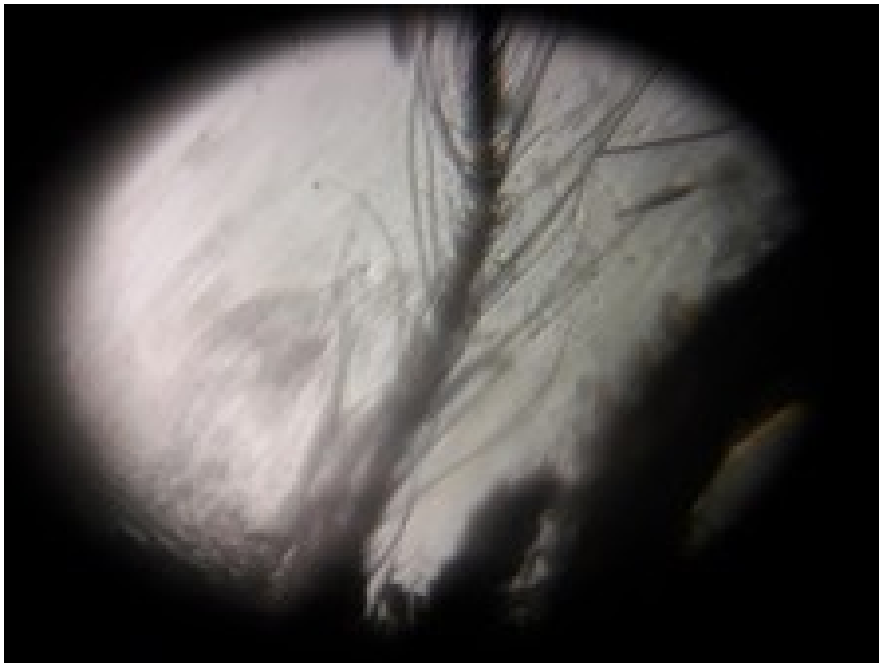

Figure 10: Foldscope workshop: 2nd January, 2018.

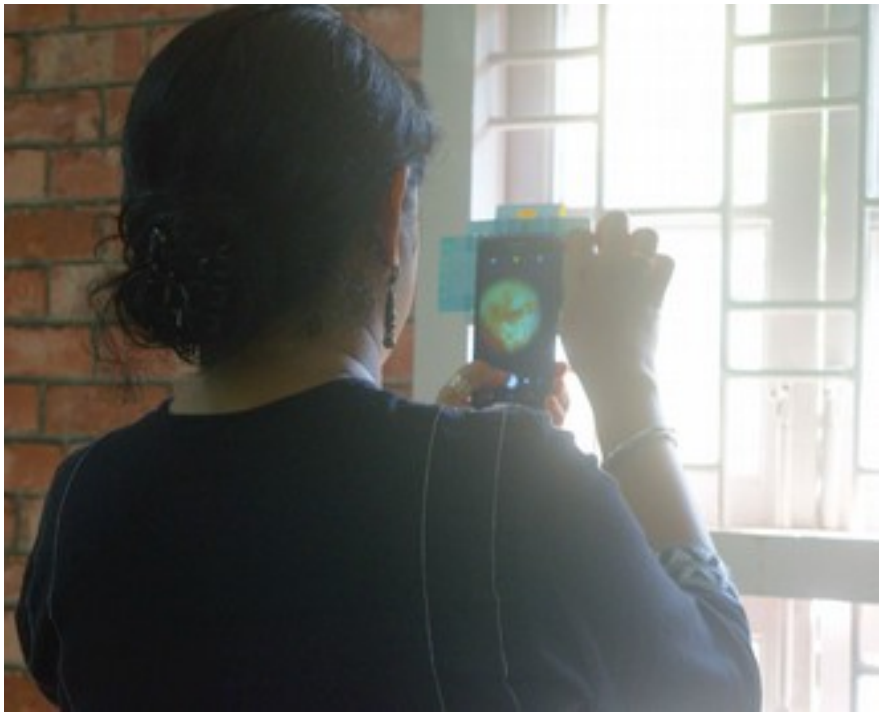

Figure 11: Foldscope workshop: 2nd January, 2018.

Figure 12: Science at the Sabha 2018, The Music Academy: 11th February 2018.

Figure 13: Indian Women in Science Exhibition, The Music Academy: 11th February 2018,

Figure 14: Indian Women in Science Exhibition, Chennai Mathematical Institute: 5th to 9th March 2018

3 Audited Statement of Accounts for the year 2017-2018

As per clause 29 of the Constitution and Bye - Laws of the Institute, the Accounts of the Institute shall be audited by Professional Chartered Accountants as prescribed by the law. The audit of the Accounts of the Institute for the Financial year 2017-18 was taken up and complied by Professional Auditors M/s Sonny Associates, Chennai - 600 041. The Report of the Auditors and the Audited Statement of Accounts including the Provident Fund Accounts for the year 2017-18 are attached herewith for reference.