



THE INSTITUTE OF MATHEMATICAL SCIENCES

C. I. T. Campus, Taramani,

Chennai - 600 113.

ANNUAL REPORT

Apr 2019 - Mar 2020

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Foreword

I am happy to present the annual report of the Institute for 2019-2020 and put forth the distinctive achievements of its members during the year along with a perspective for the future.

During the period April 2019 - March 2020, there were 144 students pursuing their PhD and 42 scholars pursuing their post-doctoral programme at IMSc.

Spread through this period, the Institute organized or co-sponsored several workshops and conferences. The *First IMSc discussion meeting on extreme QCD matter* held during Sep 16-21, 2019 brought together senior scientists to deliver a set of pedagogic lectures on the current state-of-the-art, open problems and challenges in the area of hot and dense QCD matter. The annual meeting of the International Pulsar Timing Array (IPTA) was organized during Jun 10 - Jun 21, 2019 by its Indian arm, of which IMSc is a part.

An NCM sponsored workshop on *Combinatorial Models for Representation Theory* was organised in IMSc during Nov 4-16, 2019 and saw active participation from Ph.D students and postdocs from across the country. An ACM-India Summer School on *Graphs and Graph Algorithms* and a meeting on *Recent Trends in Algorithms* were both organised during the year.

We note with a lot of satisfaction that our outreach programmes have expanded in scope and reach during this year. Our regular events such as the *Teachers Enrichment Workshop*, *Vigyan Pratibha Chennai Regional Teachers Workshop*, *Summer School Students Workshop*, *Facets*, *kaNita-kAnakam*, *Enriching Mathematics Education* and *Science at the Sabha* continued to draw enthusiastic participants across the spectrum - students, teachers and the general public. In addition, newer events were organised this year such as the *TNSF Chithirai FEST-I*, *Topics in Biology* and *Excitement in Science*. In the run-up to and during The annular solar eclipse of December 26, 2019, many institute members worked with local science popularization organizations in various public activities such as distributing masks and spreading awareness about eclipses. The institute also organised some one-off public lectures on *Using ancient DNA to understand Indian history*, *Logic for non-persons?*, *The Cryosphere and Climate of the Earth*, *A Symplectic World View* and *Science Communication and Education whose Science, for whom?*. The outreach related activities in the Institute are the initiative of several institute 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.

Research productivity of the members of the Institute has been excellent throughout the year. Several high quality publications have been reported in national and international journals, and some of the research work carried out has also been presented in international conferences.

A total of 16 students were awarded 'PhD' degree, 12 students have submitted their PhD theses. 5 students were awarded 'MSc by Research' degree, under the supervision of our faculty.

There are several ongoing collaborations between other institutions, both national and international, and research groups of IMSc. Among these, we mention a few. *Arecibo 327 MHz Drift Pulsar Survey (AO327)* is an international effort to discover pulsars and transients

using the Arecibo radio telescope (USA). The institutes involved are Naval Research Laboratory USA, University of New Mexico USA, West Virginia University USA, IMSc India (Manjari Bagchi) and Max-Planck-Institut fur Radioastronomie Bonn Germany. IMSc is also part of another such effort, using the uGMRT in Pune, along with collaborators from NCRA-TIFR Pune, SINP Kolkata, IUCAA Pune, RRI Bangalore, NISER Bhubaneswar, University of California Berkeley (USA), and ASTRON (The Netherlands).

IMSc is now an international research laboratory for the *Indo-French Program in Mathematics* for four years. The Institute is part of an R&D Networked joint Center involving partners at Jawaharlal Nehru Centre for Advanced Scientific Research (Bengaluru), Brandeis University (USA), National Centre for Biological Sciences (Bengaluru) and Northeastern University (USA), to pursue theoretical and computational research on the localization of pathways by which stress propagates in disordered, soft matter and biological systems. A new CEFIPRA funded project on *Modeling Soft Glass flow from micro to macro scale* is a collaboration with the Universit Grenoble Alpes, Grenoble, France. As part of the ongoing *Max Planck Partner Group in Mathematical Biology*, IMSc has been collaborating with MPIMIS Leizig on the study of biological networks.

During 2019-2020, a total of 35 lecture courses were conducted at the Institute.

We are proud to note the awards and honors bestowed on our faculty for their contributions: Amritanshu Prasad was elected Fellow of the Indian Academy of Sciences 2019. Dishant Pancholi was awarded *The Shanti Swarup Bhatnagar Prize for Science and Technology* in Mathematical Sciences for 2019. Saket Saurabh, was elected Fellow of the Indian Academy of Sciences 2019. R. Ramanujam was awarded the *The Indira Gandhi Prize for popularization of science for 2020*. Biplab Paul, a recent graduate student in Mathematics, has been awarded the *JSPS post-doctoral fellowship* in Japan. Roohani Sharma, a senior research fellow (graduate student) in Theoretical Computer Science was offered a *Lisa Meitner Award postdoctoral fellowship for excellent women computer scientists* at the Max Planck Institute for Informatics, that allows her to pursue independent research.

The last year also witnessed a sad event for the Institute. Prof. S.K. Joshi, former Chairman of the IMSc Executive Council and member of the IMSc Governing Board, passed away on May 15, 2020. The Institute deeply mourns his demise and places on record its appreciation for his contributions as Chairman of the Executive Council, a position which he held for over two decades.

This report was compiled through the efforts of the IMSc Annual Report Committee comprising of Drs. Areejit Samal, Sayantan Sharma, Shrihari Gopalakrishna, Vikram Sharma, S. Viswanath, Paul Pandian and Usha Devi. I owe my gratitude to all of them.

June, 2020

V. Arvind

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Chapter 1

The Institute

1.1 Governing Board

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

Shri. **K.N. Vyas**,
Chairman, Atomic Energy Commission & Secretary to Government of India,
Department of Atomic Energy, Mumbai
(**Co-Chairman**)

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

Prof. **Mustansir Barma**,
Former Director, TIFR Mumbai, Professor
Emeritus, TIFR Centre for interdisciplinary
Sciences(TCIS), Hyderabad
(**Member**)

Prof. **Amitava Raychaudhuri**,
Former Director, HRI, Allahabad, Professor
Emeritus, University of Calcutta, Kolkata
(**Member**)

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

Prof. **Sudhanshu Jha**,
Former Director, TIFR Mumbai, Mumbai
(**Member**)

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

Ms. **Richa Bagla**, IAS
Joint Secretary(Finance) to Govt. of India,
Department of Atomic Energy, Mumbai
(**Member**)

Selvi. **Apoorva**, IAS
Principal Secretary to Government,
Secretariat, Fort St.George, Chennai
(**Member**)

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

1.2 Executive Council

Shri. **K.N. Vyas**,
Chairman, Atomic Energy Commission &
Secretary to Government of India,
Department of Atomic Energy, Mumbai
(**Chairman**)

Prof. **Mustansir Barma**,
Former Director, TIFR,
Professor Emeritus,
TIFR Centre for interdisciplinary Sciences
(TCIS), Hyderabad
(**Member**)

Prof. **Amitava Raychaudhuri**,
Former Director, HRI, Allahabad,
Professor Emeritus, University of Calcutta,
Kolkata
(**Member**)

Prof. **Manindra Agrawal**,
Department of Computer Sciences and
Engineering,
Indian Institute of Technology, Kanpur
(**Member**)

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

Ms. **Richa Bagla**, IAS
Joint Secretary (Finance) to Govt. of India,
Department of Atomic Energy, Mumbai
(**Member**)

Selvi. **Apoorva**, IAS
Principal Secretary to Government,
Secretariat, Fort St. George, 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 and Publicity Minister of Government of Tamilnadu.

Shri. K. N. Vyas, Chairman, Atomic Energy Commission & Secretary to Govt. of India, Department of Atomic Energy, CSM Marg, Mumbai
(**Co-Chairman**, *Governing Board* & **Chairman**, *Executive Council*)
Shri Kamlesh Nilkanth Vyas is a Mechanical Engineering graduate from MS University, Vadodara. After completion of the training in the 22nd Batch of the BARC Training School in 1979, he joined Fuel Design Development Section of Reactor Engineering Division of BARC. Shri Vyas has worked for design & analysis of nuclear reactor fuels. He was also responsible for design & development of a novel fuel for strategic applications. He has worked extensively in thermal hydraulics and stress analysis of critical reactor core components. Mr. Vyas, as an engineer, has played a key role for completion of strategic projects. Shri Vyas has also participated in design & analysis of the Test Blanket Module planned to be installed in ITER, France.

Shri Vyas has been conferred several awards, which include Indian Nuclear Society Outstanding Service Award 2011, Homi Bhabha Science and Technology Award 2006, DAE Awards in the years 2007, 2008, 2012 and 2013. He is also a Fellow of the Indian National Academy of Engineers. Shri K. N. Vyas was Director, Bhabha Atomic Research Centre, before he has taken over the charge of Secretary, Department of Atomic Energy and Chairman, Atomic Energy Commission on 20.09.2018.

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*)

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 Sri" and the "Padma Bhushan" for his contributions.



Prof. Mustansir Barma Professor Emeritus, TIFR Center for interdisciplinary Science, Hyderabad

(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 Professor Emeritus, 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.

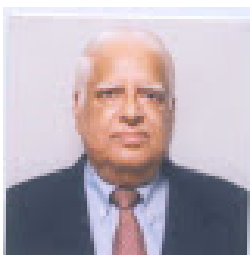
Dr. P. Duraisamy, Vice Chancellor, University of Madras, Chennai
(Member, Governing Board)



Dr. 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*)
He was Joint Secretary, Ministry of Home Affairs.



Ms. Richa Bagla, IAS
Joint Secretary(Finance) to Govt. of India,
Department of Atomic Energy, Mumbai
(**Member**, *Governing Board & Executive Council*)



Selvi. **Apoorva, IAS**
Principal Secretary to Government,
Secretariat, Higher Education Dept., Government of Tamilnadu, Chennai
(**Member**, *Governing Board & Executive Council*)



Prof. **Manindra Agrawal**,
Department of Computer Sciences and Engineering,
Indian Institute of Technology, Kanpur
(**Member**, *Executive Council*)

Prof. Manindra Agrawal is a professor at the Department of Computer Science and Engineering and the Deputy Director at the Indian Institute of Technology, Kanpur. He was also the recipient of the first Infosys Prize for Mathematics and the Shanti Swarup Bhatnagar Award in Mathematical Sciences in 2003. He has been honored with Padma Shri in 2013.



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

1.2.2 Director's Advisory Committees

Annual Report Committee

Viswanath , S. Chair
Shrihari Gopalakrishna
Vikram Sharma
Paul Pandian (Library)
Areejit Samal
Sayantan Sharma

Alumni Committee

Partha Mukhopadhyay Chair
Meena Mahajan
Sanoli Gun
Pinaki Chaudhuri (as CC-Chair)
Paul Pandian
Raveendra Reddy, B.

Computer Media & Web Committee

Pinaki Chaudhuri Chair
Venkatesh Raman
Raghavan, K.N.
Rahul Siddharthan
Satyavani Vemparala
Sanoli Gun
Sayantan Sharma
Subramoniam, G. SO'F'(Systems)
Raveendra Reddy, B. SO'F'(Systems)
A student representative (nominated by the Chair)

Events & Outreach Committee

Raghavan, K.N.
Areejit Samal Chair
Ajit C Balram
Sushmita Venugopalan
Varuni Prabhakar Research Associate

Internal Complaints Committee (Gender Bias Redressal)

Indumathi, D. Chair
Rajesh Ravindran
Sanoli Gun
Vishnu Prasad, S. Registrar
Indra, R. Administrative Officer
Geetha, V. (External Member)
A Student representative (Nominated by the Chair)

Grievance Redressal Committee

Meena Mahajan Chair
Amritanshu Prasad
Sanatan Digal
Sujoy Ashok

Guest House Advisory Committee

Pralay Chatterjee Chair
Ravindran, V.
Saket Saurabh
Vishnu Prasad, S. Registrar
(A Student Representative) (Nominated by the Chair)

HBNI Coordinators Committee

Amritanshu Prasad Dean, Student Affairs
Sibasish Ghosh Dean, Physical Sciences
Sanatan Digal Associate Dean, Physical Sciences
Vijay Kodiyalam Dean, Mathematical Sciences
Sitabhra Sinha Dean, Life Sciences

Hostel Faculty Counselor Committee

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

Manjari Bagchi Chair
Nita Sinha
Vikram Sharma

Housing & Up-Keep Committee

Ravindran, V. Chair
Pinaki Chaudhuri
Chandrashekar, C.M.
Vishnu Prasad, S. Registrar
Indra, R. Administrative Officer

Library Committee

Subramanian, C.R.
Amritanshu Prasad Chair
Sitabhra Sinha
Chandrashekar, C.M.
Manjari Bagchi
Paul Pandian (Librarian)
Chandrashekhar, K. (Student Member)

National Science Day Committee

Raghavan, K.N.
Ravindran, V.

Vikram Sharma
Sushmita Venugopalan

Official Language Implementation Committee [OLIC]

Arvind, V.	Chair
Srinivas, K.	
Saket Saurabh	
Nita Sinha	
Vishnu Prasad, S.	Registrar
Vinay Vaibhav	(Student Member)

PDF Committees

Srinivas, K. & Pralay Chatterjee	Mathematics
Manjari Bagchi	HEP
Satyavani Vemparala & Sibasish Ghosh	LEP
Sitabhra Sinha & Ajit C. Balram	

Refurbishment Committee

Saket Saurabh	Chair	
Anirban Mukhopadhyay		
Partha Mukhopadhyay		
Chandrasekar, K.	Ex-Chief Architect,	IGCAR
Vishnu Prasad, S.	Registrar	
Sundar, M.	SO 'D' (Civil)	
Mohan, S.	SO 'E'(Electrical)	

Right To Information Act [RTI] Committee

Venkatesh Raman	Appellate Authority
Vishnu Prasad, S.	Public Information Officer

Space Planning & Allocation Committee

Arvind, V.	Chair
Amritanshu Prasad	
Indumathi	
Hassan, S.R.	
Chandrashekar, C.M.	
Subramanian, C.R.	
Vishnu Prasad, S.	Registrar

Institute Seminar Day

Viswanath, S.
Areejit Samal
Sayantan Sharma
Vikram Sharma

Tender Committee

Satyavani Vemparala Chair
Hassan, S.R.

Sports/GYM Committee

Vikram Sharma

Partha Mukhopadhyay

Sundar, S.

Manjari Bagchi

Student Members :

Rakesh Netha (*Cricket*)

Pranendu Darbar(*Foot ball& Tennis*)

Anupam Sarkar(*Badminton*)

Mrigendra Singh(*Table Tennis*)

Science at the Sabha Committee

Rahul Siddharthan Chair

Viswanath, S.

Vishnu Prasad, S.

Approval Coordinators Committee

Shrihari Gopalakrishna

Physics

Srinivas, K.

Mathematics

Meena Mahajan

TCS

Sitabhra Sinha

Computational Biology

Colloquium & Seminar Committee

Nemani, V.S.

Physics

Dishant Pancholi

Mathematics

Vikram Sharma

TCS

Summer Programme Committee

Venkatesh Raman

TCS

Dishant Pancholi

Mathematics

Pinaki Chaudhuri

Physics

Associates Programme Committee

Arvind, V.

Chair

Venkatesh Raman

TCS

Srinivas, K. &

Pralay Chatterjee

Mathematics

Mukul Laad

Physics

Academic Coordinators Committee

Satyavani Vemparala

Physics

Sundar, S.

Mathematics

Subramanian, C.R. TCS

JEST Coordinators Committee

Rajesh Ravindran	Physics(JEST)
Pralay Chatterjee	Mathematics(NBHM)
Saket Saurabh	TCS(JEST)
Rahul Siddharthan	CB(JGEEBILS)

Group Conveners Committee

Chandrashekar, C.M.	- LEP
Manjari Bagchi	- HEP
Raghavan, K.N.	- Mathematics
Venkatesh Raman	- TCS
Rahul Siddharthan	- Computational Biology

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

1.3 Faculty

Name

Userid

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
Pancholi, Dishant Mayurbhai	dishant
Prasad, Amritanshu	amri
Raghavan, K. N.	knr
Roy, Indrava	indrava
Sankaran, P.	sankaran
Srinivas, K.	srini
Sundar, S.	ssundar
Sushmita Venugopalan	sushmita
Viswanath, S.	svis

Physics

Adhikari, Ronojoy	rjoy
Ashok, Sujay K.	sashok
Bagchi, Manjari	manjari
Balram, Ajit C.	ajit
Chandrashekar, C.M.	chandru
Chaudhuri, Pinaki	pinakic
Digal, Sanatan	digal
Ghosh, Sibasish	sibasish
Gopalakrishna, Shrihari	shri
Hassan, Syed Raghob	shassan
Hazra, Dhiraj Kumar	dhiraj
Indumathi, D.	indu
Laad, Mukul S.	mslaad
Menon, Gautam I.	menon

Mukhopadhyay, Partha	parthamu
Nemani, Venkata Suryanarayana	nemani
Pius, Roji	rojipius
Rajesh, Ravindran	rrajesh
Rama, S. Kalyana	krama
Ramachandran, Ganesh	ganesh
Ravindran, V.	ravindra
Sathiapalan, Balachandran	bala
Sayantana 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
Mahajan, Meena	meena
Raman, Venkatesh	vraman
Ramanujam, R.	jam
Saivasan, Prakash	prakashs
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

Vasudevan, T.V.

Parthiban, V.

Ashfack Ahmed, G.

Geetha, M.

Padmanabhan, T.

Prema, P.

Jayanthi, S.

Baskaran, R.

Balakrishnan, J.

Moorthy, E.

Radhakrishnan, M. G.

Ramesh, M.

Tamil Mani, M.

Shankaran, K.P.

Seenivasa Raghavan N.

Usha Otheeswaran

Archana Shukla

Babu, B.

Johnson, P.

Gopinath, S.

Amulraj, D.

Janakiraman, J.

Munuswamy, N.

Rajasekaran, N.

Ravichandran, N.

1.7 Project Staff

1.7.1 Project Staff [Non Academic]

Name

Balachander M.

Gayathri S.

Hari Priya T.V.

Hemamalini A.

Imran Khan H.

Jayakumar P.

Karthikeyan B.S.

Karthikeyan M.

Kirubananth P.

Krishna Balaji R.

Kavyaa Kumaravel

Mangala Pandi P.

Manikandan Sambasivam

Moovendan M.

Narmatha S.

Parthasarathi N.

Prashanna K.

Userid

mbchander

gayathris

tvhpriya

ahema

imrankhan

jayakumarp

bskarthi

mkarthikeyan

kirubananth

rkbalaji

kavyaak

mangal

moovendan

snarmatha

npsarathi

prasannak

Rajkumar S.	srajkumar
Rethinasamy D.	drsamy
Sadhana R.	sadhana
Sakthivel Murugan E.	esakthi
Shalieni D.	shalienid
Sivasubbu Raj B.	sivaraj
Sreelakshmi P.K.	lakshmipk
Srinadh G.	gsrinadh
Srinivasan G.	gsvasan
Sree Raj T.P.	sreeraj
Thennarasu S.D.	sdthennarasu
Vaideeswaran	mveswaran
Vimalraj J.	vimalraj
Vinoth Babu M.	mvinoth

1.7.2 Project Staff [Scientific/Academic]

<u>Name</u>	<u>Userid</u>
Gajendra Singh Badwal	
Harish, K.	
Janaki Raghavan	rjanaki
Md. Izhar Ashraf	ashraf
Shakthi N. Menon	shakthi
Soumya Easwaran	soumyae
Sudharshan A.	
Surendra Singh Badwal	
Varuni Prabhakar	varuni
Vinod Kumar T.	tvinodkumar

1.8 Post-Doctoral Fellows

<u>Name</u>	<u>Userid</u>
Computational Biology	
Nayana Mukerjee	nayanam
Om Prakash	omprakash
Sushmita Ghosh	susmitag
Mathematics	
Abishek Juyal	ajuyal
Amit Kumar Singh	amitsingh

Anbu Arjunan	aanbu
Anuj Jakhar	anujjakhar
Balesh Kumar	baleshk
Chandranandan Gangopadhyay	chandrang
Jyotirmoy Ganguly	jyotirmoy
Kathiravan T.	tkathiravan
Neha Prabhu	nehap
Selvaraja S.	selvaraja
Soumya Dey	soumyadey
Suratno Basu	suratnob
Usha Keshav Sangale	uksangale
Veekesh Kumar	veekeshk

Physics

Abhiram Kaushik B	abhiramkb
Amit Mukherjee	amitm
Arghya Chattopadhyay	arghyac
Arpan Das	arpandas
Arpita Choudhary	arpitac
Arunprasath V.	arunprasath
Asweel Ahemed A Jaleel	asweel
Bala Subramanian P.N.	pnbala
Bijoy Daga	bijoydaga
Chandreyee Roy	chandreyeer
Chandrima Paul	chandrimap
Gautam Sharma	gsharma
Karthick H.S	hskarthick
Prasad V.V.	prasadvv
Rahul Dandekar	rsdandekar
Samapan Sikdar	samapans
Shreyansh Shankar Dave	shreyanshsd
Srimoy Bhattacharya	srimoyb
Subhronel Chakrabarti	subhronelc
Suman Dutta	sumand

Theoretical Computer Science

Anupam Mondal	anupamm
Gurumuruhan Ganesan	ghurung
Pallavi Jain	pallavij
Purbita Jana	purbitajana
Vibha Sahlot	vibhasahlot

1.9 Ph.D. Students

Name

Userid

Computational Biology

Ajay Subbaroyan	sajay
Ajaya Kumar Sahoo	ajayaks
Chandrani Kumari	chandranik
Chandrashekar K. A.	kachandra
Devanand T.	devanandt
Farhina Mozaffer	farihinam
Janani R.	jananir
Pavitra S.	spavitra
Rakshika Lakshmi, A.	rakshikal
Reshma M	reshmam
Ria Ghosh	riaghosh
Sreevidya T.S	tssreevidya
Sunayanaa Sridharan	sunayanaas
Vadnala Rakesh Netha	rakeshnetha
Vivek Ananth R.P.	vivekananth

Mathematics

Ankur Sarkar	ankurs
Aritra Bhattacharya	baritra
Avijit Nath	avijitnath
Biplab Paul	biplabpaul
Dhananjaya Saha	dhananjayas
Digjoy Paul	digjoypaul
Jayakumar R.	rjayakumar
Jyothsnaa S.	jyothsnaa
Karthick Babu C.G.	cgkbbabu
Krishanu Roy	krishanur
Manas Mandal	manasm
Manav Gaddam	manavg
Mrigendra Singh Kushwaha	mrigendra
Nabanita Roy	nabanitar
Namitha C.H	namithach
Neelam	neelam
Oorna Mitra	oornamitra
Piyasa Sarkar	psarkar
Pranendu Darbar	dpranendu
Priyamvad Srivastav	priyamvads
Rashi Sanjay Lunia	rashisl
Ratheesh T.V	ratheeshtv
Rupam Karmakar	rupamk

Sathish Kumar, V.	vsathish
Siddheswar Kundu	siddheswark
Snehajit Misra	snehajitm
Sridhar P. Narayanan	sridharn
Sruthy Murali	sruthym
Sunil L Naik	sunilnaik
Tanmoy Bera	tanmoyb
Saurav Holme Choudhury	sauravhe
Ujjal Das	ujjaldas

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
Anjali Kundalpady	anjalik
Ankita Chakrabarti	ankitac
Anupam A.H.	anupam
Anupam Sarkar	asarkar
Aparajitha Karthikeyan	aparajithak
Aparna Sankar	aparnas
Apurba Biswas, G.	apurbab
Arindam Mitra	amitra
Arjun Hariharan	arjunh
Arkajyoti Manna	arka jyotim
Arpan Kundu	akundu
Bhargava B.A.	bhargavaba
Dheeraj Kumar Mishra	dkmishra
Dhruv Pathak	dhruvpathak
Dipanjan Mandal	mdipanjan
Garima Rani	grani
Gopal Prakash	gopalp
Himanshu Badhani	himanshub
Hitesh Garg	hiteshgarg
Jilmy P. Joy	jilmyo
Jyotijwal Debnath	jdebnath
Kamal Tripathi	kamalt
Koyena Bose	koyenb
Mahaveer Prasad	mahaveerp
Mamale Vinod Suryakant	mvinod
Manish	manishd
Mohammad Shabbir	mshabbir
Nishant Gupta	nishantg

Pavan Dharanipragada	pavand
Pooja Mukherjee	poojamukherjee
Prabhat Butola	prabhatb
Prafulla Oak	prafullao
Prateek Chawla	prateekc
Prashanth Raman	prashanthr
Prathik Cherian J.	prathikej
Prem Kumar	premk
Pritam Sen	pritamsen
Raghvendra Singh	raghvendra
Ravi T	travi
Ria Sain	riasain
Ravi Shanker	rshanker
Sabiar Shaikh	sabiarshaikh
Sabyasachi Chowdhuri	sabyasachic
Sahil	sahilm
Sanjoy Mandal	smandal
Saroj Prasad Chhatoi	sarojpc
Sayantana Ghosh	sayantang
Semanti Dutta	semantid
Shibasis Roy	shibasir
Shilpa Kastha	shilpakastha
Shivam Gola	shivamg
Shivani Singh	shivanis
Soumya Sur	soumyasur
Soumen Podder	soumenp
Sourav Ballav	sballav
Subhankar Khatua	shubankark
Sujoy Mahato	sujoymahato
Surabhi Tiwari	surabhit
Subashri, V.	subashriv
Sushovan Mondal	smondal
Sumit Shaw	sumitshaw
Tanmay Mitra	tmitra
Tanmay Saha	sahatanmay
Tanmoy Sengupta	tsengupta
Toshali Mitra	toshalim
Umang A. Dattani	umangad
Vaibhav Pathak	vaibhavp
Varun Gupta	varungupta
Vignesh, B.	bvignesh
Vigneshwar N.	vigneshwarn
Vigneshwaran K.	vigneshwaran
Vinay Vaibhav	vinayv

Theoretical Computer Science

Abhishek Sahu	asahu
Abhimanyu Choudhury	abhimanyuc
Abhranil Chatterjee	abhranilc
Anantha Padmanabha M.S.	ananthap
Arindam Biswas	barindam
Ashwin Jacob	ajacob
Gaurav Sood	gauravs
Jayakrishnan M.	jayakrishnan
Lawqueen Kanesh	lawqueen
Niranka Banerjee	nirankab
Prafullakumar Prabhakar Tale	pptale
Ramit Das	ramitd
Roohani Sharma	roohani
Rian Neogi	rianneogi
Sanjukta Roy	sanjukta
Souvik Saha	souviks
Yogesh Dahiya	yogeshdahiya

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, 2019 - Mar, 2020.

Student

Faculty

Computational Biology

Pavithra Elumalai, PSG College of Tech, Coimbatore	Areejit Samal
Yogesh.S, IISER, Kolkata	Rahul Siddharthan
Reethu Anand.A, SASTRA University, Tanjore	Sitabhra Sinha
Shiva Ramakrishna.S, SASTRA University, Tanjore	Sitabhra Sinha

Mathematics

Sanyam Gupta, IISER, Berhampur	Anirban Mukhopadhyay
Sreejani Chaudhury, University of hyderabad	Anirban Mukhopadhyay
Gurieenkaur Nanda, IISER, Bhopal	Raghavan K.N.
Vignesh S, ISI kolkata	Raghavan K.N.
Aishwarya S. Dabhale, Fergusson College , Pune	Sanoli Gun
Swathi Sucharita, Central University of Orissa, Orissa	Sanoli Gun
Ujjwal K.R. Sana, CMI, Chennai	Sanoli Gun
Kiran, D, IISER Bhopal	Srinivas K.

Supriya P.I., PSG College of Technology, Coimbatore
Sourav Ghosh, CMI, Chennai
Amrutha B Nair, IISER, Thiruvananthapuram

Srinivas K.
Sushmita Venugopalan
Viswanath S.

Physics

Abhaya S Hedge, IISER Thiruvananthapuram
Deepthi P.G., Central University of Tamilnadu, Thiruvarur
Gourab Pal, IIT Madras
Khyati Jain, BITS, Goa
Sarvesh Srinivasan, BITS Pilani
Sree Ganesh Kumar Reddy, NIT Rourkela
Abhishek Kumar, NISER, Bhubaneswar
Aakash Marthanadan, IIT Mumbai
Suyog Garg, IITDM Kancheepuram
Aditya Vaswani, BITS Pilani
Anagha K.V., NIT Calicut
Dolly Nambi, IISER, Thiruvananthapuram
Swaparjith K.S, IISER Mohali
Ashwath N. Madhusudan, IISER Pune
Sayantan Maity, IISER, Kolkata
Anandu R.S, IIT Punjab
Anubhab Sur, IISER Kolkata
Pavan, NISER, Bhubaneswar
Reena Joseph, Madras Christian College, Chennai
Anandavijayan, Chandranathan NISER, Bhubaneswar
Debopam Goswami, Scottish Church College, Calcutta
Harihar Pradhan, NISER, Bhubaneswar
Amrutha C.V., Azim Premji University, Bangalore
Vishal Pandey, Banaras Hindu University
Budharaju Sasank, IISER, Mohali
Pratyush Kullepara, BITS, Goa
Ranadeep Roy, IISER Tirupathi
Samay H.N., IIT Madras, Chennai

Chandrashekar C.M.
Chandrashekar C.M.
Chandrashekar C.M.
Chandrashekar C.M.
Chandrashekar C.M.
Chandrashekar C.M.
Hassan S R
Kalyana Rama
Manjari Bagchi
Partha Mukhopadhyay
Partha Mukhopadhyay
Partha Mukhopadhyay
Partha Mukhopadhyay
Pinaki Chaudhuri
Rajesh R
Ravindran V.
Ravindran V.
Ravindran V
Ravindran V.
Sayantan Sharma
Sayantan Sharma
Sayantan Sharma
Shankar R
Shankar R.
Sibasish Ghosh
Sitabhra Sinha
Venkata Suryanarayana Nemani
Venkata Suryanarayana Nemani

Theoretical Computer Science

Srishti Agarwal, Ashoka University, Sonapat
Anmol Agrawal, Shri Shankaracharya Group of Inst.,
Bhilai
Madhumitha Kundu, ISI, Kolkata
Navish Kumar, IIT, Kharagpur
Ananth Krishna Duggirala, CMI, Chennai
Ganesh, G, Amirtha Vishwa Vidyapeetham, Coimbatore
Pasupuleti Rekha, SSN college of engineering, Chennai
Rajhesh, R, PSG college of Technology, Coimbatore
Adarsh Srinivasan, IISER, Pune
Rahul, B.S, BITS pilani

Meena Mahajan
Saket Saurabh
Saket Saurabh
Saket Saurabh
Venkatesh Raman
Venkatesh Raman
Venkatesh Raman
Venkatesh Raman
Vikram Sharma
Vikram Sharma

1.11 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, 2019 - Mar, 2020.

Student

Faculty

Mathematics

Sen, Smith, BITS GOA
Raavali, Nookala, NIT Rourkela
Sahoo, Lalatendu Bidyadhar, NIT Rourkela

Gun, S.
Srinivas, K.
Srinivas, K.

Physics

Gupta, Divyanshu, BITS Pilani (Goa)
Rigby, Elizabeth, Oberlin College and Conservatory,
USA.
Chwalik, Erica, West Virginia University, USA
Vaswani, Aditya, BITS Pilani, Rajasthan
Kuzhively, Disha, graduated from NISER
Bhubaneswar in 2019

Ashok, Sujay K.
Bagchi, Manjari
Bagchi, Manjari
Mukhopadhyay, Partha
Sharma, Sayantan

Theoretical Computer Science

Ayyagiri, Saveri S., Sastra University, Thanjavur
Suresh, Nishank, Shiv Nadar University

Raman, Venkatesh
Raman, Venkatesh

Chapter 2

Research and Teaching

2.1 Computational Biology

2.1.1 Research Summary & Highlights

An earlier model for phototaxis in cyanobacteria, the motion of bacteria away from or towards a source of light, is extended to understand the behaviour of such bacteria when bacterial colonies are exposed to complex light input. Collective effects are emphasized in the model, since these bacteria are known to interact and exert forces on each other through extensions called type-IV pili. The agent-based model reproduces most features of what is experimentally seen. It points out that distinguishing between various proposed mechanisms for how bacteria integrate information and convert this into decisions regarding motion is hard to do at the level of colony shapes alone, precisely because such motion is collective.

First PhD in Computational Biology

Established in 2013, the Computational Biology group is the youngest at IMSc and consists of an enthusiastic group of faculty, post-docs and students who work on a variety of interdisciplinary topics.

Ankit Agrawal is the first student to complete a Ph.D in Computational Biology from IMSc, Chennai. He defended his thesis on July 18, 2019. His thesis advisors are Gautam Menon and Rahul Siddharthan. He worked on nuclear architecture with Gautam Menon and on the detection of transcription factor binding motifs with Rahul Siddharthan. After submitting his thesis, Ankit is a postdoctoral fellow at the Weizmann Institute of Science, Israel, and is working on biophysics and image analysis of cell packings.

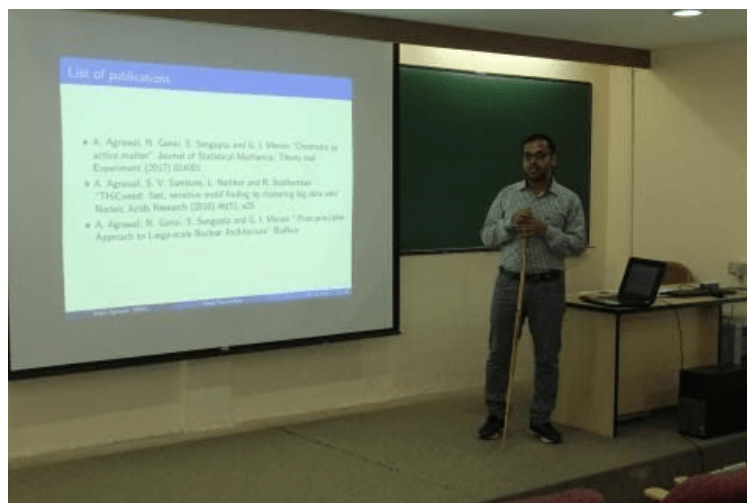


Figure 2.1: Computational Biology- Ph.D. Defence, 18th July 2019



A Community Resource Documenting Experimental Evidence on Hormone-Disrupting Environmental Chemicals

A. Samal and his students have developed a digital resource called Database of Endocrine Disrupting Chemicals and their Toxicity profiles (DEDuCT) which contains a manually curated list of 686 Endocrine Disrupting Chemicals (EDCs) compiled from 1796 scientific research articles with experimental evidence in published literature on their endocrine disruption specific to humans or rodents. EDCs are a group of chemicals of emerging concern omnipresent in the environment that are known to cause adverse effects by interfering with the human endocrine system. There has been growing interest in unraveling the endocrine disrupting mechanisms upon EDC exposure. In this direction, the research team has designed a detailed pipeline to identify such chemicals based on the experimental evidence in published literature. In addition, the team has compiled the adverse effects and the dosage levels at which each of these effects were observed upon EDC exposure. Subsequently, the EDCs were classified based on their type of supporting experimental evidence, their environmental source, and chemical classification.

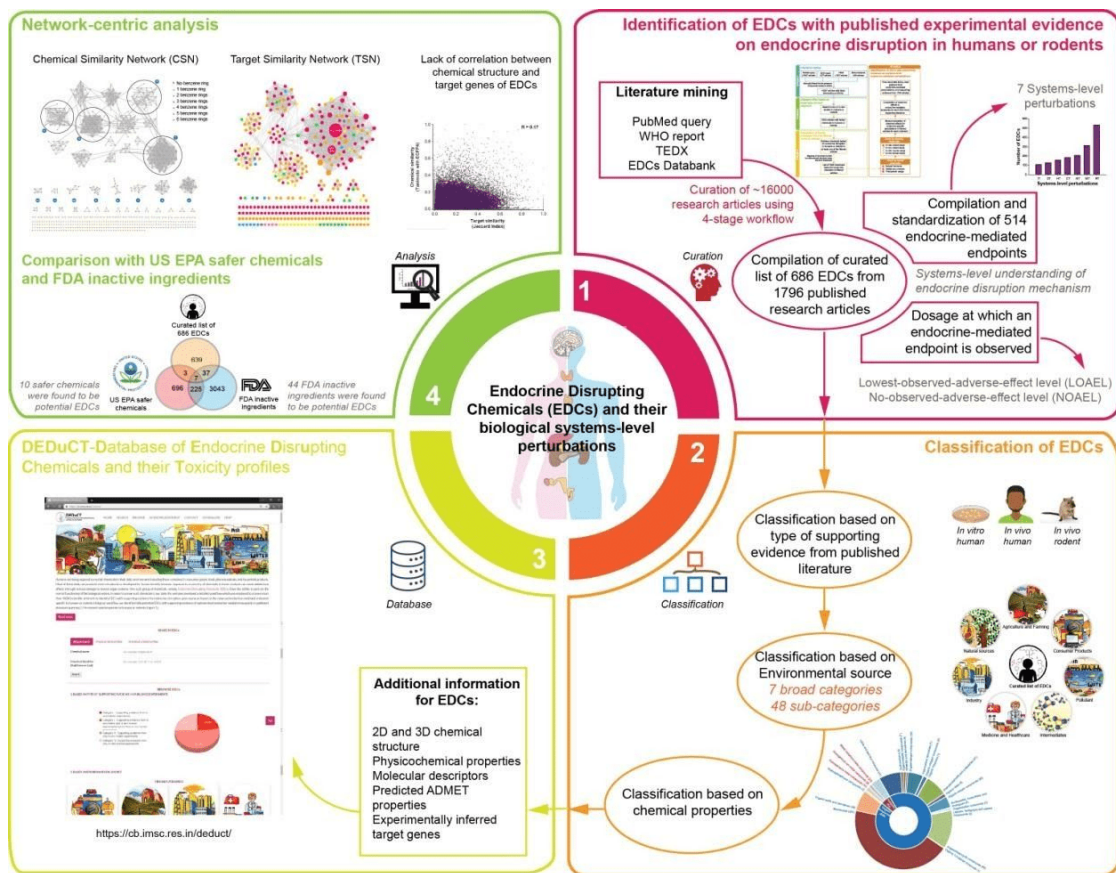


Figure 2.2: Schematic figure summarizing the work on Endocrine Disruptors

DEDuCT also contains information about chemical structure, physicochemical properties, molecular descriptors, predicted ADMET properties and target genes for potential EDCs. A network-centric analysis using DEDuCT revealed a lack of correlation between chemical structures and target genes of EDCs. In sum, this work highlights the future challenges in developing computational predictive models for adverse effects of EDCs. This large-scale compilation on EDCs along with their endocrine-mediated adverse effects will facilitate future research on systems-level understanding of perturbations upon exposure. DEDuCT is freely accessible at <https://cb.imsc.res.in/deduct/>

This work was published in the journal *Science of the Total Environment*. Further the work has been covered by national and international media such as Hindustan Times, India Science Wire, ChemicalWatch, European Trade Union Institute and ACS Chemical Engineering news.

2.1.2 List of 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. The fol-

lowing list includes in addition to Publications reported by members, Publications extracted from sources like Mathscinet, iNSPIRE/HEP, etc., which are duly verified by the members.

[B]

Karthikeyan Bagavathy Shanmugam, Janani Ravichandran, Karthikeyan Mohanraj, Vivek-Ananth R.P., and Areejit Samal.

A curated knowledgebase on endocrine disrupting chemicals and their biological systems-level perturbations.

Science of The Total Environment, **692**, 281–296, 2019.

[K]

Harish Kannan, Emil Saucan*, Indrava Roy, and Areejit Samal.

Persistent homology of unweighted complex networks via discrete morse theory.

Scientific Reports, **9**, 13817, 2019.

[M]

Maria Augusta Horta*, Nils Thieme*, Yuqian Gao*, Kristin E. Burnum-Johnson*, Carrie D. Nicora*, Marina A. Gritsenko*, Mary S. Lipton*, Karthikeyan Mohanraj, Leandro Jose de Assis*, Liangcai Lin*, Chaoguang Tian*, Gerhard H. Braus*, Kartherine A. Borkovich*, Monika Schmoll*, Luis F. Larrondo*, Areejit Samal, Gustavo H. Goldman*, and J Philipp Benz*.

Broad substrate-specific phosphorylation events are associated with the initial stage of plant cell wall recognition in *neurospora crassa*.

Frontiers in Microbiology, **10**, 2317, 2019.

[P1]

Om Prakash.

Algorithm for extraction of sub-structure from co-crystallized PDB ligand for selective targeting.

2020.

(Preprint: bioRxiv 2020.02.02.931436; doi: <https://doi.org/10.1101/2020.02>).

[P2]

Om Prakash.

Algorithm for theoretical mapping of bio-strings for co-expression: bridging genotype to phenotype.

2020.

(Preprint: bioRxiv 2020.03.05.979781; doi: <https://doi.org/10.1101/2020.03>).

[P3]

Om Prakash.

Intra-molecular Electro-potential Circuit ElectroNegatode: Hypothesis, algorithm implementation for universal indicative rule towards activity of biomolecules.

2020.

(Preprint: bioRxiv 2020.03.05.979807; doi: <https://doi.org/10.1101/2020.03>).

[R]

Indrava Roy, Sudharsan Vijayaraghavan, Sarath Jyotsna Ramaia, and Areejit Samal.

Forman-ricci curvature and persistent homology of unweighted complex networks.
2019.

(Preprint: arXiv: 1912.11337).

[S]

Consuelo Torrini*, Ryan J. Cubero*, Ellen Dirx*, Luca Braga*, Hashim Ali*, Giulia Prosdocimo*, Maria I. Gutierrez*, Chiara Collesi*, Danilo Licastro*, Lorena Zentilin*, Miguel Mano*, Serena Zacchigna*, Michele Vendruscolo*, Matteo Marsili*, Areejit Samal, and Mauro Giacca.

Common regulatory pathways mediate activity of micornas inducing cardiomyocyte proliferation.

Cell Reports, **27(9)**, 2759, 2019.

2.2 Mathematics

2.2.1 Research Summary & Highlights

Algebra

Understanding the tensor product of two irreducible finite dimensional representations of a complex semisimple Lie algebras is a very important problem that has been studied intensely by mathematicians for the past 75 years. The celebrated conjecture of Parthasarathy-Ranga Rao-Varadarajan from the 1960s and its extensions by Kostant, Verma, Kumar and Montgard were the subject of recent research by members of the mathematics group at IMSc [Kus]. Significant new results were obtained employing the “path model”, a powerful combinatorial tool first formulated by Littelmann in the 1990s.

Using the decomposition rule, we establish a lower bound for multiplicities of PRV components in Kostant-Kumar modules, thereby generalising simultaneously the KPRV and the refined PRV theorems of Kumar.

Algebraic Number Theory

Lenstra introduced the notion of Euclidean ideal classes to study number fields with cyclic class groups. In particular, he showed that the class group of a number field with unit rank at least one is cyclic if and only if it has a Euclidean ideal class where the only if part is conditional on the Extended Riemann hypothesis.

In [Gu1], the authors prove an unconditional version of the above result for a family of Abelian extensions with unit rank at least 3. This strengthens an earlier result of Murty and Graves.

It is an inherent feature of this theme that the number fields with small unit rank are more difficult to handle.

In a paper “On existence of Euclidean ideal classes in real cubic and quadratic fields with cyclic class group”, by S. Gun & J. Sivaraman, the authors show that same assertion holds for a family of real cubic (respectively quadratic) fields with cyclic class groups with at most one (respectively two) exceptions.

An important problem in algebraic number theory is to study whether a polynomial over rationals is irreducible or not? If not, then what can be said about the degrees of its irreducible factors. A general criteria to find a lower bound for each irreducible factor (over rationals) of a given polynomial with integer coefficients is given in [J9].

Differential Geometry

Sushmita Venugopalan of IMSc was a co-organizer of the conference titled ‘**Novel Vistas in Vortices**’ in the Simons Center for Geometry and Physics. Vortices are gauge-theoretic objects that originated in the study of super-conductors. Research in the last two decades has uncovered connections between vortices and various aspects of symplectic geometry and representation theory. This conference succeeded in bringing together a community of mathematicians and physicists spread across many countries. The details of the conference can be accessed at the following URL: <http://scgp.stonybrook.edu/archives/29486>

Koszul duality and the alternating Schur algebra

The polynomial representation theory of a full matrix group is a fundamental problem of algebra and leads to a deep understanding of tensor spaces as well as symmetric functions. About 100 years ago, Issai Schur classified the building blocks of such representations by relating them to representations of permutation groups. Work done at IMSc by Amritanshu Prasad and Shraddha Srivastava in collaboration with T Geetha of IISER Thiruvananthapuram, set out to understand Schur’s theory when restricted to even permutations. This led to the discovery of a beautiful connection with Koszul duality, a fundamental duality on the polynomial representations of a full matrix group.

Modular forms

Suppose for all but finitely many primes p , we are given an elliptic curve E_p defined over a finite field \mathbb{F}_p of p elements. In [Gu4], the authors derive a criterion for the existence of an elliptic curve E defined over \mathbb{Q} for which the reduction of E modulo p is isogenous to E_p for all p .

Non Commutative Geometry

Higson-Roe sequence for transformation groupoids:

Coarse Geometry investigates the large-scale structure of geometric objects. Building on earlier ideas of Gromov, Lawson and others, John Roe developed an axiomatic approach to study coarse structures (sometimes also referred as uniform or bornological structures),

with the goal of extending classical index theoretic results on compact manifolds, to the non-compact setting. A particularly striking application in the context of coarse geometry, is a K-theoretic generalization of a classical theorem of Gromov-Lawson on the index-theoretic obstruction for the existence of a metric of positive scalar curvature.

In joint work with M.T. Benamou, we have extended in a systematic way the seminal results of N. Higson and J. Roe on the construction of the analytic surgery sequence for discrete groups, to the case of étale transformation groupoids. In particular, we give generalizations of the Paschke-Higson duality theorem as well as new secondary index classes that are invariants of foliations and laminations. In the process, we also develop a coarse analogue of a deep result of Pimsner-Popa-Voiculescu. Two papers on this area are scheduled to appear in the Journal of Noncommutative Geometry.

Novikov's Theorem in Higher Dimensions?

A foliation is an equivalence relation in a manifold whose equivalence classes are embedded submanifolds of codimension one. Novikov's theorem says that a taut foliation on a three-manifold does not have any Reeb components. Thus the class of taut foliations on three manifolds has a certain rigidity. For higher dimensional manifolds, the existence of a strong symplectic form has been proposed as an analog for tautness in order to achieve similar rigidity. It was conjectured (about ten years ago) that strong symplectic foliations would satisfy an analogue of Novikov's theorem. However, this turned out to be false, and in an article 'Novikov's theorem in higher dimensions?' [arXiv 1907.05876]. IMSc mathematician S. Venugopalan constructs a counter example.

Representation Theory

Polynomial representations of general linear groups can be viewed as modules for the Schur algebra. This algebra is the commutant for the action of the symmetric group on tensor space by permuting the tensor factors. Schur-Weyl duality relates these representations to representations of the symmetric group.

The commutant of the alternating group on tensor space, called the alternating Schur algebra, was studied in [Pr3]. This algebra is a $\mathbf{Z}/2\mathbf{Z}$ -graded algebra, its 0th graded part being the classical Schur algebra S . Its 1th graded part is an (S, S) bimodule S^- . The functor $M \mapsto S^- \otimes M$ was defined as the Koszul duality functor on the category of S -modules. Under Schur-Weyl duality, this functor corresponds to multiplication by the sign character of a representation of the symmetric group. This definition was shown to be consistent with a more abstract notion of Koszul duality defined by Krause on the category of strict polynomial functors.

A combinatorial interpretation of the structure constants of this algebra was used to study properties of Koszul duality.

Multivariate polynomials give rise to class functions on all symmetric groups by substituting for the i th variable the number of cycles of size i in a permutation. In [N1] a simple formula for computing the Schur inner product of such class functions was obtained. The restriction problem seeks to determine how an irreducible representation of GL_n decomposes when restricted to its subgroup of permutation matrices. Multivariate polynomials giving rise to

characters of such restrictions were computed. Together with the formula for Schur inner products, restriction coefficients were computed. This is a new approach to the restriction problem.

Topology

Application of topology to complex networks:

Topological data analysis (TDA) is an emerging field which employs tools from combinatorial and algebraic topology to study the ‘shape’ of data. In particular, it reveals higher-order patterns within the data that remain hidden to classical methods of investigating the structure of data.

In network science, capturing such higher-order patterns is a key challenge. High-volume data that emerges from large networks such as Facebook, can therefore be studied using TDA.

The main tool in TDA is ‘Persistent homology’, which has its origins in the field of algebraic topology and is used to capture the ‘global’ structures that are present in an object. The computation of persistent homology is further rendered more efficient by the use of discrete Morse theory, which is a purely combinatorial way of studying the underlying topology of the object. An interdisciplinary collaboration between Indrava Roy in Mathematics group and Areejit Samal in the Computational biology group, along with Harish Kannan (project assistant to Areejit Samal) of the institute has led to the development of a new method to investigate such higher-order structures in complex networks using TDA. Specifically, the team has developed a new method to study persistent homology in unweighted networks based on discrete Morse theory. Informally, this method produces an efficient algorithm to obtain a discrete Morse function that not only helps to capture the higher-order relations in an unweighted network, but can also be used in the lossless compression of such data. In addition to capturing the topology of the network, this function is then used to compute the persistent homology of the network in an efficient manner.

The team has employed this new method to explore persistent homology of several unweighted model and real-world networks. They show that the persistence diagrams can distinguish between the topology of different types of model and real networks. A manuscript on this work appeared in the journal Scientific Reports.

2.2.2 List of 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. The following list includes in addition to Publications reported by members, Publications extracted from sources like Mathscinet, iNSPIRE/HEP, etc., which are duly verified by the members.

[B1]

S. Adhikari*, R. Balasubramanian, S. Eliahou*, and D. Gryniewicz*.

On a conjecture of foxkleitman and additive combinatorics.

Proc. Indian Acad. Sci. Math. Sci., **129(4)**(Source:MR: 3959302), Article:43, 2019.

[B2]

R. Balasubramanian, Saminathan Ponnusamy*, and **Karl-Joachim Wirths***.

Inequalities for weighted sums of Mertens functions.

Archiv der Mathematik, **113**(Source: MR: 3988822), 273, 2019.

[Ba]

Suratno Basu, Arjun Paul, and Arideep Saha.

System of hodge bundles and generalized opers on smooth projective varieties.

Journal of Geometry and Physics, **145**, (10)(Source: MR: 3991649), Article.103484, 2019.

[C]

Karthick Babu C. G. and Usha Keshav Sangale.

Note on a problem of ramanujan.

2020.

(Submitted).

[D]

Pranendu Darbar and Anirban Mukhopadhyay.

Correlation of multiplicative functions over function fields.

2019.

arXiv:1905.09303 (Submitted).

[De]

Nikita Agarwal*, **Soumya Dey**, **Neeraj K. Dhanwani***, and **Kashyap Rajeevsarathy***.

Liftable mapping class groups of regular cyclic covers.

arXiv:1911.05682 (Submitted), 2019.

[G1]

Jyotirmoy Ganguly, Amritanshu Prasad, and Steven Spallone*.

On the divisibility of character values of the symmetric group.

Electronic Journal of Combinatorics, **27(2)**, P 2.1, 2020.

[G2]

Jyotirmoy Ganguly and Steven Spallone*.

Spinorial representations of symmetric groups.

Journal of Number Theory, **544**, 29, 2020.

[G3]

Jyotirmoy M. Ganguly and Rohit M. Joshi*.

Spinorial representations of orthogonal groups.

2020.

arXiv:2003.06636 (Submitted).

[Gu1]

J.-M. Deshouillers*, **S. Gun**, and **J. Sivaraman***.

On Euclidean ideal classes in certain Abelian extensions.

Math Z., 2019.

(To be published).

[Gu2]

S. Gun and **W. Kohnen***.

On the Ramanujan-Petersson conjecture for modular forms of half-integral weight.

Forum Mathematicum, **31(3)**, 703, 2019.

[Gu3]

S. Gun, **B. Kumar**, and **B. Paul**.

The first simultaneous sign change and non-vanishing of Hecke eigenvalues of newforms.

J. Number Theory, **200**, 161, 2019.

[Gu4]

S. Gun and **K. Murty***.

Lifting of Elliptic curves.

Pacific J. Math., **301(1)**, 101, 2019.

[I1]

P. del Angel R.*, **C. Doran***, **P. Luis***, **M. Kerr***, **J. Lewis***, **Jaya N. Iyer**, **S. Miller-Stach***, and **D. Patel***.

Specialization of cycles and the k -theory elevator.

Communications in Number Theory and Physics, **13(2)**(Source: MR: 3951112), 299, 2019.

[I2]

Jaya N. Iyer and **Roy Joshua***.

Brauer groups of schemes associated to symmetric powers of smooth projective curves in arbitrary characteristics.

Journal of Pure and Applied Algebra, **224 (3)**(Source: MR: 4009565), 1009–1022, 2020.

[J1]

Anuj Jakhar, **Sudesh K. Khanduja***, and **Neeraj Sangwan***.

Some results on integrally closed domains.

In *Contributions in Algebra and Algebraic Geometry*, page 75. Contemporary Mathematics, American Mathematical Society, Dec 2019.

[J2]

Anuj Jakhar.

A useful irreducibility test for integer polynomials.

The American Mathematical Monthly, **126(10)**, 943, 2019.

[J3]

Anuj Jakhar.

On the factors of a polynomial.

Bulletin of the London Mathematical Society, **52(1)**, 158, 2020.

[J4]

Anuj Jakhar.

On the irreducible factors of a polynomial.

Proceedings of the American Mathematical Society, **148**, 1429, 2020.

[J5]

Anuj Jakhar.

On primes dividing the index of a quadrimonial.

2020.

(Submitted).

[J6]

Anuj Jakhar and Sudesh K. Khanduja*.

On the index of an algebraic integer and beyond.

Journal of Pure and Applied Algebra, **224(7)**, 106281, 2020.

[J7]

Anuj Jakhar and Sudesh K. Khanduja*.

A note on dedekind criterion.

Journal of Algebra and its Applications, 2020.

(To be published).

[J8]

Anuj Jakhar, Sudesh K. Khanduja*, and Neeraj Sangwan*.

On prolongations of a valuation to the composite field.

Journal of Pure and Applied Algebra, **224(2)**, 551, 2020.

[J9]

Anuj Jakhar and Srinivas Kotyada.

On the irreducible factors of a polynomial ii.

Journal of Algebra, 2020.

YJABR17626 (To be published).

[Ju]

Abhishek Juyal and Sudhansu Rout*.

The mordell-weil bases for the elliptic curve $y^2 = x^3 + m^2x + m^2$.

2020.

(Submitted).

[K1]

Keshab Bakshi* and Vijay Kodiyalam.

Commuting squares and planar subalgebras.

2020.

(Submitted).

[K2]

Vijay Kodiyalam and Sruthy Murali.

Planar algebras associated to latin squares are of subgroup-group type.

Proc. AMS, 2020.

(To be published).

[K3]

Vijay Kodiyalam, Sruthy Murali, and V S Sunder.

Planar algebras, quantum information theory and subfactors.

2019.

(Submitted).

[Ko1]

Srinivas Kotyada and Subramoni Muttukrishnan*.

A survey of certain euclidean number fields.

In Kalyan Chakraborty, Azizul Hoque, and Prem Prakash Pandey, editors, *Class Groups of Number Fields and Related Topics*, page 57. Springer, Oct 2019.

[Ko2]

Srinivas Kotyada and Subramani Muthukrishnan*.

On admissible set of primes in real quadratic fields.

In Bernhard Heim B. Ramakrishnan and Brundaban Sahu, editors, *Modular Forms and Related topics in Number Theory*. Springer Proceedings of Mathematics and Statistics, Jan 2020.

(To be published).

[Ku1]

Veekesh Kumar and Carsten Elsner.

On linear independence results for values of jacobi theta-constants.

2019.

(Preprint: arXiv:1911.06513 [math.NT], 2019).

[Ku2]

Veekesh Kumar and R. Thangadurai.

On simultaneous approximation of algebraic numbers.

2020.

(Preprint: arXiv:2001.00386).

[Kus]

Mrigendra S. Kushwaha, KN Raghavan, and Sankaran Viswanath.

A study of kostant-kumar modules via littelmann paths.

2019.

(Preprint: arXiv:1905.05302).

[M]

B. Rajarama Bhat*, Robin Hillier*, Nirupama Mallick, and U. Vijaya Kumar*.

Roots of completely positive maps.

Linear Algebra and its Applications, **587**(Source: MR: 4030295), 143–165, 2020.

[Mu]

Kamalakshya Mahatab* and **Anirban Mukhopadhyay**.

Omega theorems for the twisted divisor function.

Functiones et Approximatio, 2019.

(To be published).

[N1]

Sridhar P. Narayanan, **Digjoy Paul**, **Amritanshu Prasad**, and **Shraddha Srivastava***.

Character polynomials and the restriction problem.

2020.

arXiv:2001.04112 (Submitted).

[N2]

Sridhar P. Narayanan, **Digjoy Paul**, **Amritanshu Prasad**, and **Shraddha Srivastava***.

Polynomial induction and the restriction problem.

2020.

arXiv:2004.03928 (Submitted).

[P1]

Stephan Baier*, **Neha Prabhu**, and **Kaneenika Sinha***.

Central limit theorems for elliptic curves and modular forms with smooth weight functions.

Journal of Mathematical Analysis and Applications, 485(1), 2020.

(To be published).

[P2]

Ram M. Murty* and **Neha Prabhu**.

Central limit theorems for sums of quadratic characters, hecke eigenforms, and elliptic curves.

Proceedings of the American Mathematical Society, **148**(3), 965, 2020.

[Pr1]

Amritanshu Prasad, **Digjoy Paul**, and **Arghya Sadhukhan***.

Tableau correspondences and representation theory.

In S G Dani et al, editor, *Contributions in Algebra and Algebraic Geometry*, page 109. American Mathematical Society, Sep 2019.

[Pr2]

Arvind Ayyer*, **Amritanshu Prasad**, and **Steven Spallone***.

Macdonald trees and determinants of representations for finite coxeter groups.

Indian J. Discrete Math., 2019.

(To be published).

[Pr3]

Thangavelu Geetha*, **Amritanshu Prasad**, and **Shraddha Srivastava**.

Schur algebras for the alternating group and Koszul duality.

Pacific Journal of Mathematics, 2020.

arXiv:1902.02465 (To be published).

[Pr4]

Dilpreet Kaur*, **Sunil Prajapati***, and **Amritanshu Prasad**.

Simultaneous conjugacy classes as combinatorial invariants of finite groups.

2019.

arXiv:1905.07957 (Submitted).

[Pr5]

Amritanshu Prasad.

An introduction to Schur polynomials.

Graduate J. Math., **4(2)**, 62, 2019.

[R]

Nabanita Ray.

Geometry of $BbbP^2$ blown up at seven points.

Mathematica Slovaca, **69**, (6)(Source: MR: 4045518), 12791292, 2019.

[Ro1]

Moulay-Tahar Benameur* and **Indrava Roy**.

An equivariant Poincaré duality theorem and Paschke-Higson duality.

2020.

<https://arxiv.org/abs/2001.09811> (Submitted).

[Ro2]

Harish Kannan*, **Emil Saucan***, **Indrava Roy**, and **Areejit Samal**.

Persistent homology of unweighted networks via discrete Morse theory.

Scientific Reports, **9**, 13817, 2019.

[Ro3]

Indrava Roy, **Mahashweta Patra***, and **Soumitro Banerjee***.

Shilnikov-type dynamics in three-dimensional piecewise smooth maps.

Chaos, Solitons, and Fractals, **133**, 109655, 2020.

[Ro4]

Indrava Roy, **Sudharsan Vijayaraghavan***, **Sarath Jyotsna Ramaia***, and **Areejit Samal**.

Forman-Ricci curvature and persistent homology of unweighted complex networks.

2019.

(ArXiv preprint: <https://arxiv.org/pdf/1912.11337.pdf>).

[S]

T. Mubeena* and **Parameswaran Sankaran**.

Twisted conjugacy and quasi-isometric rigidity of irreducible lattices in semisimple lie groups. *Indian Journal of Pure and Applied Mathematics*, **50 (2)**(Source: MR: 3954533), 403–412, 2019.

[Su]

V. S. Sunder.

Operator algebras in india in the past decade.

Indian J. Pure Appl. Math., **50 (3)**(Source: MR: 3995089), 801–834, 2019.

[T]

Kathiravan T, Karthick Babu C. G, and Srinivas K.

Proofs of some conjectures of sun on $T(a, b, c; n)$ for some special values of (a, b, c) .

2019.

BULSCI-D-19-00150 (Submitted).

[V]

Suresh Govindarajan*, Sachin S. Sharma*, and Sankaran Viswanath.

The brylinski filtration for affine kac-moody algebras and representations of w-algebras.

2019.

(Preprint: arXiv:1912.13353).

2.3 Physics

2.3.1 Research Summary & Highlights

Astrophysics & Cosmology

An effort is going on to build an “Indian Pulsar Timing Array” which will join the “International Pulsar Timing Array” to detect nano-Hertz gravitational waves. Observations using GMRT and ORT have been performed.

The International Pulsar Timing Array (IPTA) consortium consists of established Pulsar Timing Array (PTA) efforts, that include the European Pulsar Timing Array (EPTA), the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), and the Parkes Pulsar Timing Array (PPTA) as well as the emerging efforts like the Indian Pulsar Timing Array (InPTA), South African Pulsar Timing Array and the Chinese Pulsar Timing Array. The IPTA consortium aims to detect gravitational waves using an ensemble of millisecond pulsars located in our Galaxy. To nurture the collaborative nature of the IPTA consortium, annual meeting is held in different continents. This year, the annual meeting of the IPTA was held in Pune, India between June 10 to 21, 2019.

The first week (June 10 - 14, 2019) was a school for students, where lectures and hands on experiments by international experts were arranged. This part was hosted by NCRA-TIFR. The second week (June 17 - 21, 2019) was the conference week, and was held in the Orchid Hotel, Pune. It was a very successful meeting. The conference week was attended by 90 scientists throughout the globe (26 Indians working in India, 12 Indian students and post-docs abroad, and 52 foreign nationals). There were presentations by scientists on their research

results as well as policy making discussions for the IPTA. There was a dedicated session on diversity and equity, lead by Prof. Ketki Ranade and Prof. Shewli Kumar from Tata Institute of Social Sciences, Mumbai.



Figure 2.3: Annual Meeting of the IPTA, 10th-21st June 2019, Pune

IMSc members had pivotal roles in organising both of the weeks. Dhruv Pathak, Phd student in IMSc was part of the Scientific Organising Committee of the student workshop (the first week) and the Scientific Organising Committee of the conference week was chaired by Manjari Bagchi, faculty member of the theoretical physics group of IMSc. Additionally, Arpita Choudhury, DST-WOSA postdoctoral fellow at IMSc attended the meeting. Bagchi and Pathak presented their research work and Choudhury presented a collaborative work done by the InPTA team. Pulsar surveys to discover new pulsars are being undertaken using the upgraded GMRT as well as Arecibo radio telescopes [Bag2].

The effects of velocity and accelerations of pulsars in their observed derivatives and second derivatives of periods are being studied.

Magnetars are neutron star with very high magnetic fields (around 10^{10} Tesla). Magnetars usually emit persistent X-rays, but no radio pulsations. However, there are two magnetars that emit occasional radio pulses. XTE J1810-197 is one of these. Since December-2018, this is in a radio emitting phase. This source is being monitored using the Giant Metrewave Radio Telescope. Interesting spike like features in the radio pulses have been seen. Similar features have been seen in mysterious cosmological Fast Radio Bursts for which magnetars (out of our Galaxy) are one probable sources. This similarity is interesting.

This study has been recently published in the Astrophysical Journal Letters [Bag1] This work has received some media attention and highlighted in space.com (<https://www.space.com/magnetar-clues-mystery-fast-radio-bursts.html>)

Classical and Quantum Gravity, Black Holes, Cosmology

In 1970's, W.G. Dixon completed a programme initiated by Myron Mathisson of describing the motion of an extended, but compact object in an arbitrary, but fixed background space-

time M . In this approach the dynamics is given by equations along an average worldline that resembles a generalised form of Newton's laws for rigid body motion. The generalised force and torque appearing in these equations are given by coupling of background gravity with a set of infinite number of multipole moments of the object. In Dixon's computation a derivative appears which can be interpreted as a natural connection on TM . In an ongoing work, attempt is being made to make the bundle structure more manifest in the problem. In another ongoing work, Dixon's construction is being used to study dynamics of a small string in M .

Condensed Matter Physics

Condensed matter theory with an emphasis on the physics of the fractional quantum Hall effect and topological insulators

Using extensive computations, we have studied both equilibrium and out-of-equilibrium behaviour of disordered materials like glasses, emulsions etc.

Motivated by recent experiments and also mean field predictions related to how glassy systems respond to quenched disorder, we have studied [H] the response of a model two-dimensional colloidal glass former to an externally imposed spatially random potential. The external field induces the onset of the glassy dynamics at increasingly smaller field roughness, with increasing packing fraction of the particulate assembly, and the existence of aging processes within the glassy regime is also observed.

Furthermore, along the axis of increasing field roughness, the dynamical slowdown is not correlated to the hexatic order within the supercooled regime. In the context of non-equilibrium properties of glassy materials, we have probed response of a model glassy forming system to an externally applied thermal gradient.

In the first study [Cha2], we have shown that near the glass transition temperature, where the structural relaxation time becomes very long, the measured thermal conductivity decreases with increasing age. Second, the thermal conductivity of the disordered solid obtained at low temperatures is found to depend on the cooling rate with which it was prepared. For the cooling rates accessible in simulations, lower cooling rates lead to lower thermal conductivity. Our analysis links this decrease of the thermal conductivity with increased exploration of lower-energy inherent structures of the underlying potential energy landscape.

In the next study [V], for the same model system, we have studied the Soret effect, i.e., the flow of matter caused by a temperature gradient. The transport processes associated with this effect are thermal diffusion and interdiffusion. While interdiffusion processes exhibit a drastic slowing down when approaching the glass transition, thermal diffusion appears to be a fast process even in the glass.

We show that the Soret effect becomes more pronounced in the vicinity of the glass transition, due to the decoupling between thermal diffusion and interdiffusion as well as the chemical ordering in the considered LJ mixture. This is reflected in the occurrence of large concentration gradients, nonlinear concentration profiles, and long-lived nonstationary structures.

To understand the mechanical response of amorphous materials having defects in the form of inclusions, we have studied [Cha1] the yielding response, in the athermal quasistatic limit, of a model system having inclusions in the form of randomly pinned particles. We

show that, with increasing pinning concentration, the plastic activity becomes more spatially localized, resulting in smaller stress drops, and a corresponding increase in the magnitude of strain where yielding occurs. We demonstrate that, unlike the spatially heterogeneous and avalanche led yielding in the case of the unpinned glass, for the case of large pinning concentration, yielding takes place via a spatially homogeneous proliferation of localized events.

Our continued interest in studying the rheology of emulsion-like granular systems, led us to investigate the steady-shear rheology of a model adhesive dispersion in the dense regime [Cha3]. We vary the range of the attractive interparticle forces as well as the strength of the dissipation. We observed that for large dissipative forces, the rheology is governed by the Weissenberg number and displays Herschel-Bulkley form. Decreasing the strength of dissipation, the scaling with Weissenberg number breaks down and inertial effects show up. The stress decreases via the Johnson-Samwer law, where thermal effects are exclusively due to shear-induced vibrations. During flow, particles slide past each other such that their relative velocities are primarily directed tangentially to the particle surfaces. This tangential channel of energy dissipation and its suppression leads to a discontinuity in the flow curve and an associated discontinuous shear-thinning transition.

We set up an analogy with frictional systems, where the phenomenon of discontinuous shear-thickening occurs. In both cases, tangential forces, frictional or viscous, mediate a transition from one branch of the flow curve with low tangential dissipation to one with larger tangential dissipation.

Explaining the Ubiquity of Complex Patterns

A recent paper published by scientists from IMSc shows that patterns seen in processes as diverse as chemical reactions, a cell undergoing division, and interactions between populations of predators and prey, can arise through the same fundamental mechanism. All of these systems (and more) consist of many oscillators, each trying to suppress the activity of its neighbors - a phenomenon that can be termed as lateral inhibition in analogy to the similar mechanism in operation in sensory systems. Although one may see a dazzling range of patterns that vary over space as well as in time, these can be traced to effectively two basic patterns - one which shows patterns frozen in time, and the other in which the oscillators are organized into clusters of synchronous activity.

Mathematical Physics

In the area of mathematical physics, there has been work done in the derivation of non-linear differential equations satisfied by automorphic forms of Hecke groups, which are discrete subgroups of $SL(2, R)$. The work was motivated by the appearance of Hecke groups as symmetries in certain supersymmetric gauge theories, and the associated automorphic forms made an appearance in the low energy effective actions of these theories. While the motivation for the work came from physics, the work in [As2] is purely mathematical. It was found that the automorphic forms satisfy generalized Ramanujan relations and that it was possible to associate non-linear differential equations to each Hecke group that are higher order generalizations of the Chazy equation.

It was shown that the solution to the non-linear equation in each case is a quasiautomorphic

weight-2 Eisenstein series and its orbit under the group action.

Non-perturbative Quantum field theory

The main focus of the group was to study and develop new theoretical tools for understanding novel non-perturbative physics in quantum field theories. These include detailed study of the Z₃ metastable states in PNJL model [Di], topological vortices in complex scalar field theories with oscillating metric background [D2], the onset of plasma instabilities in strongly coupled quantum electrodynamics [Sha1, Sha5], the role of topological objects near the chiral crossover transition in QCD [Sha4]. Another important focus was to relate ab-initio theoretical calculations of fluctuations and correlations of conserved quantum numbers in thermal QCD to the recent state-of-the-art experimental data from the STAR experiment, for the first time, finding a consistent agreement between the two [Sha2].

Particle Physics

The discovery of the Higgs boson at the CERN Large Hadron Collider and the knowledge of its mass allowed us to ask if the Higgs vacuum state is stable or not. It was argued by other groups that for the measured values of the Higgs couplings, the vacuum state is not stable but can quantum mechanically tunnel into a deeper true vacuum. The particle properties will be very different if this were to happen. But the life-time for such a tunneling event to happen is much larger than the age of the Universe. We show that if new fermions beyond the standard model are coupled to the Higgs, the vacuum can either become unstable or can become absolutely stable depending on the coupling values.

In Ref. [Go], the effects of vectorlike fermions (VLFs) on the stability of the Higgs electroweak vacuum, using the renormalization group improved Higgs effective potential was studied. The scale at which the effective Higgs quartic coupling becomes zero and goes negative, signaling vacuum instability was computed. For cases where the vacuum is metastable, the probability of quantum tunneling from the false electroweak vacuum into a deeper true vacuum in our Hubble volume was computed by numerically solving for the bounce configuration in Euclidean space-time and computing the bounce action for it.

Statistical Mechanics

The nature of the velocity distribution of a driven granular gas, though well studied, is unknown as to whether it is universal or not, and if universal what the distribution is. The tails of the steady state velocity distribution is determined exactly for a microscopic model for a granular gas in two dimensions within the well-mixed limit. It is shown that there are two universal regimes depending on how the system is driven. In the more generic universal regime, the distribution is a gaussian with logarithmic corrections. In the second universal regime, the distribution is an exponential with additional logarithmic corrections. Both of these are in contradiction to well accepted results based on phenomenological modelling. Data from experiments are re-analysed to show that they may be reinterpreted to fall into one of the two universality classes. The results are made more rigorous in one dimension, and has also been extended to the case of binary gases [Pr1, Pr2, Bi].

Models with only hard interactions have been studied for a long time as the simplest models

to show phase transitions. In these models, the phases and phase transitions are determined by only the shape and density of the particles. Here, the phase diagram and nature of the phase transitions are determined for a system of hard cubes on a three dimensional cubic lattice. By implementing a Monte Carlo algorithm with a cluster move, it is possible to access densities close to full packing. It is shown that the system undergoes three phase transitions with increasing density, contrary to what was seen and expected up to now [Vi].

Shock propagation in conservative as well as dissipative systems has been a topic of interest for a long time. Well-known examples include the spread of disturbance after a nuclear explosion. The solution for the radial distribution of pressure, density, temperature and flow velocity fields in a blast wave propagating through a medium at rest, following an intense explosion, starting from hydrodynamic equations, is one of the classic problems in gas dynamics.

However, there is very little direct verification of the theory and its assumptions from simulations of microscopic models. Here, the results and assumptions of the hydrodynamic theory are compared with results from large scale event driven molecular dynamics simulations of a hard sphere gas in three dimensions. It is found that the predictions for the radial distribution of the thermodynamic quantities do not match well with the numerical data.

The theory is improved by replacing the ideal gas law with a more realistic virial equation of state for the hard sphere gas. While this improves the theoretical predictions, it still fails to describe the data well.

To understand the reasons for this discrepancy, the different assumptions of the hydrodynamic theory are tested within the simulations. A key assumption of the theory is the existence of a local equation of state. This assumption is validated by showing that the local pressure, temperature and density obey the equation of state for a hard sphere gas. However, the probability distribution of the velocity fluctuations has non-gaussian tails, especially away from the shock front, showing that the assumption of local equilibrium is violated. This, along with neglect of heat conduction, could be the possible reasons for the mismatch between theory and simulations [Jo].

Extensive simulations have been performed to probe the induced phase transitions in the model cell membranes when membrane active agents interact with them. The simulations were setup with the membrane active protein Nogo-66 with dimyristoylphosphocholine (DMPC) membranes and the protein-membrane interactions were shown to remodel the membrane and induce interdigitation in the DMPC membrane.

This phase change is seen to occur only when the temperature is close to the main transition temperature of the membrane (T_m) and only in the presence of the protein. No similar interdigitation of the membrane lipids was observed temperatures well above T_m in the presence of the protein.

Also, in protein-free simulations, no interdigitation of the membrane lipids was found both at temperatures near or well above T_m indicating that the observed effect is caused by the interactions of Nogo-66 with the membrane. Analysis of the simulations suggest protein-membrane interactions, even if transient, alter the lifetimes of lipid head defects and can potentially alter the effective T_m and cause interdigitation.

This study emphasize the importance of membrane active proteins and their interactions with membranes leading to phase transitions which would affect other membrane related processes such as domain formation [T].

To understand the effects of addition of different salts on the kinetics and dynamics of

early-stage aggregated structures of steric zipper peptides in water, detailed molecular dynamics simulations have been employed. The simulations reveal that the chemical identity and valency of cation in the salt play a crucial role in aggregate dynamics and morphology of the peptides. Sodium ions induce the most aggregated structures, but this is not replicated equivalently by potassium ions which are also monovalent. Divalent magnesium ions induce aggregation but to a lesser extent than that of sodium, and their interactions with the charged peptides are also significantly different. The aggregate morphology in the presence of monovalent sodium ions is a compact structure with interpenetrating peptides, which differs from the more loosely connected peptides in the presence of either potassium or magnesium ions.

The different ways in which the cations effectively renormalize the charges of peptides are suggested to be the cause of the differential effects of different salts studied here. These simulations underscore the importance of understanding both the valency and nature of salts in biologically relevant aggregated structures [G].

A spherically confined neutral polymer in the presence of crowding particles was studied to investigate the polymer shapes and conformations as a function of the strength of the attraction to the confining wall, solvent quality, and the density of crowders. The conformations of the polymer under good solvent conditions are weakly dependent on crowder particle density, even when the polymer is strongly confined.

In contrast, under poor solvent conditions, when the polymer assumes a collapsed conformation when unconfined, it can exhibit transitions to two different adsorbed phases, when either the interaction with the wall or the density of crowder particles is changed. One such transition involves a desorbed collapsed phase change to an adsorbed extended phase as the attraction of the polymer towards the confining wall is increased. Such an adsorbed extended phase can exhibit a second transition to an ordered adsorbed collapsed phase as the crowder particle density is increased. The ordered adsorbed collapsed phase of the polymer differs significantly in its structure from the desorbed collapsed phase. We revisit the earlier understanding of the adsorption of confined polymers on attractive surfaces in light of our results [Tr].

An invited book chapter summarizing our long-time efforts on biomimetic antimicrobial polymers in general and on our work on methacrylate-based polymers in particular has been written. Following a brief summary of the physiochemical features of methacrylate AMPoly, and the most significant developments in their design as potent antimicrobial agents, special emphasis is laid on recent insights gained using computer simulations on their mechanism of microbial membrane recognition, invasion, and subsequent destabilization [Ve].

Do we need a new kind of physics for understanding social behavior ?

The enterprise of trying to explain different social and economic phenomena using concepts and ideas drawn from physics has a long history. Statistical mechanics, in particular, has been often seen as most likely to provide the means to achieve this, because it provides a lucid and concrete framework for describing the collective behavior of systems comprising large numbers of interacting entities. Several physicists have, in recent years, attempted to use such tools to throw light on the mechanisms underlying a plethora of socio-economic phenomena. These endeavors have led them to develop a community identity - with their academic enterprise being dubbed as “econophysics” by some.



Figure 2.4: EconoPhysics-A New kind of Physics for understanding Social Behaviour

However, the emergence of this field has also exposed several academic fault-lines. Social scientists often regard physics-inspired models, such as those involving spins coupled to each other, as over-simplifications of empirical phenomena. At the same time, while models of rational agents who strategically make choices based on complete information so as to maximize their utility are commonly used in economics, many physicists consider them to be caricatures of reality.

A recent essay written by IMSc scientists which will be appearing in a book to be published by Springer shows that while these contrasting approaches may seem irreconcilable there are in fact many parallels and analogies between them. In addition, the scientists suggest that a new formulation of statistical mechanics may be necessary to permit a complete mapping of the game-theoretic formalism to a statistical physics framework.

As the essay puts it, “This may indeed turn out to be the most significant contribution of econophysics”.

String Theory

Research in string theory at IMSc encompasses various aspects of gravity and quantum field theory, including holography, supersymmetric gauge theories, perturbative string theory and also topics in mathematical physics such as integrable systems.

Starting from the Exact Renormalization Group equation of a boundary conformal field theory it is shown that one can obtain Holographic Renormalization Group equations in some simple cases. This goes some distance towards a derivation of the AdS/CFT correspondence, also called “holography”.

In a paper the fixed point Wilson action for the critical $O(N)$ model in $4 - \epsilon$ dimensions is written down in the ϵ expansion to order ϵ^2 . It is obtained by solving the fixed point Polchinski Exact Renormalization Group equation (with anomalous dimension) in powers of ϵ . This is an example of a theory that has scale and conformal invariance while having a finite UV cutoff. The energy momentum tensor for this theory is also constructed (at zero momentum) to order ϵ^2 . This is done by solving the Ward identity for the bare action to leading order in powers of the momentum, and then evolving down to the lower scale as a composite operator using exact RG equations. It is verified that the trace of the energy

momentum tensor is proportional to the violation of scale invariance as given by the exact RG (i.e. β -function) and that at the lower scale the energy momentum tensor is traceless (to the required order in ϵ), thus ensuring scale and conformal invariance of the IR fixed point theory [Du]

Covariant string bits model has been constructed. This can be viewed as a lattice regularisation of the bosonic non-linear sigma model with an arbitrary curved target space. It has been shown that the model admits a remnant of the local Diff X Weyl symmetry and isometries of the target space as global symmetries. Classical BRST construction has been performed. Work is in progress to investigate quantum consistency. In a parallel investigation the new lattice approach is being applied to higher dimensional Poincare invariant quantum field theories. In [As1], three dimensional supersymmetric gauge theories were studied. It had been shown by various groups that partition functions and indices of such three dimensional theories can be obtained by performing gluing operations on some basic building blocks called holomorphic blocks. These satisfy q-difference equations and in [As1] it was shown that various non-trivial properties of these blocks could be derived by applying exact WKB methods to the q-difference operators that annihilate the blocks. It is likely that these new methods could be generalized to more complicated situations where traditional physics methods prove inadequate.

In [As3] and [As4], various aspects of two dimensional quantum gravity coupled to minimal and non-minimal matter were studied. A particular focus was a derivation of open/closed string duality by using the Kontsevich matrix model description of the system. By integrating out off-diagonal degrees of freedom associated to one source eigenvalue in the matrix model, an open/closed topological string partition function was derived. This allowed a match between the resulting open partition function with the generation function derived in the mathematics literature. The open/closed partition function was also related to a wavefunction of the KP integrable hierarchy.

Systemic Risk: Frustration Suggests Imminent Depression

A recent article published by scientists at IMSc suggests that measuring the level of frustration, a concept central to the physics of disordered systems, in financial markets can give warning about the build-up of systemic risk, which, left unchecked can lead to a catastrophic failure of the economy. Unlike previous studies focusing on relatively short periods that possibly include only one extreme event, the article looks at the evolution of the largest financial market of the world for close to a century.

2.3.2 List of 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. The following list includes in addition to Publications reported by members, Publications extracted from sources like Mathscinet, iNSPIRE/HEP, etc., which are duly verified by the members.

[A1]

Taushif Ahmed*, **A. Ajjath**, **Long Chen***, **Prasanna K. Dhani**, **Pooja Mukherjee**,
and V. Ravindran.

Two-loop QCD helicity amplitudes for higgs production associated with a vector boson through bottom quark annihilation.

In *Proceedings, 14th International Symposium on Radiative Corrections: Application of Quantum Field Theory to Phenomenology (RADCOR 2019): Avignon, France, September 8-13, 2019*, Oct 2019.

[A2]

A. Ajjath, **Pulak Banerjee**, **Amlan Chakraborty**, **Prasanna K. Dhani**, **Pooja Mukherjee**, **Narayan Rana**, **and V. Ravindran**.

Higgs pair production from bottom quark annihilation to NNLO in QCD.

JHEP05(2019)030, **2019**(Source: eprint:1811.01853 [hep-ph]), Article 30, 2019.

[A3]

A. Ajjath, **Pulak Banerjee**, **Amlan Chakraborty**, **Prasanna K. Dhani**, **Pooja Mukherjee**, **Narayan Rana**, **and V. Ravindran**.

Nnlo QCD \oplus QED corrections to higgs production in bottom quark annihilation.

Phys. Rev. D., **100**(Source: eprint: 1906.09028), 114016, 2019.

[A4]

A. Ajjath, **Amlan Chakraborty**, **Goutam Das***, **Pooja Mukherjee**, **and V. Ravindran**.

Resummed prediction for higgs boson production through $b\bar{b}$ annihilation at N^3 LL.

JHEP, *11(2019)006*, **11**(Source: eprint: 1905.03771), Article. 006, 2019.

[A5]

A. Ajjath, **Goutam Das***, **M. Kumar***, **Pooja Mukherjee**, **V. Ravindran**, **and Kajal Samantha***.

Resummed drell-yan cross-section at N^3 LL.

In (Source: eprint: 2001.11377). 2020.

eprint: 2001.11377 (Submitted).

[A6]

A. Ajjath, **Pooja Mukherjee**, **and V. Ravindran**.

Infrared structure of $SU(N) \times U(1)$ gauge theory to three loops.

In (Source: eprint: 1912.13386). 2019.

eprint: 1912.13386 (Submitted).

[An]

Ramesh Anishetty **and T. Sreeraj**.

Addition of $SU(3)$ generators and its singlet hilbert space.

Journal of Mathematical Physics, **60** (6)(Source: MR: 3959133), 061701, 13, 2019.

[Anu]

A. Anupam **and P. Athira***.

Generalised coherent states in QCD from asymptotic symmetries.

In **(Source: eprint: 1907.06255)**. 2019.

eprint: 1907.06255[hep-th] (Submitted).

[As1]

Sujay K. Ashok, P. N. Balasubramanian, Aditya Bawane*, Dileep P. Jatkar*, Dharmesh Jain*, and Arkajyoti Manna.

Exact WKB analysis of CP1 holomorphic blocks.

Journal of High Energy Physics, **10(2019)**, 075, 2019.

[As2]

Sujay K. Ashok, Dileep P. Jatkar*, and Madhusudhan Raman*.

Aspects of hecke symmetry: Anomalies, curves, and chazy equations.

SIGMA, **16**, 01, 2020.

[As3]

Sujay K. Ashok and Jan Troost*.

A duality in two-dimensional gravity.

Journal of High Energy Physics, **2019(05)**, 111, 2019.

1812.05822 (Submitted).

[As4]

Sujay K. Ashok and Jan Troost*.

Topological open/closed string dualities: Matrix models and wave functions.

Journal of High Energy Physics, **09(2019)**, 064, 2019.

[B]

Himanshu Badhani and C. Chandrasekhar.

Gravitationally induced entanglement between two quantum walkers.

In **(Source: eprint: 1907.06953)** . 2019.

1907.06953 (Submitted).

[Ba]

Trilochan Bagarti and Shakti N. Menon.

Milling and meandering: Flocking dynamics of stochastically interacting agents with a field of view.

Physical Review E, **100(1)**, 012609, 2019.

[Bag1]

Y. Maan*, B. Joshi*, M. Surnis*, M. Bagchi, and P. Manoharan*.

Distinct properties of the radio burst emission from the magnetar XTE J1810-197.

Astrophysical Journal Letters, **882(1)**, L9, 2019.

[Bag2]

J. Martinez*, P. Gentile*, P. Freire*, K. Stovall*, J. Deneva*, G. Desvignes*, F. Jenet*, M. McLaughlin*, M. Bagchi, and T. Devine*.

The discovery of six recycled pulsars from the Arecibo 327-MHz Drift-Scan Pulsar Survey.
The Astrophysical Journal, **881(2)**, 166, 2019.

[Bal]

Sourav Ballav and Renjan Rajan*.

Modular properties of surface operators in $N = 2$ SQCD.

JHEP07(2019), **2019(Source: eprint: 1905.10898)**, Article:177, 2019.

[Ban1]

Taushif Ahmed*, **Pulak Banerjee**, **Amlan Chakraborty**, **Prasanna K. Dhani**, and **V. Ravindran**.

Form factors with two-operator insertion and violation of transcendentality principles.

In (Source: **arXiv:1911.11886 [hep-th]**). 2019.

arXiv:1911.11886 [hep-th] (Submitted).

[Ban2]

Taushif Ahmed*, **Pulak Banerjee**, **Amlan Chakraborty**, **Prasanna K. Dhani**, and **V. Ravindran**.

The curious case of leading transcendentality: Three point form factors.

In (Source: **arXiv:1905.12770 [hep-th]**). 2019.

arXiv:1905.12770 [hep-th] (Submitted).

[Bas]

Melissa van Beekveld*, **Wim Beenakker***, **Rahul Basu**, **Eric Laenen***, **Anuradha Misra***, and **Patrick Motylinski***.

Next-to-leading power threshold effects for resummed prompt photon production.

Phys. Rev., D, **100 (5)**(Source :eprint: 1905.11771), 056009, 2019.

[Bh1]

Srimoy Bhattacharya, **Aritra Biswas***, **Soumitra Nandi***, and **Sunando Kumar Patra***.

Exhaustive model selection in $b \rightarrow s\ell\ell$ decays: Pitting cross-validation against AICajjath, resummed prediction for higgs boson production throughajjath, resummed prediction for higgs boson production through $_c$.

Phys. Rev., D, **101 (5)**(Source: eprint: 1908.04835), 055025, 2020.

[Bh2]

Srimoy Bhattacharya, **Soumitra Nandi***, **Sunando Kumar Patra***, and **Ria Sain**.

A detailed study of the $\lambda_b \rightarrow \lambda\ell^+\ell^-$ decays in the standard model.

(Source: eprint: 1912.06148), 2019.

1912.06148 (Submitted).

[Bi]

Apurba Biswas, **V. V. Prasad***, and **R. Rajesh**.

Asymptotic velocity distribution of a driven one dimensional binary granular maxwell gas.

Journal of Statsitical Mechanics, **2020**, 013202, 2020.

[C1]

Subhrooneel Chakrabarti, Deepali Mishra*, Yogesh K. Srivastava*, and Amitabh Virmani*.

Generalised Garfinkle-Vachaspati Transform With Dilaton.

Classical and Quantum Gravity, **36 (12)**, Article. 125008, 2019.

[C2]

Subhrooneel Chakrabarti and Madhusudan Raman*.

Chiral decoupling from irrelevant deformations.

In (Source: eprint: 2001.06870). 2020.

eprint: 2001.06870 (Submitted).

[Ch]

Arghya Chattopadhyay, Suvankar Dutta*, Debangshu Mukerjee*, and Neetu*.

Quantum mechanics of plancherel growth.

2019.

eprint: 1909.06797 (Submitted).

[Cha1]

Bhanu P. Bhowmik*, Pinaki Chaudhuri, and Smarajit Karmakar*.

Effect of pinning on the yielding transition of amorphous solids.

Physical Review Letters, **123**, 185501, 2019.

[Cha2]

Pranab J. Bhuyan*, Rituparno Mandal*, Pinaki Chaudhuri, Abhishek Dhar*, and Chandan Dasgupta*.

Aging effects on thermal conductivity of glass-forming liquids.

Physical Review E, **101**, 022125, 2020.

[Cha3]

Ehsan Irani*, Pinaki Chaudhuri, and Claus Heussinger*.

Discontinuous shear-thinning in adhesive dispersions.

Physical Review Fluids, **4**, 074307, 2019.

[Chaw]

Prateek Chawla, C V Ambarish*, and C. M. Chandrashekar.

Quantum percolation in quasicrystals using continuous-time quantum walk.

J. Phys. Commun., **3(12)**, 125004, 2019.

[Chh]

Saroj Prasad Chhatoi and S. Kalyana Rama.

Non singular, bouncing M theory universe.

In (Source: eprint: 2002.10161). 2020.

eprint: 2002.10161 (Submitted).

[Co1]

Ajit Coimbatore Balram, Karsten K. Flensberg*, Jens J. Paaske*, and Mark M.

Rudner*.

Current-induced gap opening in interacting topological insulator surfaces.
Physical Review Letters, **123(246803)**, 246803, 2019.

[Co2]

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 \mathbb{Z}_n superconductivity of composite bosons and the 7/3 fractional quantum Hall effect.
Phys. Rev. Research, **2(1)**, 013349, 2020.

[Co3]

Jeroen J. Danon*, **Ajit Coimbatore Balram**, **Samuel S. Sanchez***, and **Mark M. Rudner***.
Charge and spin textures of ising quantum hall ferromagnet domain walls.
Phys. Rev. B, **100(23)**, 235406, 2019.

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Re-visiting gravitational wave events via pulsars.
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[D2]

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Effects of oscillating spacetime metric background on a complex scalar field and formation of topological vortices.
In (Source: eprint: 1911.13216). 2019.
e-Print: 1911.13216 [hep-th] (Submitted).

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Minati Biswal*, **Sanatan Digal**, and **P. Saumia***.
 \mathbb{Z}_3 meta-stable states in PNJL model.
In (Source: eprint: 1907.07981). 2019.
eprint: 1907.07981 (Submitted).

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Semanti Dutta, **Balachandran Sathiapalan**, and **Hidenori Sonoda***.
Wilson action for the O(N) model.
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[G]

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Aggregation dynamics of charged peptides in water: effect of salt concentration.
The Journal of Chemical Physics, **151**, 074901, 2019.

[Go]

Shrihari Gopalakrishna and **Arunprasath Velusamy**.

Higgs vacuum stability with vectorlike fermions.
Physical Review D, **99**, 115020–1, 2019.

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Embedding into flat spacetime and black hole thermodynamics.
Mod. Phys. Lett. A, **35(5)** (Source: eprint: 1908.09074), 2050013, 2020.

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Light-front QED, stueckelberg field and infrared divergence.
Modern Phys. Lett. A, **34(18)**(Source: MR: 3963202), 1950141, 2019.

[H]

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Glass forming liquid in a quenched random potential.
Soft Matter, 2020.
DOI: 10.1039/C9SM01729A (To be published).

[I1]

D. Indumathi.
India-based neutrino observatory (ino): Physics and status report.
In *Proceedings, 16th Conference on Flavor Physics and CP Violation (FPCP 2018): Hyderabad, India, July 14-18, 2018*, pages Spring. Proc. Phys., 234, 309–314, Nov 2019.

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Phys. Rev. D, **100 (11)**(Source: eprint: 1701.08997), 115027, 2019.

[I4]

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Study of neutrino oscillation parameters at the INO-ICAL detector using event-by-event reconstruction.
Eur. Phys. J. C, **79**(Source: eprint: 1804.02138), Article: 295, 2019.

[J]

R. Janaki, Shakti N. Menon, Rajeev Singh, and Sitabhra Sinha.
Lateral inhibition provides a unifying framework for spatiotemporal pattern formation in

media comprising relaxation oscillators.
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[Jo]

Jilmy P. Joy and R. Rajesh.

Shock propagation in the hard sphere gas in two dimensions: comparison between simulations and hydrodynamics.

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[K1]

Anirban Karan and Abinash Kumar Nayak.

Estimation of T and CPT violation in neutral B meson mixing from Indirect CP asymmetry: Proceedings, 16th conference on flavor physics and CP violation (FPCP 2018): Hyderabad, india, July 14-18, 2018.

In *Springer Proc. Phys.: vol.234 (Source: iNSPIRE-HEP)*, pages 277–285, Nov 2019.

[K2]

Anirban Karan and Abinash Kumar Nayak.

Behavior of observables for neutral meson decaying to two vectors in the presence of T , CP , and CPT violation in mixing only.

Phys. Rev., D., **101**(Source: eprint: 2001.05282), 015027, 2020.

[Ka]

Shilpa Kastha, Anuradha Gupta*, K. Arun*, B. Sathyaprakash*, and Chris V. Broeck*.

Testing the multipole structure and conservative dynamics of compact binaries using gravitational wave observations: The spinning case.

Phys. Rev., D, **100**(Source: eprint: 1905.07277), 044007, 2019.

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Abhiram Kaushik, Siddhesh Padval*, Rohini M. Godbole*, Vaibhav Rawoot*, and Anuradha Misra*.

Gluon sivers function and transverse single spin asymmetries in $e + p^\uparrow \rightarrow \gamma + X$.

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[Ku]

Debajyoti Choudhury*, Nilanjana Kumar, and Anirban Kundu*.

Search for an opposite sign muon-tau pair and a b -jet at the LHC in the context of flavor anomalies.

Phys. Rev. D., **100 (07)**(Source: eprint: 1905.07982), 075001, 2019.

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Sanjoy Mandal.

Constraining right handed gauge boson mass from lepton number violating meson decays in a low scale left right model: Proceedings, 39th international conference on high energy

physics (ICHEP2018): Seoul, Korea, July 4-11, 2018.
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- *Parallel: Beyond the Standard Model*, Aug 2019.

[M2]

Rojalin Padhan*, **Sanjoy Mandal**, **Manimala Mitra***, and **Nita Sinha**.

Signatures of \tilde{R}_2 class of leptoquarks at the upcoming ep colliders.

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Shakti N. Menon, **V. Sasidevan***, and **Sitabhra Sinha**.

Is life (or at least socioeconomic aspects of it) just spin and games?

In *Network theory and agent-based modeling in economics and finance*, pages 265–281.

Springer, Singapore, Apr 2019.

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A current perspective on wound healing and tumour-induced angiogenesis.

Bulletin of Mathematical Biology, **82**, 23, 2020.

[N]

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Testing electroweak-penguin pollution in weak phase α measurement using $B \rightarrow \pi\pi$ and

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On Chebyshev wells: Periods, deformations, and resurgence.

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Journal of Statistical Mechanics, **2019**, 063201, 2019.

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V. V. Prasad and **R. Rajesh**.

Asymptotic behavior of the velocity distribution of driven inelastic gas with scalar velocities:

Analytical results.

Journal of Statistical Physics, **176**, 1409, 2019.

[R]

G. Rajasekaran.

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In **(Source: eprint: 1907.08380)**. 2019.
1907.08380 [hep-ph] (Submitted).

[Ra1]

Pinaki Banerjee*, **Alok Laddha***, and **Prashanth Raman**.

Stokes polytopes: the positive geometry for ϕ^4 interactions.

Journal of High Energy Physics, **2019**(**Source: MR: 4014536**), Article: 67, 2019.

[Ra2]

Prashanth Raman.

The positive geometry for ϕ^p interactions.

Journal of High Energy Physics, **10**, (271) **33**.(**Source: MR: 4051117**), Article:271, 2019.

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Gen. Rel. Grav., **51**, (6)(**Source: eprint: 1903.09770**), Article: 75, 2019.

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In **(Source: eprint: 1912.05300)**. 2019.

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Importance of being cross-linked for the bacterial cell wall.

Phys. Rev. E, **100**(6), 062408–1, 2019.

[Ran2]

Garima Rani and Issan Patri*.

Modeling heterogeneities in the crosslinked bacterial sacculus.

Phys. Rev. Research, **2**(1), 013090–1, 2020.

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Rathul Nath Raveendran.

Gauge invariant prescription to avoid a γ -crossing instability in a galileon bounce.

Phys. Rev., D, **99**(**Source: MR: 4002799**), 103517, 5, 2019.

[Rav2]

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Phys. Rev. D, **100**(**Source: eprint: 1812.06803**), 083523, 2019.

[Ravi]

Arunima Bhattacharya*, **Maguni Mahakhud***, **Prakash Mathews***, and **V. Ravindran**.

Two loop QCD amplitudes for di-pseudo scalar production in gluon fusion.

JHEP, **02**(Source: eprint: 1909.08993), 121, 2020.

[Ri]

Sain Ria.

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Radiative b -baryon decays to measure the photon and b -baryon polarization.

The European Physical Journal C, **79**(Source: eprint: 1902.04870), Article: 634, 2019.

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Shibasis Roy, **Rahul Sinha**, and **N. Deshpande***.

Nonleptonic beauty baryon decays and cp asymmetries based on an $SU(3)$ -flavor analysis.

Phys. Rev. D, **101**(Source: eprint: 1911.01121), 036018, 2020.

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Anupam Sarkar and **C. M. Chandrashekar**.

Multi-bit quantum random number generator from a single qubit quantum walk.

Nature Scientific Reports, **9**, 12323, 2019.

[Sh]

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PLoS Computational Biology, **15**(5), e1006977, 2019.

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In *Proceedings for Quark Matter 2019*, Mar 2020.

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[Sha2]

A. Bazavov*, **D. Bollweg***, **H. Ding***, **P. Enns***, **J. Goswami***, **P. Hegde***, **O. Kaczmarek***, **F. Karsch***, **C. Larsen***, **Swagato Mukherjee***, **H. Ohno***, **P. Petreczky***, **C. Schmidt***, **Sayantana Sharma**, and **P. Steinbrecher***.

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In (Source: eprint: 2001.08530). 2020.
arXiv:2001.08530 [hep-lat] (Submitted).

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P. Petreczky*, **R. Thakkar***, **H. Sandmeyer***, **C. Schmidt***, **Sayantana Sharma**,
and **P. Steinbrecher***.

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Towards a semi-classical description of QCD vacuum around t_c .

In (Source: eprint: 1912.09141). 2019.

arXiv:1912.09141 [hep-lat] (Submitted).

[Sha5]

Mark Mace*, **Niklas Mueller***, **Soeren Schlichting***, and **Sayantana Sharma**.

Chiral instabilities & the onset of chiral turbulence in QED plasmas.

In *Phys. Rev. Lett.* **124**, 191604. 2020.

(Source: eprint: 1910.01654) arxiv: 1910.01654.

[Si]

Timokhin I.V.*, **Matveev S.A.***, **Siddharth N.**, **Tyrtysnikov E.E.***, **Smirnov A.P.***, and **Brilliantov N.V.***.

Newton method for stationary and quasi-stationary problems for smoluchowski-type equations.

J. of Computational Physics, **382**(Source:iNSPIRE-HEP), 124–137, 2019.

(<https://doi.org/10.1016/j.jcp.2019.01.013>).

[Sin1]

Ilaria Pizio*, **Shivani Singh**, **C. M. Chandrashekar**, and **Matteo G. Paris***.

Quantum probes for quantum wells.

J. Phys. A: Math. Theor., **52**, 265302, 2019.

[Sin2]

Ilaria Pizio*, **Shivani Singh**, **C.M. Chandrashekar**, and **Matteo G.A. Paris***.

Optimal strategies to infer the width of an infinite square well by performing measurements on the particle(s) contained in the well.

J. Phys. A, **52** (26)(Source: MR: 3962345), 265302, 17, 2019.

[Sin3]

Shivani Singh, **Radhakrishnan Balu***, **Raymond Laflamme***, and **C. M. Chandrashekar**.

Accelerated quantum walk, two-particle entanglement generation and localization.

Journal of Physics Communications, **3**(5), 055008, 2019.

[Sin4]

Shivani Singh, C. M. Chandrashekar, and Matteo G. Paris*.

Quantum walker as a probe for its coin parameter.

Phys. Rev. A, **99**, 052117, 2019.

[Sinh1]

Eung Jin Chun*, Arindam Das*, Sanjoy Mandal*, Manimala Mitra*, and Nita Sinha.

Sensitivity of lepton number violating meson decays in different experiments.

Phys. Rev. D, **100**(Source: eprint: 1908.09562), 095022, 2019.

[Sinh2]

C. Soumya*, Monojit Ghosh*, Sushant K. Raut*, Nita Sinha, and Poonam Mehta*.

Probing muonic charged current nonstandard interactions at decay-at-rest facilities in conjunction with T2HK.

Phys. Rev. D, **101** (5)(Source: eprint: 1911.05021), 055009, 2020.

[Sr]

T. Sreeraj and Ramesh Anishetty.

Gauss law at a vertex in lattice QCD and its gauge invariant hilbert space.

In (Source: eprint: 1906.03893). 2019.

arxiv: 1906.03893(hep-lat) (Submitted).

[T]

Devanand T, Krishnaswamy Sankaran, and Satyavani Vemparala.

Interdigitation of lipids induced by membrane active proteins.

Journal of Membrane Biology, **331**, 252, 2019.

[Th]

R. Thiru Senthil and G. Rajasekaran.

Anomalous kolar events and dark matter decay in dwarf spheroidal galaxies.

In (Source: eprint: 1906.08951). 2019.

arXiv:1906.08951v1 [hep-ph] (Submitted).

[Tr]

Kamal Tripathi, Gautam I. Menon, and Satyavani Vemparala.

Confined crowded polymers near attractive surfaces.

The Journal of Chemical Physics, **151**, 244901, 2019.

[V]

Vinay Vaibhav, Juergen Horbach*, and Pinaki Chaudhuri.

Response of glassy liquids to thermal gradients.

Physical Review E, **101**, 022605, 2020.

[Ve]

Upayan Baul* and Satyavani Vemparala.

Biomimetic antimicrobial polymers.

In Shady Farah Abraham J Domb, Konda Reddy Kunduru, editor, *Antimicrobial Materials for Biomedical Applications*, page 113. The Royal Society of Chemistry, 2019.

[Vi]

N. Vigneshwar, D. Mandal, K. Damle*, D. Dhar*, and R. Rajesh.

Phase diagram of a system of hard cubes on the cubic lattice.

Physical Review E, **99**, 052129, 2019.

2.4 Theoretical Computer Science

2.4.1 Research Summary & Highlights

Automata, Logic and Concurrency

Notions of equilibria are central not only to game theory but also computational social choice theory and voting systems, and most algorithmic problems in these areas can be seen as computation of fixed-points of suitably defined operators. In [D], we suggest the extension of first order logic with monadic least fixed-point operators and counting is appropriate for a variety of these problems, and present a model checking algorithm for the logic, An important aspect of security theory is the study of algebraic properties of encryption algorithms and how they impact security verification. When encryption is distributive over pairing, as we have in the case of blind pairs, the associated Dolev-Yao theory is generally hard, and becomes non-elementary for Abelian group operators. [R] presents an intermediate theory of associative distributive encryption which is elementary but yet DEXPTIME-complete.

Term-modal logics are closely related to First order modal logics. These are of great interest for infinite state systems but are typically undecidable, hence it is a challenge to find decidable fragments. [P] identifies the two variable fragment of term-modal logic as a decidable one. The proof proceeds by constructing a new normal form as well as a novel inductive construction generalizing the one for two variable first order logic.

Algorithms and Data Structures

Prof Pavol Hell, a renowned graph theorist from Simon Fraser University, Canada, visited IMSc during November 27th to 30th, and in conjunction with the visit, a two day workshop was organized with the title, ‘**Graphs, Structures and Algorithms**’ on November 28th and 29th. The meeting had 13 talks by experts from IIT Madras, IISc Bangalore, IIT Hyderabad, Chennai Mathematical Institute and Indian Statistical Institute Chennai apart from Prof Pavol Hell and students and faculty of IMSc. It had over 50 participants from IMSc, IIT Madras, CMI and other institutions in Chennai.

For a graph G and a positive integer d , a set S is a fair set with the fairness factor d if for every vertex in G , at most d of its neighbours are in S . In the Π -Fair Vertex Deletion

problem, the aim is to find in a given graph a fair set S of minimum size such that $G - S$ satisfies the property II. In [J3], the authors initiate a systematic study on various Fair Vertex Deletion problems under various parameterizations.

In list-coloring, each vertex is given a list of allowed colors with which it can be colored. In [J2], the authors show that, given a graph of n vertices with each vertex having a list of size $n - k$, there is an algorithm which is FPT with respect to k that determines whether there is a coloring that respects the lists.

Set Cover is one of the well-known classical NP-hard problems. In [J1], the authors study the conflict-free version of the Set Cover problem. Here we have a universe U , a family F of subsets of U and a graph G_F on the vertex set F and we look for a subfamily $F' \subseteq F$ of minimum size that covers U and also forms an independent set in G_F . The authors initiate a systematic study of the problem in parameterized complexity by restricting the focus to the variants where Set Cover is fixed-parameter tractable (FPT). They give upper bounds and lower bounds for conflict-free version of the Set Cover with and without duplicate sets along with restrictions to the graph classes of G_F .

Computational Complexity

For quantified Boolean formulas (QBF) there are two main different approaches to solving: conflict-driven clause learning (QCDCL) and expansion solving. In [Ma], the underlying proof systems are compared, and it is shown that expansion systems admit strictly shorter proofs than QCDCL systems for formulas of bounded quantifier complexity, thus pointing towards potential advantages of expansion solving techniques over QCDCL solving.

The first result shows that *tree-like* expansion systems allow short proofs of QBFs that are a source of hardness for QCDCL, i.e. tree-like $\forall\text{Exp}+\text{Res}$ is strictly stronger than tree-like Q-Resolution.

The second result shows that *dag-like* Q-Resolution proofs of QBFs with bounded quantifier complexity can be efficiently transformed into $\forall\text{Exp}+\text{Res}$ proofs. This is theoretical confirmation of experimental findings by Lonsing and Egly, who observed that expansion QBF solvers often outperform QCDCL solvers on instances with few quantifier alternations.

2.4.2 List of 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. The following list includes in addition to Publications reported by members, Publications extracted from sources like Mathscinet, iNSPIRE/HEP, etc., which are duly verified by the members.

[A1]

V. Arvind, Abhranil Chatterjee, Rajit Datta*, and Partha Mukhopadhyay*.

Efficient black-box identity testing for free group algebras.

In Laszlo A. Vegh Dimitris Achlioptas, editor, *Approximation, Randomization, and Combinatorial Optimization. Algorithms and Techniques, APPROX/RANDOM 2019*, page 57:1. LiPiCS, Schloss Dagstuhl - Leibniz-Zentrum fr Informatik, Sep 2019.

[A2]

V. Arvind, Frank Fuhlbruck*, Johannes Koebler*, and Oleg Verbitsky*.

On weisfeiler-leman invariance: Subgraph counts and related graph properties.

In Levcopoulos Gasieniec, Jansson, editor, *Fundamentals of Computation Theory - 22nd International Symposium, FCT 2019*, page 111. Lecture Notes in Computer Science vol. 11651, Springer Verlag, Aug 2019.

[A3]

V. Arvind, Abhranil Chatterjee, Rajit Datta*, and Partha Mukhopadhyay*.

Fast exact algorithms using hadamard product of polynomials.

In Paul Gastin Arkadev Chattopadhyay, editor, *39th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science, FSTTCS 2019*, page 9:1. LiPiCS, 150, Schloss Dagstuhl, Leibniz-Zentrum fuer Informatik 2019, Dec 2019.

[A4]

V. Arvind, Abhranil Chatterjee, Rajit Datta*, and Partha Mukhopadhyay*.

On explicit branching programs for the rectangular determinant and permanent polynomials.

In Guochuan Zhang Pinyan Lu, editor, *30th International Symposium on Algorithms and Computation, ISAAC 2019*, page 38:1. LIPIcs 149, Schloss Dagstuhl - Leibniz-Zentrum fuer Informatik, Dec 2019.

[A5]

V. Arvind, Frank Fuhlbruck*, Johannes Koebler*, and Oleg Verbitsky*.

On the weisfeiler-leman dimension of fractional packing.

In Alberto Leporati, Carlos Martin-Vide, Dana Shapira, and Claudio Zandron, editors, *Language and Automata Theory and Applications - 14th International Conference, LATA 2020*, page 357. Lecture Notes in Computer Science 12038, Springer 2020, Mar 2020.

[B]

Niranka Banerjee, Venkatesh Raman, and Saket Saurabh.

Fully dynamic arboricity maintenance.

In Tian C. Du Dz, Duan Z, editor, *International Computing and Combinatorics Conference (COCOON)*, page 1. Springer, Jul 2019.

[D]

Ramit Das, R. Ramanujam, and Sunil Simon*.

Reasoning about social choice and games in monadic fixed-point logic.

In Larry Moss, editor, *Theoretical Aspects of Rationality and Knowledge*, page 106. EPTCS Volume 297, Jul 2019.

[G1]

Ghurumuruhan Ganesan.

Graph extensions, edit number and regular graphs.

Discrete Applied Mathematics. The Journal of Combinatorial Algorithms, Informatics and Computational Sciences, **258**(Source: MR: 3926434), 269–275, 2019.

[G2]

Ghurumuruhan Ganesan.

Traveling salesman problem across well-connected cities and with location-dependent edge lengths.

Proceedings - Mathematical Sciences, **129**(Source: MR: 3993866), Article number: 78, 2019.

[J1]

Ashwin Jacob, Diptapriyo Majumdar*, and Venkatesh Raman.

Parameterized complexity of conflict-free set cover.

In *Computer Science Theory and Applications, 13th International Computer Science Symposium in Russia, CSR 2019*, Jul 2019.

[J2]

Aritra Banik*, Ashwin Jacob, Vijay K. Paliwal*, and Venkatesh Raman.

Fixed-parameter tractability of $(n-k)$ list coloring.

In *Combinatorial Algorithms, 30th International Workshop on Combinatorial Algorithms, IWOCA 2019, Pisa, Italy*, Jul 2019.

[J3]

Ashwin Jacob, Venkatesh Raman, and Vibha Sahlot.

Deconstructing parameterized hardness of fair vertex deletion problems.

In *Computing and Combinatorics: International Computing and Combinatorics Conference COCOON 2019*, Jul 2019.

[M1]

Jayakrishnan Madathil, Roohani Sharma, and Meirav Zehavi*.

A sub-exponential fpt algorithm and a polynomial kernel for minimum directed bisection on semicomplete digraphs.

In *Proceedings of the 44th International Symposium on Mathematical Foundations of Computer Science (MFCS), 2019.*, Aug 2019.

[M2]

Jayakrishnan Madathil, Pranabendu Misra*, and Saket Saurabh.

An erdosposa theorem on neighborhoods and domination number.

In *Proceedings of the 25th International Conference on Computing and Combinatorics (COCOON), 2019.*, Jul 2019.

[M3]

Akanksha Agarwal*, Sudeshna Kolay*, Jayakrishnan Madathil, and Saket Saurabh.

Parameterized complexity classification of deletion to list matrix-partition for low-order matrices.

In *Proceedings of the 30th International Symposium on Algorithms and Computation (ISAAC), 2019.*, Nov 2019.

[Ma]

Olaf Beyersdorff*, **Leroy Chew***, **Judith Clymo***, and **Meena Mahajan**.

Short proofs in QBF expansion.

In *The 22nd International Conference on Theory and Applications of Satisfiability Testing SAT, LNCS 11628*, pages 19–35. Springer, Jul 2019.

[Maj]

Diptapriyo Majumdar, **Rian Neogi**, **Venkatesh Raman**, and **Vaishali S.**

Tractability of konig edge deletion problems.

TCS, **796**, 207, 2019.

[N1]

Rian Neogi, **MS Ramanujan***, **Saket Saurabh**, and **Roohani Sharma**.

On the parameterized complexity of deletion to h-free strong components.

Feb 2020.

(Submitted).

[N2]

Mathew Francis*, **Rian Neogi**, and **Venkatesh Raman**.

Recognizing k-clique extendible orderings.

Mar 2020.

(Submitted).

[P]

Anantha Padmanabha and **R. Ramanujam**.

Two variable fragment of term modal logic.

In Pinar Heggernes Peter Rossmanith and Joost-Pieter Katoen, editors, *Mathematical Foundations of Computer Science*, page 30:1. LIPIcs series vol 138, Schloss Dagstuhl, Aug 2019.

[Pr]

Swaroop N. Prabhakar and **Vikram Sharma**.

Improved bounds on absolute positiveness of multivariate polynomials.

Journal of Symbolic Computation, 2019.

(To be published).

[R]

A. Baskar*, **R Ramanujam**, and **S P Suresh***.

Dolev-yao theory with associative blindpair operators.

In Michal Hospodar and Galina Jiraskova, editors, *CIAA 2019, Conference on Implementation and Application of Automata*, page 58. Springer LNCS vol 11601, Jul 2019.

[Ra]

Aritra Banik*, **Fahad Panolan***, **Venkatesh Raman**, **Vibha Sahlot**, and **Saket Saurabh**.

Parameterized complexity of geometric covering problems having conflicts.
Algorithmica, **82**, 1, 2019.

[S]

Marek Cygan*, **Daniel Lokshtanov***, **Marcin Pilipczuk***, **Michał Pilipczuk***, and **Saket Saurabh**.

Minimum bisection is fixed-parameter tractable.

SIAM J. Comput., **48(2)**(Source: MR: 3937925), 417, 2019.

[Sh]

Prashant Batra* and **Vikram Sharma**.

Complexity of a root clustering algorithm.

2019.

(Submitted).

[Sr]

Olaf Beyersdorff*, **Leroy Chew***, and **KartEEK Sreenivasaiah**.

A game characterisation of tree-like q -resolution size.

Journal of Computer and System Sciences, **104**(Source: MR: 3959707), 82–101, 2019.

[Su1]

Abhiruk Lahiri*, **Joydeep Mukherjee***, and **C. R. Subramanian**.

Approximating MIS over equilateral b_1 -vpg graphs.

2019.

(Preprint: arXiv:1912.07957v1).

[Su2]

C. R. Subramanian.

Approximation of MIS on geometric intersection graphs.

2019.

(Preprint: manuscript, 16 pages.).

2.5 Student Programmes

2.5.1 Degrees Awarded

Doctoral Degrees Awarded during 2019 – 2020

Computational Biology

Name: **Ankit Aggarwal**

Thesis Title: Nuclear architecture from chromosomes to motifs

Thesis Advisor: Gautam I. Menon

University: HBNI

Mathematics

Name: **Avijth Nath**

Thesis Title: Topology of Generalized Dold Manifolds

Thesis Advisor: Parameswaran Sankaran

University: HBNI

Name: **Pranendu Darbar**

Thesis Title: Correlation of multiplicative functions

Thesis Advisor: Anirban Mukhopadhyay

University: HBNI

Name: **Biplab Paul**

Thesis Title: Arithmetic of Hecke eigenvalues of Siegel modular forms

Thesis Advisor: Sanoli Gun

University: HBNI

Name: **Priymvad Srivastav**

Thesis Title: An alternate Vaughan's Identity in the ternary goldbach problem

Thesis Advisor: Sanoli Gun

University: HBNI

Name: **Jyothsnaa Sivaraman**

Thesis Title: On Euclidean ideal classes in Abelian extensions

Thesis Advisor: Sanoli Gun

University: HBNI

Physics

Name: **Anirban Karan**

Thesis Title: Probing some beyond standard model scenarios in different sectors of flavour physics

Thesis Advisor: Rahul Sinha

University: HBNI

Name: **Arnab Priya Saha**

Thesis Title: Soft graviton theorems in higher spacetime dimensions

Thesis Advisor: Kalyana Rama

University: HBNI

Name: **Dipanjan Mandal**

Thesis Title: Entropy driven phase transitions in hard core lattice gases

Thesis Advisor: R. Rajesh

University: HBNI

Name: **R. Rathul Nath**

Thesis Title: Two field models of Inflationary and bouncing scenario

Thesis Advisor: Balachandran Sathiapalan
University: HBNI

Name: **Sagnik Chakraborty**
Thesis Title: Phenomenological and foundational aspects of non-markovianity
Thesis Advisor: Sibasish Ghosh
University: HBNI

Name: **Sanjoy Mandal**
Thesis Title: Search for sterile neutrinos at colliders
Thesis Advisor: Nita Sinha
University: HBNI

Name: **Tanmay Mitra**
Thesis Title: Adaptive dynamics of intra- and inter- cellular networks: Emergence of memory and learning in cell signaling and immune system.
Thesis Advisor: Sitabhra Sinha
University: HBNI

Name: **Anvy M. Tom**
Thesis Title: Attractive interactions in similarly charged polyelectrolytes
Thesis Advisor: S. Vemparala & R. Rajesh
University: HBNI

Theoretical Computer Science

Name: **Anantha Padmananba**
Thesis Title: Propositional term modal logic
Thesis Advisor: R. Ramanujam
University: HBNI

Name: **N.P. Swaroop**
Thesis Title: New results in bounds for positiveness of polynomial
Thesis Advisor: Vikram Sharma
University: HBNI

Doctoral Theses Submitted during 2019 – 2020

Computational Biology

Name: **Devanand, T.**
Thesis Title: Allosteric effects in protein dynamics and their interactions with membranes
Thesis Advisor: Satyavani Vemparala
University: HBNI

Mathematics

Name: **Nabanita Ray**

Thesis Title: Projective bundle and blowup

Thesis Advisor: Sanoli Gun

University: HBNI

Name: **Narayanan P. A.**

Thesis Title: Eigenvalue Statistics of Higher Rank Anderson Model on the Canopy Tree

Thesis Advisor: Vijay Kodiyalam

University: HBNI

Name: **Sohan Lal Saini**

Thesis Title: Topics in planar algebras and their presentations

Thesis Advisor: Vijay Kodiyalam

University: HBNI

Name: **Snehajit Misra**

Thesis Title: Higgs bundles on ruled surfaces and nef and pseudo effective cones of certain projective varieties

Thesis Advisor: Sanoli Gun

University: HBNI

Physics

Name: **Ankita Chakrabarti**

Thesis Title: Quantum Geometry of correlated Many Body states

Thesis Advisor: S.R. Hassan

University: HBNI

Name: **Dheeraj Kumar Mishra**

Thesis Title: Thermodynamic corrections due to an invariant ultraviolet scale and its implications

Thesis Advisor: Sibasish Ghosh

University: HBNI

Name: **Jilmy P. Joy**

Thesis Title: Shock propagation in dilute inelastic and elastic media

Thesis Advisor: R. Rajesh

University: HBNI

Name: **Prafulla Oak**

Thesis Title: Holographic and exact RG beta function computations of the *Sine – Gordon* model

Thesis Advisor: Balachandran Sathiapalan

University: HBNI

Name: **Prashanth Raman**
Thesis Title: Positive Geometry of Scalar Theories
Thesis Advisor: Nemani Venkata Suryanarayana
University: HBNI

Name: **Shilpa Kastha**
Thesis Title: Gravitational waves from compact binary coalescences: tests of general relativity and astrophysics
Thesis Advisor: Manjari Bagchi
University: HBNI

Name: **N. Vigneshwar**
Thesis Title: Entropy driven phase transition in hard core lattice gas models in three dimensions
Thesis Advisor: R. Rajesh
University: HBNI

Masters Degrees awarded during 2019 – 2020

Physics

Name: **Anupam Sarkar**
Thesis Title: Randomness in a quantum system, it's extraction and application
Thesis Advisor: C.M. Chandrashekar
University: HBNI

Name: **Arindram Mitra**
Thesis Title: Incompability in Quantum information processing: An operational point of view
Thesis Advisor: Manjari Bagchi
University: HBNI

Name: **B.A. Bhargava**
Thesis Title: Collective excitation in emergent lattices
Thesis Advisor: R. Ganesh
University: HBNI

Name: **Sahil**
Thesis Title: Studies in weak measurements, entanglements, Information, scrambling, open systems and all that
Thesis Advisor: Sibasish Ghosh
University: HBNI

Name: **Soumya Sur**
Thesis Title: Investigations into Quantum spin liquids and Superconductor- Inductor phase transition

Thesis Advisor: Mukul S. Laad
University: HBNI

Master's Theses during 2019 – 2020

External Master's Theses

The following is the list of master's theses of various students from other institutions under the supervision of IMSc faculty.

Mathematics

Name: **K. Seethalakshmi**
Thesis Title: A Chinese Remainder Theorem for Partitions
Thesis Advisor: Amritanshu Prasad
University: IISER Pune

Name: **Divya Chopra**
Thesis Title: Euclidean algorithm in Number Fields
Thesis Advisor: K. Srinivas
University: Central University of Rajasthan, Rajasthan

Theoretical Computer Science

Name: **Mitali Thatte**
Thesis Title: Survey of Algorithms for Different Matchings
Thesis Advisor: Meena B. Mahajan
University: IISER Pune

Name: **Shyam Dhamapurkar**
Thesis Title: Study of Quantum Walks and Quantum PageRank Algorithm
Thesis Advisor: Meena B. Mahajan
University: Savitribai Phule Pune University

2.5.2 Lecture Courses During 2019 – 2020.

The following **lecture courses** were offered during 2019 – 2020.

Course Title	Period	Lecturer
Mathematics		
Floer theory	Jan-Apr 2019	Venugopalan, Sushmita
Measure Theory	Jul-Dec 2019	Roy, Indrava

Algebra-I	Aug-Nov 2019	Mukhopadhyay, Anirban
Complex Analysis	Aug-Dec 2019	Srinivas, K.
Topology	Aug-Nov 2019	Gun, S.
Algebra II	Jan-May 2020	Kodiyalam, Vijay
Algebraic number theory	Jan-Apr 2020	Gun, S.
Topology II	Jan-May 2020	Raghavan, K. N.

Physics

Classical Field Theory	Jan-Apr 2019	Ashok, Sujay K.
Gravitation and Cosmology	Jan-Apr 2019	Bagchi, Manjari
Quantum Field Theory II	Jan-May 2019	Gopalakrishna, Shrihari
Statistical Mechanics	Jan-Apr 2019	Vemparala, Satyavani
Quantum Mechanics II	Mar-Mar 2019	Sharma, Sayantan
Classical Mechanics	Aug-Dec 2019	Sathiapalan, Balachandran
Electromagnetic Theory	Aug-Nov 2019	Bagchi, Manjari
Mathematical Methods II	Aug-Dec 2019	Rajesh, R.
Particle Physics -I	Aug-Nov 2019	Sharma, Sayantan
Advanced Condensed Matter Physics	Jan-May 2020	Coimbatore Balram, Ajit
Cosmology and Gravitation	Jan-Apr 2020	Mukhopadhyay, Partha
Quantum Field Theory II	Jan-Apr 2020	Ashok, Sujay K.

Theoretical Computer Science

Computational Complexity	Jan-Mar 2019	Arvind, V.
Game theory	Jan-May 2019	Ramanujam, R.
Parameterized Complexity	Jan-Apr 2019	Raman, Venkatesh
Proof Complexity	Jan-May 2019	Mahajan, Meena B.
Theory of Computation (through video for IIT-Jodhpur BTech)	Jan-Mar 2019 & Apr-May 2019	Subramanian, C. R.
Algorithms Design and Analysis	Aug-Dec 2019	Raman, Venkatesh
Communication Complexity	Aug-Dec 2019	Mahajan, Meena B.
Discrete Mathematics	Aug-Dec 2019	Subramanian, C.R. & Sharma, Vikram
Linear Programming and combinatorial optimization	Aug-Dec 2019	Sharma, Vikram
Theory of Computation	Aug-Dec 2019	Mahajan, Meena B.
Boolean Function Complexity	Jan-May 2020	Mahajan, Meena B.
Computational Complexity	Jan-May 2020	Mahajan, Meena B.
Parameterized Complexity	Jan-Apr 2020	Raman, Venkatesh

Computational Biology

Protein Structure	Aug-Nov 2019	Vemparala, Satyavani
Statistical Field Theory	Jan-May 2019	Menon, Gautam I.

2.6 Honours and Awards

Amritanshu Prasad was elected Fellow, for 2019, by the Indian Academy of Sciences.

Dishant Pancholi was awarded The Shanti Swarup Bhatnagar Prize for Science and Technology in Mathematical Sciences for 2019.

Ramanujam, R. was awarded Indira Gandhi Prize for popularization of science for 2020.

Saket Saurabh was elected fellow of Indian Academy of Sciences.

Biplab Paul, a recent graduate student in Mathematics, has been awarded JSPS postdoctoral fellowship in Japan.

Roohani Sharma, a senior research fellow(graduate student) in Theoretical Computer Science was offered a “Lisa Meitner Award postdoctoral fellowship for excellent women computer scientists at “Max Planck Institute for Informatics, that allows her to pursue independent research.

Chapter 3

Other Professional Activities

This chapter lists the activities carried out by the individual members of the institute in their professional capacity.

Arvind, V.

Member of Academic Council, Homi Bhabha National Institute

Associate Editor of Editorial Board, ACM Journal on Transactions of Computation Theory

Editor of Computational Complexity Column, Bulletin European Association of Theoretical Computer Science

Member of Programme Committee of the Symposium on Theoretical Aspects of Computer Science during Aug 2019 – Mar 2020.

Bagchi, Manjari

Convener of International Organising Committee for IPTA 2019 Conference held at Orchid Hotel, Pune, India during Jun 10 – Jun 21, 2019.

Reviewer of GMRT observation proposals during Aug 2019 – Feb 2020.

Reviewer of online course on Astronomy and Astrophysics (ARPIT-2019) for teachers of colleges and universities as a part of the SWAYAM programme of the Government of India. The course was prepared by IUCAA, the National Resource Centre for Astronomy and Astrophysics, during August, 2019.

Lecture at Coimbatore, India on Sep 22, 2019. “Talking to the stars” at Scicon India 2019 (<https://sciconindia.com/>), a science and technology conference (covering astronomy, data science, biology, climate science, and sustainable living) for school students.

Lecture at VIT University, Chennai, India on Jan 27, 2020. “Talking to undead stars” in

the workshop on “Women in Science” (organized by SPIE Student Chapter).

Delivered a lecture on “Neutron Stars - Two Body Problem” at Hindustan Institute of Technology and Science, Chennai on Mar 12, 2020. The event was organized by the School of Aeronautical Sciences and Nebula Astro Club.

Gopalakrishna, Shrihari

Inaugural lecture in Ripples 19 at Ethiraj College for Women on Aug 21, 2019. The inaugural lecture titled “Cosmology, Particle Physics, and Dark Matter” was delivered in the Ripples 19 event for the benefit of BSc and MSc students.

Gun, S.

Reviewer of Mathematical Reviews during Jul 2008 – Dec 2019.

Reviewer of Zentralblatt Reviews during Apr 2011 – Dec 2019.

Managing Editor of IMSc monograph series during Apr 2015 – Dec 2019.

Editor of JRMS during Mar 2017 – Dec 2019.

Editor of PMSC during Jan 2018 – Dec 2019.

Mahajan, Meena B.

Chairperson of Steering Committee for FSTTCS Conference during Jul 2018 – Jun 2019.

Member of Programme Committee of 37th Symposium on Theoretical Aspects of Computer Science (STACS), 10-13 March 2020, Montpellier, France during Sep 2019 – Mar 2020.

Member of Programme Committee, Computer Science in Russia Conference during Jan 2020 – Jul 2020.

Member of EATCS Presburger Award Committee, during Feb 2020 – Jul 2021.

Menon, Gautam I.

Member of Program Committee, International Centre for Theoretical Sciences- TIFR, Bengaluru during Mar 2018 – Mar 2020.

Member of SERB Programme Advisory Committee on Condensed Matter Physics and Materials Science during Mar 2018 – Mar 2020.

Member of Wellcome Trust/DBT India Alliance Early Career Fellowship Selection Commit-

tee during Mar 2018 – Mar 2020.

Member of Program Advisory Board, TPSC, S.N. Bose National Centre for Basic Science, Kolkata, during Jan 2019 – Mar 2020.

Prasad, Amritanshu

Exposition on Category Theory for Computer Science at Tata Consultancy Services (IGNITE) on Jan 2, 2020.

Raghavan, K. N.

Member of Board of Studies in Mathematics, CUSAT

Convener (southern region) of NBHM Library Committee

Associate Editor of Indian Journal of Pure and Applied Mathematics

Board Member of National Board for Higher Mathematics

Secretary of Forum D'Analystes

Member of Programme Committee for AFS of NCM

Member of Steering Committee of the Talent Nurture Programme of the Kerala School of Mathematics

Chair of NBHM Examination Committee

Member of Indian Academy of Sciences, Science Education Panel

Member of Board of Studies (Mathematical Sciences) of HBNI

Convener of National Organising Committee for Teachers' Enrichment Workshop held at MEPCO Schlenk Engineering College, Sivakasi during May 13 – May 18, 2019.

Convener of Local Organising Committee for Conference on Topology, Geometry, and Related Topics held at IMSc during May 27 – May 28, 2019.

Convener of Advisory Committee for Eleventh Summer Training Programme in Mathematics held at RIASM, University of Madras during May 8 – May 28, 2019.

Convener of National Organising Committee for Instructional School for Teachers (NCM event) held at IISER Thiruvanthapuram during Jun 3 – Jun 15, 2019.

Mathematics Club Inauguration at Guru Nanak College on Aug 16, 2019. Delivered a lecture

Mentor at DST INSPIRE programme for school students at Panjab University, Chandigarh on Oct 17, 2019. Lectured and interacted with school students

Mathematics meeting for school children at Vana Vani School (IIT Madras) on Nov 2, 2019.

Convener of Local Organising Committee for Teachers' Enrichment Workshop held at IMSc during Nov 25 – Nov 30, 2019.

Convener of National Organising Committee for ATM Workshop on Combinatorial Methods in Representation Theory held at IMSc during Nov 4 – Nov 16, 2019.

Mentor at DST INSPIRE programme for school students at University of Madras, Guindy Campus on Dec 26, 2019. Lectured to and interacted with the participants

One-off lecture to college students at SA Engineering College, Chennai on Feb 20, 2020. Lectured to Engineering students on linear algebra

Raman, Venkatesh

Member of Board of Studies in Mathematics at PSG College of Technology, Coimbatore during Apr 2017 – Mar 2020.

Member of Board of Studies in Computer Science at Stella Maris College, Chennai during Apr 2017 – Mar 2020.

Convener of National Organising Committee for Computational Thinking in Schools (CTiS) 2019 held at Pune on Apr 20, 2019.

Convener of Local Organising Committee for ACM-India Summer School on Graphs and Graph Algorithms held at National Institute of Technology, Calicut during Jun 17 – Jul 5, 2019.

Convener of National Organising Committee for Recent Trends in Algorithms held at IIT Gandhinagar during Feb 16 – Feb 19, 2020.

Ramanujam, R.

Vice President of Executive Council of Mathematics Teachers' Association of India during Apr 2018 – Dec 2019.

Co-chair, Track on Comput Logic of Program Committee of CLMPST2019: 16th International Congress on Logic, Methodology and Philosophy of Chance during May 2018 – Sep 2019.

Sharma, Sayantan

Convener of Local Organising Committee for First IMSc discussion meeting on extreme QCD matter held at IMSc during Sep 16 – Sep 21, 2019.

Srinivas, K.

Member of Board of Studies, NIT Rourkela

Co-managing Editor of Hardy Ramanujan Journal

Convener of NCM TEW Programme Committee

Convener of Local Organising Committee for Teachers' Enrichment Workshop held at IMSc during Nov 25 – Nov 30, 2019.

Subramanian, C. R.

Member of Programme Committee, 6th International Conference on Algorithms and Discrete Applied Mathematics (CALDAM-2020), IIT-Hyderabad, February 2020, during Apr 2019 – Feb 2020.

Vemparala, Satyavani

Speaker: Lecture Programme for students of class XI and XII at Chennai Mathematical Institute, Siruseri, Chennai on Jul 9, 2019. This is a Lecture Programme for students of class XI and XII, in association with National Academy of Sciences, Allahabad, held at the Chennai Mathematical Institute, Siruseri.

And spoke about “What can computer simulations teach us about materials”.

Viswanath, Sankaran

Lecturer in ‘Facets 2019’ at IMSc on Jul 8, 2019. Delivered a lecture on “Matrix representations” in the IMSc outreach program “Facets” for college students.

Member of Faculty selection committee, IIT Kanpur during October, 2019.

Lecturer in kaNita kAnakam 2019 at IMSc on Oct 24, 2019. Lectured in Tamil on Integer Partitions to school students primarily from Tamil medium.

Convener of Local Organising Committee for NCM Workshop: Combinatorial models in representation theory held at IMSc during Nov 4 – Nov 16, 2019.

Lecturer in National Mathematics Day at Ramanujan Institute for Advanced Study in Mathematics on Dec 22, 2019. Gave a lecture titled “Combinatorics and representation theory” as part of the National Mathematics day celebrations at RIASM.

Lecturer at “Forays 2020” at IIT Madras on Mar 1, 2020. Delivered a lecture titled “Counting is Fun” to school students at the annual mathematics festival “Forays 2020” of IIT Madras.

Chapter 4

Colloquia

4.1 Conferences/Workshops Held at IMSc

4.1.1 Conference on Topology, Geometry, and Related Topics during May 27 – May 28, 2019.

K.N. Raghavan was the co-organiser of this event along with Arghya Mondal.

4.1.2 First IMSc discussion meeting on extreme QCD matter during Sep 16 – Sep 21, 2019.

This discussion meeting consisted of a set of pedagogic lectures by senior scientists on the current state-of-the-art, open problems and challenges in the area of hot and dense QCD matter.

These lectures were supplemented with mini-review talks by young scientists and talks by graduate students working within this broad theme of research.

4.1.3 Teachers' Enrichment Workshop during Nov 25 – Nov 30, 2019.

Teacher's Enrichment workshop, an outreach programme for teachers of Engineering colleges from Chennai was held at IMSc during Nov 25 - 30, 2019. This programme was sponsored by NCM, financially supported by the Homi Bhabha fellowship of Prof. Ram Dass, CMI and IMSc.

K.N. Raghavan was co-organiser and resource person for this event along with Pralay Chatterjee and Kotyada Srinivas

4.1.4 ATM Workshop on Combinatorial Models for Representation Theory during Nov 4 – Nov 16, 2019.

A National centre for mathematics sponsored workshop on “Combinatorial Models for Representation theory” was held at IMSc during Nov 4-16, 2019. There was enthusiastic participation from Ph.D students and postdocs from across the country.

K.N. Raghavan, was co-organiser of this NCM sponsored event along with Sankaran Viswanath.



Figure 4.1: NCMW-The Path Model

4.2 Other Conferences/Workshops Organized by IMSc

4.2.1 Computational Thinking in Schools (CTiS) 2019 on Apr 20, 2019.

This is the first conference targeting school teachers teaching computing science.

Venkatesh Raman participated as a program committee chair

4.2.2 Teachers’ Enrichment Workshop during May 13 – May 18, 2019.

K.N. Raghavan was the academic convener of this meeting and also a resource person

4.2.3 Eleventh Summer Training Programme in Mathematics during May 8 – May 28, 2019.

K.N. Raghavan helped with the organisation of this event. Also acted as a resource person.

4.2.4 ACM-India Summer School on Graphs and Graph Algorithms during Jun 17 – Jul 5, 2019.

Venkatesh Raman coordinated the summer school and gave several lectures on NP-completeness, Approximation and Parameterized Complexity

4.2.5 Instructional School for Teachers (NCM event) during Jun 3 – Jun 15, 2019.

K.N. Raghavan was the academic convener of this event and also a resource person.

4.2.6 IPTA 2019 Conference during Jun 10 – Jun 21, 2019.

The International Pulsar Timing Array (IPTA) is a consortium of consortia, comprised of the European Pulsar Timing Array (EPTA), the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), and the Parkes Pulsar Timing Array (PPTA). There are three emerging PTAs, the Indian Pulsar Timing Array (InPTA), the Chinese Pulsar Timing Array, and the South African Pulsar Timing Array.

The goal of the IPTA is to detect and characterize the low-frequency gravitational wave universe through timing a global array of approximately 100 millisecond pulsars using the largest radio telescopes in the world. Through sharing resources and creating combined pulsar timing data sets, the IPTA is constructing the most sensitive low-frequency gravitational wave detector possible. Sharing resources will also help to reach other IPTA goals.

Every year, one PTA gets the responsibility of organising the annual meeting of IPTA. This year InPTA organised it.

4.2.7 Recent Trends in Algorithms during Feb 16 – Feb 19, 2020.

Venkatesh Raman helped organise the meeting and gave a talk on ‘Fast Fourier Transform: Algorithms and Applications’

4.3 IMSc Outreach Activities

4.3.1 TNSF Chithirai FEST-I : 6th - 8th May 2019

This is part of the efforts to popularize science to the general public and students who are pursuing science as their career and to fill the gap between what students are acquiring through the curriculum and what it is required. A Summer Camp was organised at Anna Centenary Library, Kotturpuram, Chennai, on June 15, 2019, hosting “Popular Science Lecture Series VIII, LHC and Detection of Higgs Boson.

The event was co-organised by The Institute of Mathematical Sciences, Indian Institute of Technology Madras, Anna Centenary Library Tamil Nadu Science Forum.

4.3.2 Summer Camp for college students:

About 50 students from various local colleges attend a 3 day science workshop including talks on a range of topics from physics to evolution. (Co-organised by The Institute of Mathematical Sciences, Indian Institute of Technology Madras and Tamil Nadu Science Forum)

Organizer: R Ramanujam

4.3.3 Summer School Students Workshop: 14th - 22nd May 2019

Week-long summer science workshop for high school students IMSc students and post-docs ran a 9-day summer workshop for students from class XI. We designed and ran activity and interactive problem sessions for school students on various topics in mathematics and science. About 30 students attended the workshop.

Organizers: Sushmita V, Varuni P



Figure 4.2: Summer School Students Workshop, 14th-22nd May 2019



4.3.4 Teacher's Enrichment Workshop: 20th - 25th May 2019

Linear Algebra and Calculus on \mathbb{R}^n : (A workshop for mathematics teachers of Arts and Science colleges)

Organizer: Sanoli Gun

4.3.5 Exhibitions:

The "Indian Women in Science" exhibition was displayed at TCS Ignite and Periyar Science and Technology Center.

The "From Learning to Doing: Science, Education and Public Service in Chennai" exhibition was displayed at TCS Ignite and Chennai Mathematical Institute.

4.3.6 Facets: 8th - 9th July 2019

Facets is the Institutes's outreach program for advanced undergraduate and postgraduate students of mathematics. This two day program is intended for mathematics students to interact with professional mathematicians working in various fields. This year too, in addition to academics, the program featured mathematicians in industry as well as in the field of education.

The program also featured a career panel where students asked questions to panelists. This year, around 200 students attended this program.

Organizers: Sushmita V, Varuni P.

Speakers: Karen Haydock (HBCSE), R. Rajesh, R. Ramanujam, S. Sunder, Swarna Srinivasan (Ignite TCS), S. Viswanath, Vijay Ravikumar

4.3.7 Annular Solar Eclipse Planning Workshop: 20th - 21st July 2019

Organizers: Ramanujam R, Varuni P Co-organizers: IMSc, Public Outreach and Education Committee of the Astronomical Society of India (ASI-POEC), Vigyan Prasar (DST) An Annular Solar Eclipse (ASE) will be visible on the morning of 26 December 2019 in India, with the annular track passing from southern Karnataka, northern Kerala through central Tamil Nadu. IMSc hosted a two-day workshop for institutions and organizations to plan outreach activities surrounding this Annular Solar Eclipse.

The mass campaigns during past solar eclipses in India are unique in their range and reach. This is a 2-day Nucleation Meeting on the ASE, for the southern states which will be in the path of the annularity. The workshop aimed to collate a list of resource material with responsibilities for their creation, translation and production (all under Creative Commons) and arrive at a shared set of strategies to get as many people as possible to see the eclipse safely. We hope that these plans will also be adapted for the ASE that will occur on 21 June 2020, whose path will cross northern India.

Organizers: Ramanujam R, Varuni P Co-organizers: IMSc, Public Outreach and Education Committee of the Astronomical Society of India (ASI-POEC), Vigyan Prasar (DST)

4.3.8 Vigyan Pratibha Chennai Regional Teachers Workshop (2019-2020:I): 9th-11th September 2019

IMSc organized a 3-day regional teachers workshop for the Vigyan Pratibha program, a Government of India program to nurture of talent in Science and Mathematics among VIII - X students. In addition to the resource people from Homi Bhabha Centre for Science Education (HBCSE), Mumbai, IMSc members also had sessions for the teachers. The workshop was attended by 25 teachers from central schools (KV, JNV and AECS) in the southern region.

Organizers: R. Ramanujam, Varuni P.

Speakers: Chaitanya Ursekar (HBCSE), R. Ramanujam, Prateek Chawla, Rohini Karandikar (HBCSE), Subashri V, Swapna Narvekar (HBCSE), Varuni P.

4.3.9 Annual Solar Eclipse Planning meeting: 15th Sept 2019

A follow-up meeting for the Annular Solar Eclipse (ASE) planning attended by 20 resource people from the southern region.

Organizer: Ramanujam R

Co-organizers: IMSc, Public Outreach and Education Committee of the Astronomical Society of India (ASI-POEC), Vigyan Prasar (DST).

4.3.10 Public lecture: A Symplectic World View: 15th October 2019

Prof. Dishant Pancholi, IMSc Shanti Swaroop Bhatnagar Prize 2019 awardee delivered a public lecture on “Symplectic Geometry and its applications to the understanding of our physical world”.

4.3.11 kaNita-kAnakam: 24th Oct 2019

This is the 3rd year of IMSc’s outreach program for school children in Tamil. The workshop was aimed at students of class VIII - XII. The program included Mathematics activities conducted by IMSc members for students to engage with topics more interactively. About 100 students from various government and corporation schools from the area attended the program.

Organizers: Amritanshu Prasad, Varuni P.

Speakers: R. Baskaran, S. Viswanath, R. Ventakesh (IISc).

4.3.12 Enriching Mathematics Education: 8th Nov 2019

This is the 8th edition of IMSc’s outreach program for school teachers. This year, the workshop has focused on the use of Geogebra as an exploration tool for students. The program was attended by 25 teachers from various Chennai schools.

Organizers: Varuni P, S. Viswanath

Speakers: Aaloka Kanhere (HBCSE)

Hosted by: Balasubramanian V (SSN College)

4.3.13 Public lecture: Using ancient DNA to understand Indian history: 11th Nov 2019

Vagheesh Narasimhan Department of Genetics, Harvard Medical School gave a public lecture on how the genetic makeup of modern Indian populations came to be.

4.3.14 Topics in Biology: 21st Nov 2019

This is the 1st of the institutes outreach program for advanced undergraduate (BSc) and postgraduate (MSc) students of biology and related fields. This year, the program focused on Evolution and Ecology. The program was attended by 20 people from various local institutions. Organizers: Rahul Siddarthan, Varuni P

Speakers: Analabha Basu (NIBMG, Kalyani), Geeta R (Rtd, Delhi University), Manjari Jain (IISER-Mohali), Nandini Rajamani (IISER-Tirupati), Robin Vijayan (IISER-Tirupati)

4.3.15 Teachers Enrichment Workshop: 25th - 30th Nov 2019

Workshop for mathematics teachers of Engineering colleges.

This week-long workshop was aimed at mathematics teachers in Engineering colleges, to enable them to revisit and update content knowledge specifically focusing on Algebra, Linear Algebra, and Cryptography. The program was attended by 40 teachers who were selected from about 200 applicants. This program was part of IMSc's Enriching Collegiate Education (ECE) series of workshops as an effort to facilitate interactions between research mathematicians and college teachers. The workshop was held as a 'Teachers Enrichment Workshop of the National Centre for Mathematics (NCM)', Workshop for mathematics teachers of Engineering colleges.

Organizer: K. Srinivas

Speakers: K. N. Raghavan, Pralay Chatterjee, K. Srinivas.

4.3.16 Excitement in Science: 30th Nov 2019

A series of lectures on Science to celebrate Silver Jubilee year of the International Academy of Physical Sciences (IAPS). The program was attended by 100 students from various local colleges.

Organizers: Ashok Kumar Mishra, K. N. Raghavan

Speakers: Balasubramanian Ramachandran, Madhavan Mukund (CMI), G. Rajasekaran, K. Ramesha (CSIR-CECRI), Sitabhra Sinha (IMSc).

4.3.17 Annular Solar Eclipse : 26th December 2019

An Annular Solar Eclipse (ASE) was visible on the morning of 26 December 2019 in India, with the annular track passing from southern Karnataka, northern Kerala through central Tamil Nadu.

Solar eclipses are of huge public interest and provide an exceptional opportunity to promote science and scientific temper among the people, as well as challenge the myths surrounding the topic. The mass campaigns during past solar eclipses in India are unique in their range and reach. IMSc members worked with local science popularization organizations in various public activities surrounding the ASE including distributing masks and spreading awareness about eclipses.

DSC images: Himanshu Badani at Govt. Arts College, Ooty
Other images: Ariel Huber at Govt. High School, Manathavady, Kerala

4.3.18 Public Lecture: Logic for non-persons?: (7th Jan 2020), By Rohit Parikh, City University of New York, USA

A public lecture on logic and reasoning in babies, animals and groups was organised at the institute. The talk focussed on two themes:

1. To what extent is the reasoning of animals and children logical? What do they think?
2. To what extent can we regard groups: corporations, or political parties, etc. as individuals to whom we can assign goals and beliefs? In other words, how far can we extend the notion of an individual?

For the first part, the speaker referred to experiments in animal behavior and what we know about the thinking of animals and children. For the second part, he spoke about issues in game theory and in states of knowledge, and subsequent coordinated action arising from communication.

4.3.19 Science at the Sabha: (16th Feb 2020)

Talks on science for the general public at The Music Academy:

Science at the Sabha, IMSc's annual flagship outreach program, was held as usual at the Madras Music Academy on Sunday, 16th February. The program, which is free and open to all features talks aimed at anyone with an interest in science, irrespective of age or background. The program this year the program also featured a poster exhibition: "Deep History Sites of the Indian Subcontinent" highlighting some important prehistoric sites in the Indian subcontinent. It attracted around 1000 people and was extensively covered in the press and media.

Organizers: Rahul Siddharthan, Varuni P, S. Viswanath

Speakers: Shannon Olsson (NCBS), Harinath Chakrapani (IISER Pune), V Madhurima (CUTN), R. Ramanujam (IMSc)

Photos: <https://ekalavya.imsc.res.in/node/3897>, <https://ekalavya.imsc.res.in/node/3898>



Figure 4.3: Science at the Sabha, 16th February 2020



4.3.20 Public Lecture: The Cryosphere and Climate of the Earth: (22nd Feb 2020) By R. Shankar, IMSc

This lecture, addressing issues of climate change was co-organized with the Tamil Nadu Science Forum as a part of its Popular Science Lecture series (PSL-17). The ice on earth, the cryosphere, is inextricably tied up with the climate of the earth. It affects and is affected by life on earth. This talk addressed this aspect along with several related questions. The main themes of the talk were: What caused the ice ages ? How did they affect the sea level ? Why is this interplay of great concern today ? What is the evidence that the climate is changing at an “unnaturally” fast rate today ? Closer home, what is the role of the ice in the Himalaya in the water cycle ? How will the current rapid rate of climate change affect the flow of the rivers of North India ? How will it affect the sea level ? What will be the effect of the sea level rise on coastal regions like Chennai ?

4.4 Seminars

Date	Speaker Affiliation	Title
1-4-2019	Vikram Soni JNU	Can there be truly Elementary Particle at all Scales
3-4-2019	Swaroop NP IMSc, HBNI	(PhD Thesis Defense) New Results in Bounds for positiveness of Polynomials
8-4-2019	Arnab Priya Saha HRI, Allahabad	Soft graviton theorems in higher spacetime dimensions
10-4-2019	Ashmita Das IIT Guwahati	Fluctuation-Dissipation in de-Sitter Universe and Black Hole Spacetime
10-4-2019	Snehajit Misra IMSc	Higgs bundles on ruled surfaces and Nef and Pseudoeffective cones of certain projective varieties.
10-4-2019	Celestine P Lawrence IMSc, Chennai	Avalanche effect in single-electron tunneling networks
11-4-2019	Bijoy Daga IMSc	Effects of Stochasticity and non-locality on a model of aggregation-fragmentation for Saturn rings
15-4-2019	G. S. Vaitheeswaran University of Hyderabad	Energetic materials under compression: Computational Approach
16-4-2019	Ankita Chakrabarti IMSc	Synopsis presentation of Ph.D thesis on “Quantum Geometry of correlated many body states”
17-4-2019	Prafulla Kumar Behera IIT Madras	Higgs measurements at LHC
17-4-2019	Sinnou David University of Paris 6	Heights on abelian varieties

22-4-2019	V Saran IIT Madras	Skyrmion-like textures in superconductors with competing orders
22-4-2019	Rahul Santhanam Oxford, UK	Godel's Theorem and Propositional Proof Complexity
24-4-2019	Susmita Ghosh IMSc	Aggregation dynamics of charged peptides in water: effect of salt concentration
25-4-2019	Vasudharani Devanathan IISER Tirupati	Biology-2 course
25-4-2019	Vasudharani Devanathan IISER Tirupati	Biology-2 course
26-4-2019	Biplab Paul IMSc	Arithmetic of Hecke eigenvalues of Siegel modular forms
26-4-2019	Indranil Mazumdar TIFR, Mumbai	Nuclear Halos and Efimov Effect: A three-body approach
26-4-2019	Vasudharani Devanathan IISER Tirupati	Biology-2 course
26-4-2019	Vasudharani Devanathan IISER Tirupati	Biology-2 course
29-4-2019	Mihir Chakraborty IEST, Shibpur	(Residuated) Topological Quasi - Boolean Algebras
30-4-2019	Surendra Pal Singh University of Arkansas, USA	Orbital Angular Momentum Carrying Light Beams
2-5-2019	Sinnou David University of Paris 6	Heights on abelian varieties
6-5-2019	Thomas Konrad University of KwaZulu Natal, Durban, South Africa	Control of quantum systems by Self-fulfilling Prophecy

9-5-2019	Arpan Das IOP - Bhubaneswar	Manifestation of Entanglement in Quantum Foundations and Thermodynamics
13-5-2019	Anil Shaji IISER - Thiruvananthapuram	Non-Markovian open dynamics from collision models
13-5-2019	Satyam Mukherjee Indian Institute of Management, Udaipur, India	Early Career Mentorship and Scientific Creativity
17-5-2019	Prashant Kocherlakota TIFR, Mumbai	Gravitomagnetic and Pulsar Beam Precession near a Kerr Black Hole
19-5-2019	Saket Saurabh IMSc	Seminar on ML
21-5-2019	Celestine P Lawrence IMSc, Chennai	Avalanche effect by local interactions
22-5-2019	Samyadeb Bhattacharya S. N. Bose National Centre for Basic Sciences	Convex resource theory of non-Markovianity
22-5-2019	Krishnakumar Sabapathy Toronto, Canada	Current status of quantum computing
23-5-2019	John Bechhoefer Simon Fraser University, Canada	The details are in the devil: Maxwells demon in the real world
23-5-2019	Joseph Samuel Raman Research Institute, Bangalore	Lorentzian Geometry of Qubit Entanglement
24-5-2019	Supurna Sinha Raman Research Institute, Bangalore	A quantum diffusion law
24-5-2019	Bidisha Chakrabarty ICTS-TIFR, Bangalore	Out of Time Ordered Quantum Dissipation
27-5-2019	J. Sivaraman IMSc	On Euclidean ideal classes in Abelian extensions (Thesis Defense)

28-5-2019	Subhrajit Modak Weizmann Institute, Israel	PT Symmetry, Supersymmetry and Nonlinearity
31-5-2019	M. G. Thiruvalluvan VP (Engineering), Aqfer Inc., IIT Madras Research Park, Chennai	Big Data and Data Lakes on the Cloud
3-6-2019	T R Govindarajan CMI	Is photon really massless?
6-6-2019	N. Vigneshwar IMSc	Entropy-driven phase transitions in hard core lattice gas models in three dimensions (Pre-synopsis seminar)
11-6-2019	Venkat Guruswami Carnegie Mellon University	Sub-packetization of Minimum Storage Regenerating Codes: A lower bound and a work-around
12-6-2019	Chandreyee Roy S. N. Bose National Centre for Basic Sciences	Some studies of the brittle to quasi-brittle transition in fibre-bundle models
13-6-2019	Solomon Owerre Perimeter Institute	Theoretical and Experimental Observation of Topological Magnon in Honeycomb Ferromagnet CrI ₃
14-6-2019	M. V. N. Murthy IMSc	Introduction to particles and symmetries
19-6-2019	Samapan Sikdar IMSc	Metal ion induced conformational change and electronic redistribution in proteins: Insights from MD simulations and QM calculations
19-6-2019	M. V. N. Murthy IMSc	Introduction to particles and symmetries
21-6-2019	G Baskaran IMSc, Chennai	Room Temperature Superconductivity
24-6-2019	M. V. N. Murthy IMSc	Introduction to particles and symmetries

26-6-2019	C. S. Sudheer Kumar IISER–Pune	Frequentist-approach inspired theory of quantum random phenomena predicts signaling
28-6-2019	Gautam Sharma HRI–Allahabad	Fine-grained uncertainty determines preparation contextuality
1-7-2019	Prafulla Oak IMSc	Holographic and exact RG beta function computations of the Sine-Gordon model
2-7-2019	Sandeep K. Goyal IISER–Mohali	Photonic quantum memory using an intra-atomic frequency comb
3-7-2019	M.C. Kumar IIT Guwahati	Graviton production at the LHC to higher orders in QCD.
4-7-2019	G. Rajasekaran IMSc	Neutrino physics and the Indian Neutrino Observatory
4-7-2019	E V Sampathkumaran TIFR Mumbai	Exceptional magnetoelectric coupling behavior of spin-chain compounds, Tb_2BaNiO_5 and Tb_2BaCoO_5
5-7-2019	Nikhil Karthik BNL	Towards first principle understanding of the quark and gluon structure of hadrons
8-7-2019	Prashanth Jaikumar California State University Long Beach	Discovering Novel Phases of Dense Matter in Neutron Stars with Gravitational Waves
8-7-2019	Shakir Ali Aligarh Muslim University	Jordan derivations and related maps in rings
9-7-2019	Arnab Priya Saha HRI, Allahabad	Asymptotic analysis of sub-leading soft photon theorem in four dimension
10-7-2019	Bhuvnesh Jain Department of Physics and Astronomy, University of Pennsylvania, USA	Galaxy surveys and the breakdown of the standard model of cosmology
10-7-2019	Abhishek Iyer INFN, Naples	Probing physics across the energy frontier

11-7-2019	Abhishek Iyer INFN, Naples	Unearthing the pattern of lepton flavour universality violations
11-7-2019	Kiran Yadav Central University of Rajasthan, Bandar Sindri, Rajasthan	Control of coexisting attractors through discontinuous feedback
12-7-2019	Anjali Krishnan Brooklyn College, City University of New York, New York City, USA	Multivariate meta-analysis of functional brain imaging literature
15-7-2019	Biswajit Karmaker Physical Research laboratory	Consequences of mu-tau reflection symmetry for 3+1 neutrino mixing
15-7-2019	Sandeep Chowdhary IISER, Pune	Dynamics of pulse coupled inhibitory neural networks
16-7-2019	Anup Dixit Queen's University	Euler Kronecker constants and the generalized Brauer-Siegel conjecture
16-7-2019	Prashanth Raman IMSc	Positive Geometries of Scalar Theories
17-7-2019	Shilpa Kastha IMSc	Gravitational waves from compact binary merger and tests of general relativity
18-7-2019	Sanga Mitra NIH, USA	Exploring the sequence space and 5' U bias of PIWI-interacting RNAs
19-7-2019	Ankit Agrawal Weizmann Institute of Science, IL	Is the packing of cells important for tissue morphogenesis?
19-7-2019	Ashish Srivastava BARC, Mumbai	Advances in Chemical and Genetic approaches for enhancing abiotic stress tolerance in crops
22-7-2019	Nikhil Karthik BNL	Numerical approach to infrared conformality and associated dualities in 2+1 dimensions
22-7-2019	Biswajit Karmaker PRL	Consequences of mu-tau reflection symmetry for 3+1 neutrino mixing

23-7-2019	Arun Ravishankar University of Arizona	The Aretakis instability of extremal asymptotically AdS black holes
23-7-2019	Kaustuv Sanyal JNCASR Bengaluru	Determinants of a rapidly evolving chromosomal locus - the centromere
29-7-2019	Shibashis Guha Universit Libre De Bruxelles, Belgium	Formal Methods in Network Games
29-7-2019	Sonia Sen Tata Institute of Genomics and Science, inStem centre, Bengaluru	Generating neural diversity by integrating spatial and temporal cues within neural stem cells
29-7-2019	E. Gayatri, Accounts Officer IMSc	Part I (4) CCS (Pension) Rules 1972 including CCS (Commutation of Pension) Rules 1981
29-7-2019	Soumitro Banerjee IISER Kolkata	Science in ancient india
29-7-2019	P A Narayanan IMSc	Eigenvalue statistics of the higher rank Anderson model over the canopy tree
30-7-2019	Roji Pius UC Davis	Entanglement in topological string theory
30-7-2019	Sudhakaran Prabakaran IISER Pune / University of Cambridge	Translational products encoded by novel ORFs may form protein-like structures and have biological functions
30-7-2019	Shibhashis Guha Universit Libre De Bruxelles, Belgium	Game on Markov Decision Processes
31-7-2019	Nirupam Dutta NISER	Bound to unbound stata transition of heavy quarkonia in the cooling phase of QGP
31-7-2019	Abhimanyu Choudhury IMSc	Credit Seminar

2-8-2019	Taushif Ahmed Max-Planck-Institut fr Physik	Four Gluon Amplitudes at Three Loops in QCD
5-8-2019	Piyasa Sarkar IMSc	Arveson's characterisation of CCR flows
6-8-2019	Satyavani Vemparala IMSc	Protein Structure
7-8-2019	Gaurav Prakash Shrivastav TU Vienna	Mixtures of liquid crystals and magnetic nanoparticles: hybrid materials with tunable flow properties
7-8-2019	Ramesh Anishetty IMSc	Towards solving Lattice QCD analytically
8-8-2019	Satyavani Vemparala IMSc	Protein Structure
9-8-2019	R Rajaraman Jawaharlal Nehru University, New Delhi	Uranium Enrichment, Centrifuges and the Iran Crisis
9-8-2019	Subinoy Das IIA, Bengaluru	Dark Matter decay and cosmological Hubble measurement anomaly
13-8-2019	Chandan Kumar Jana ICTS-TIFR, Bangalore	Non-linear Fluctuation Dissipation Relation via holography
14-8-2019	Pritam Sen IMSc	Cancellation of infrared divergences in bino-like theories of dark matter at finite temperature
14-8-2019	Surajit Kalita IISc, Bengaluru	White dwarf physics in Einsteins gravity and its modification and magnetic field
14-8-2019	Sushmita Gupta NISER Bhubaneshwar	Matching under preferences: stability is ubiquitous but popularity is hard to find
14-8-2019	Guhan Venkat Universit Laval	Stark-Heegner cycles for Bianchi modular forms

16-8-2019	Rahul Srivastava Astroparticle and High Energy Physics (AHEP) Group Instituto de Fisica Corpuscular (IFIC) Valencia, Spain	Dark matter stability and Dirac neutrinos using only Standard Model symmetries
20-8-2019	Pantangi Venkata Raghu Tej University of Florida	Critical groups of graphs
21-8-2019	Rajesh Singh DAMTP, Cambridge	Incomplete phase separations in scalar active matter
22-8-2019	Narendra M Dixit Department of Chemical Engineering, Indian Institute of Science, Bengaluru	A dynamical systems view of viral infections
27-8-2019	Shauri Chakraborty S. N. Bose National Centre for Basic Sciences, Kolkata	Dynamics Of Propagating Modes and Characterisation Of Ordering In Coupled Non-Equilibrium Systems
27-8-2019	Akshaa Vatwani IIT Gandhinagar	Voronoi summation formula for a generalized divisor function
28-8-2019	Kannabiran Seshasayanan CEA Saclay,France	Growth rate distribution and intermittency in kinematic turbulent dynamos: Which moment predicts the dynamo onset?
28-8-2019	Satyavani Vemparala IMSc	Protein Structure Course
29-8-2019	Aprameyo Pal Universitat Duisburg-Essen	A central value formula of degree 6 complex L-series and arithmetic applications
29-8-2019	David Peleg Weizmann Institute of Science, Israel	Realizability of Graph Specifications: Characterizations and Algorithms
30-8-2019	Satyavani Vemparala IMSc	Protein Structure

3-9-2019	Richard N. Manchester Astronomy and Space Science - The Commonwealth Scientific and Industrial Research Organisation (CSIRO, Australia)	Tests of GR using Pulsar Timing (Remote Talk)
3-9-2019	Arun Paramekanti University of Toronto	Skyrmions in solids: Classical crystals and quantum liquids
9-9-2019	Kamalakshya Mahatab NTNU	Large Oscillations of the Argument of the Riemann Zeta-function
11-9-2019	Soumyakanti Bose IISER–Mohali	Coherence Assisted Non-Gaussian Measurement Device Independent Quantum Key Distribution
12-9-2019	Pranendu Darbar ISI, Kolkata	Correlation of multiplicative functions
12-9-2019	Vwani Roychowdhury University of California, Los Angeles	Brain Inspired Automated Concept and Object Learning: Vision, Text, and Beyond
13-9-2019	Darshana Narayanan Developmental Neuromechanics and Communication Lab, Princeton University, Princeton, NJ, USA	The prenatal origins of vocalizations in marmoset monkeys
13-9-2019	Abhranil	Efficient Black-Box Identity Testing for Free Group Algebra
18-9-2019	Sutapa Roy Max-Planck Institute for Intelligent Systems, Stuttgart, Germany	Non-equilibrium dynamics of inhomogeneous fluids
23-9-2019	Prosenjit Kundu Department of Mathematics, National Institute of Technology (NIT) Durgapur, India	Transition to synchronization in complex networks: Role of frustration
24-9-2019	Steven Spallone IISER Pune	Divisibility of characters values of symmetric groups

25-9-2019	Amit Chakraborty Department of Mathematics, Central University of Rajasthan, Bandar Sindri, Rajasthan, India	Bio-Complexity: Limiting Resource-Diversity-the Functioning of Systems (R-D-FS) framework
1-10-2019	S. Kalyana Rama IMSc	Loop Quantum Stars : Modifying stars using equations of Loop Quantum Cosmology
3-10-2019	Naveen Prabhakar TIFR, Mumbai	Large N exact Landau-Ginzburg potentials for Chern-Simons theories coupled to fundamental matter
4-10-2019	Naveen Prabhakar TIFR, Mumbai	(0,4) Projective Superspace and the ADHM Construction
4-10-2019	Amritanshu Prasad IMSc	Character polynomials
7-10-2019	Nitin Saurabh MPII, Technion	Improved Bounds on Fourier entropy and Min-entropy
10-10-2019	Anirban Polley	Multiscale Modeling to unravel cellular and subcellular process in biological systems: Implication on signaling and exocytosis
10-10-2019	K V Subrahmanyam CMI	The Singular tuples of matrices is not a null cone
15-10-2019	Dishant Pancholi Institute of Mathematical Sciences	A symplectic world view
17-10-2019	Devanand T	Pre-Synopsis Talk
17-10-2019	Ramakrishnan Natesan University of Pennsylvania	Bending by binding: How protein organization remodels the structure of membranes and genomes?
18-10-2019	Avijit Nath IMSc	Topology of generalized Dold manifolds
23-10-2019	Suman Kumbhakar IIT Bombay	A global fit to charged current B anomalies

28-10-2019	Harinath Chakrapani IISER Pune	Strategies For Addressing Antibiotic Resistance
29-10-2019	Apratim Chatterji IISER Pune	Bacterial chromosome organization: special crosslinks, confinement effects and molecular crowders play the pivotal roles
29-10-2019	Farhat Habib inMobi, Bangalore	Machine learning and its application to online advertising
29-10-2019	Sebastien Tavenas Universit Savoie Mont Blanc, France	Nonnegative rank measures and monotone algebraic branching programs
31-10-2019	Uri Onn Australian National University	Representation growth of arithmetic groups
31-10-2019	S KrishnaSwamy	Protein Structure
1-11-2019	Sreekrishna Dani CEBS, Mumbai	Diophantine approximation with nonsingular integral transformations
1-11-2019	Palash Pal SINP	Fermion mixing from inter-generational symmetry
5-11-2019	Krishnaswamy	Protein Structure
7-11-2019	Krishnaswamy	Protein Structure
11-11-2019	Vagheesh Narasimhan, Department of Genetics, Harvard Medical School	Using ancient DNA to understand Indian history
12-11-2019	Krishnaswamy	Protein Structure
13-11-2019	Apurba Biswas The Institute of Mathematical Sciences	Asymptotic velocity distribution of driven binary granular gases
14-11-2019	Ravi Kunjwal Perimeter Institute, Canada	Bell Quantified: The Resource Theory of Nonclassicality of Common-Cause Boxes

14-11-2019	Krishnaswamy	Protein Structure
15-11-2019	Sujan Sengupta Indian Institute of Astrophysics	Exoplanets: The Search for Unintelligent Life
15-11-2019	Anwesha Chakraborty S. N. Bose National Centre for Basic Sciences, Kolkata	Spectral Distance in Non-commutative Lorentzian Plane
19-11-2019	Namitha C. V. Dept. of Physics, Pondicherry University	Control of Entanglement Longevity in Open Interacting Two Qubit System
19-11-2019	Krishnaswamy	Protein Structure
20-11-2019	Fabio Maltoni Universit catholique de Louvain, Belgium	The top and Higgs windows onto new physics
20-11-2019	Pratik Tarafdar S. N. Bose National Centre for Basic Sciences	Effect of disc configuration on low angular accretion onto rotating black holes
20-11-2019	Digjoy Paul IMSc	Introduction to Cores and Quotients
22-11-2019	Christian Schmidt Bielefeld University	QCD phase diagram from a Taylor expansion approach
22-11-2019	Mohd Suhail Rizvi Universit Grenoble Alpes and CNRS, France	Mechanics of motility: from unicellular organisms to tissues
22-11-2019	Ebtsam H. Taha HRI	Frobenius integrability and metrizable problem
22-11-2019	Manjari Jain IISER Mohali	Cocktail party problem in the animal world and how animals solve it
25-11-2019	Hitesh J. Changlani Florida State University	The mother of all states of the kagome quantum antiferromagnet
27-11-2019	Torben Braner Roskilde University, Denmark	Hybrid Logic and its Proof-Theory

29-11-2019	Sudip K. Garain Korea Astronomy and Space Science Institute	High Order Numerical Schemes for Magnetohydrodynamics on Geodesic Mesh
29-11-2019	Pavol Hell Simon Fraser University, Canada	A Graph Theorist's perspective on the Quest for Dichotomy
2-12-2019	Ioana Boureanu University of Surrey, UK	Symbolic Verification of Epistemic Properties in Programs
3-12-2019	Shounak Datta S. N. Bose National Centre for Basic Sciences, Kolkata	Sharing of nonlocal advantage of quantum coherence by sequential observers
3-12-2019	A V Sreejith IIT Goa	Block products for algebras over countable words
5-12-2019	Winfried Kohlen University of Heidelberg	q -product expansions of modular functions
6-12-2019	Anantha Padmanabha IMSc	Propositional Term Modal Logic
6-12-2019	Sarjick Bakshi CMI	Torus quotients of Richardson varieties in the Grassmannian
9-12-2019	Suman Dutta IMSc	Onset of Fluidization in Yield Stress Materials: Insights from microscopic simulations
10-12-2019	Snehajit Misra TIFR	Higgs bundles on ruled surfaces and Nef and Pseudoeffective cones of certain projective varieties
12-12-2019	Pratyush Pranav Ecole Normale Suprieure de Lyon, France	Geometry and Topology: Application to (cosmological) datasets
12-12-2019	Peter Petreczky BNL	Progress and Challenges in Hot and Cold Non-perturbative Quantum Chromodynamics

12-12-2019	Sarbeswar Pal, IISER, TVM	Classification of obstructed bundles over a very general sextic surface using Alexander-Hirschowitz Theorem and Mestrano-Simpson Conjecture
16-12-2019	Projesh Roy IISc, Bangalore	The thermodynamical properties of the random networks in 2D-silica glass
17-12-2019	Arindam Das Osaka University	Phenomenology of the general U(1)extended Standard Model
17-12-2019	Najmul Haque NISER	The application thermal field theory to study hot and dense nuclear matter
17-12-2019	Larry Rolen Vanderbilt University	Jensen-Polya Criterion for the Riemann Hypothesis and Related Problems
18-12-2019	Debabrata Deb Indian Institute of Engineering Science and Technology, Shibpur	Study on charged strange stars in f(R,T) gravity
18-12-2019	Ankit Aggarwal ULB, Belgium	Warped symmetries of the Kerr Black Hole
18-12-2019	Larry Rolen Vanderbilt University	Jensen-Polya Criterion for the Riemann Hypothesis and Related Problems
19-12-2019	Ken Ono University of Virginia	The Riemann Hypothesis
20-12-2019	Niladri Sarkar Leiden University	Electrohydrodynamics of epithelial tissues
23-12-2019	Sanjukta, Jayakrishnan, Lawqueen IMSc	Pre-Synopsis Talks
24-12-2019	Saikat Sur IIT-Kanpur	Effect of local quantum dynamical processes on spin chain dynamics
24-12-2019	Sivaramakrishnan Sivasubramanian IIT Bombay	Gamma positivity of the Exceedance Based Eulerian Polynomial in positive elements of Classical Weyl Groups

27-12-2019	Rahul Srivastava IISER, Bhopal	Understanding neutrino oscillations
1-1-2020	Sandeep Aashish IISER, Bhopal	Quantum and Cosmological Aspects of Antisymmetric Tensors
6-1-2020	Shriya Pai, University of Colorado at Boulder	*Fracton Fusion and Statistics*
7-1-2020	P G Kubendran Amos IAM-CMS, Karlsruhe	Multiphase-field modelling of microstructural evolution in solid-state system
7-1-2020	Rohit Parikh City University of New York, USA	Logic for non-persons ?
8-1-2020	Nabanita TIFR	Projective Bundle and Blow-up
9-1-2020	Raj Mohan ISI Bangalore	Cohn-Leavitt path algebras of bi-separated graphs
9-1-2020	Aswin Balasubramanian Rutgers University	Deformations of the Hitchin Integrable System and Supersymmetric Quantum Field Theories
10-1-2020	Santosh Kumar Das IIT Goa	Heavy quark dynamics in QCD matter produced in heavy-ion collisions
13-1-2020	Sthitadhi Roy University of Oxford	Many-body localisation: a tale of correlations and constraints on Fock space
13-1-2020	Sagnik Mukhopadhyay KTH, Stockholm	Connecting query and communication algorithms: Upper and lower bounds
13-1-2020	Yuri Bilu University of Bordeaux	p-adic numbers and Diophantine equations
14-1-2020	Sagnik Mukhopadhyay KTH, Stockholm	Weighted min-cut: Sequential, cut-query and streaming algorithms
16-1-2020	Yuri Bilu University of Bordeaux	p-adic numbers and Diophantine equations

20-1-2020	Chandrachur Chakraborty Kavli Institute for Astronomy and Astrophysics, Peking University	Can we see a singularity, the most extreme object in the universe?
20-1-2020	Manoj Kumar Mandal Universita' degli Studi di Padova, Italy	Feynman Integral: From Integration-By-Parts reduction to Intersection Theory
20-1-2020	R. Ramanujam IMSc, Chennai	Science Communication and Education – whose Science, for whom?
20-1-2020	Rupam Karmakar IMSc	Positive cones of cycles and Seshadri constants on certain projective varieties
22-1-2020	Digjoy Paul IMSc	The Multiset Partition Algebra
23-1-2020	S. Viswanath IMSc	The Brylinski filtration and W-algebras
24-1-2020	Giuseppe Policastro ENS, Paris	The semiholographic approach to non-Fermi liquids
27-1-2020	Manoj Changat University of Kerala	Graph Transit Functions, Characterizations and Impossibility Results on First Order Axioms
28-1-2020	Sbastien Ferenczi Institut de Mathmatiques de Luminy	On Sarnak's conjecture
28-1-2020	Omkar Srikrishna Seoul National University, South Korea	Resource-efficient fault tolerant quantum computation with hybrid entanglement of light
28-1-2020	Nimmala Narendra IIT-Hyderabad	A Relation Between Dark Matter and Leptogenesis, and Neutrino Mass in light of current experimental bounds
29-1-2020	Kummari Mallesham ISI Kolkata	Non-linear twists of Fourier coefficients of $GL(3)$ -Maass forms.

29-1-2020	Bhaskaran Muralidharan Indian Institute of Technology Bombay	Quantum Transport in topological superconductor hybrid systems
29-1-2020	Rahul Dandekar IMSc	Hydrodynamics of run and tumble particles
31-1-2020	Nishad Kothari University of Campinas, Brazil	Conformal Subgraphs, 5 Open problems
4-2-2020	Diptimoy Ghosh IISER Pune	The Large, the Small, and the Extremes
4-2-2020	Kirsten Martens LIPhy, University of Grenoble	Modelling plastic deformation and flow of dense disordered materials
4-2-2020	Sbastien Ferenczi Institut de Mathmatiques de Luminy	On Sarnak's conjecture
5-2-2020	A. P. Balachandran Syracuse University	Causality and Entanglement in Quantum Field Theory
5-2-2020	Yuri Bilu University of Bordeaux	p-adic numbers and Diophantine equations
6-2-2020	Balagopal Komarath Saarland University, Germany	Lower Bounds for Natural Algorithms
6-2-2020	Bala Iyer ICTS-TIFR, Bangalore	The fascinating interplay of gravitational wave detection and the two-body problem in general relativity
6-2-2020	Sbastien Ferenczi Institut de Mathmatiques de Luminy	On Sarnak's conjecture
7-2-2020	Sujit Sarkar Poornaprajna Institute of Scientific Research	A Study of Interaction Effects and Quantum Berezinskii- Kosterlitz-Thouless Transition in the Kitaev Chain
7-2-2020	Balagopal Komarath Saarland University, Germany	Finding Graph Patterns

10-2-2020	Soumya Bhattacharya IIT Kharagpur	Perturbations of spiky strings in flat and curved backgrounds
10-2-2020	Ankita Budhraja Indian Institute of Science Education and Research, Bhopal	Soft-Collinear Effective Theory
11-2-2020	Sourendu Gupta Tata Institute of Fundamental Research	Effective Field Theory for warm QCD
12-2-2020	Anton Rebhan TU Vienna	The hadronic light-by-light scattering contribution to the muon $g-2$ from holographic QCD
12-2-2020	Anupama Sharma University of Michigan, Ann Arbor, Michigan, USA	Cooperation, resistance, and spatial patterning of microbial communities
12-2-2020	Rishi Vyas Krea University	Idempotents in path algebras
14-2-2020	Tanmoy Modak National Taiwan University	Additional Yukawa couplings: Probing Electroweak Baryogenesis at the LHC and beyond
14-2-2020	Deshdeep Sahdev Quazar Technologies	Hydrodynamic and Ballistic Transport of Electrons in 2d Materials
17-2-2020	Ponnurangam Kumaraguru IIIT, Delhi	Social Computing, Machine Learning and Online Social Media
17-2-2020	Navaneetha K. Ravichandran IISc, Bangalore	Microscopic view of heat conduction in solids
17-2-2020	S Krishnaswamy IMSc, Chennai	Biology-2 course
19-2-2020	Sweta Kumari Technion, Israel	An Efficient Framework for Concurrent Execution of Smart Contracts

19-2-2020	Archit Somani Technion, Israel	Design and Implementa Techniques to Achieve Compositionality using Object-based Software Transactional Memory Systems
19-2-2020	Sourav Roychowdhury CMI	Non-Abelian T-dual of Klebanov-Witten Background and its Penrose limits
19-2-2020	S Krishnaswamy IMSc, Chennai	Biology-2 course
20-2-2020	Amritanshu Prasad IMSc	Schur expansions of multipartite partition generating functions
20-2-2020	Andreas Osterloh Institute for Theoretical Physics, University of Duisburg-Essen, Duisburg, Germany	Multipartite Entanglement as a tool for analyzing complex systems
20-2-2020	Koushik Ray IACS, Kolkata	Holographic bulk reconstruction and Gel'fand Graev Radon transform
21-2-2020	S Krishnaswamy IMSc, Chennai	Biology-2 course
22-2-2020	R Shankar IMSc	Ice on Earth
24-2-2020	Abhishek Sahu IMSc	Pre-Synoposis Talk
24-2-2020	Vijay Kodiyalam IMSc	The Temperley-Lieb planar algebra
24-2-2020	S Krishnaswamy IMSc, Chennai	Biology-2 course
25-2-2020	Himadri S. Dhar Imperial College, London	Novel approaches to study light-matter interaction: From hybrid quantum systems to photon condensation
25-2-2020	Pushpita Ghosh TIFR, Hyderabad	Spatiotemporal orders in the realm of biology and chemistry

25-2-2020	Jahanur Haque CMI, Chennai	A linearized mass loss law: With or without a positive cosmological constant
26-2-2020	Vivek Kumar Yadav IIT Kanpur	First principle simulations of liquids and 2D materials using High Performance Computing
26-2-2020	Indrajit Ghosh Agricultural and Ecological Research Unit, ISI, Kolkata	Mathematical modeling of some infectious diseases: Transmission dynamics and control
26-2-2020	S Krishnaswamy IMSc, Chennai	Biology-2 Course
27-2-2020	Sunandan Gangopadhyay S. N. Bose National Centre for Basic Sciences, Kolkata	Information theoretic quantities from gauge/gravity correspondence
27-2-2020	Priyanka Chakraborty Department of Applied Mathematics, University of Calcutta, Kolkata	Nonlinear analysis of EEG signal for ADHD children
28-2-2020	Amritanshu / Digjoy IMSc	Algebraic Combinatorics group meeting
28-2-2020	S Krishnaswamy IMSc, Chennai	Biology-2 Course
2-3-2020	S Krishnaswamy IMSc, Chennai	Biology-2 Course
3-3-2020	Marc-Hubert Nicole Institut de Mathematiques de Luminy	Families of Drinfeld modular forms for $GL(N)$
4-3-2020	Arghya Majee Max Planck Institute for Intelligent Systems, Stuttgart, Germany	Theory of soft matter systems: Surprises in electrostatic interaction
4-3-2020	S Viswanath IMSc	The Hive model for Littlewood-Richardson coefficients

4-3-2020	S Krishnaswamy IMSc, Chennai	Biology-2 Course
5-3-2020	Andreas Osterloh Institute for Theoretical Physics, University of Duisburg-Essen, Duisburg, Germany	Towards a generalization of W-states
5-3-2020	Gopal Sardar IIT-Jodhpur	Aspects of polymer quantization of scalar matter field
6-3-2020	Darshana Joshi Vigyan Shaala International	Experiences in science communication
6-3-2020	S Krishnaswamy IMSc, Chennai	Biology-2 Course
6-3-2020	Ameya Vaze Ivory Dental Clinic, Indore	Mathematical modeling in public health
9-3-2020	R Bharathkumar IISER Mohali	Lefschetz Thimbles and Quantum Phases in Zero-Dimensional Bosonic Models
10-3-2020	James Ferguson University of Zurich	Challenges in Mathematical Modelling of Glaciers
11-3-2020	Augniva Ray SINP, Kolkata	Supersymmetric Localization on dS : Sum over Topologies
11-3-2020	S Viswanath	Algebraic Combinatorics Group meeting
13-3-2020	Anand Pathak	Uncovering functional correlates of structural organization in brain networks at multiple scales: From the worm to the human
20-3-2020	S Krishnaswamy IMSc, Chennai	Biology-2 Course

Chapter 5

External Interactions

5.1 Collaborative Projects with Other Institutions

5.1.1 Arecibo 327 MHz Drift Pulsar Survey (AO327)

** ongoing project **

AO327 has been running using the Arecibo radio telescope (USA) since 2010. To date, the survey has discovered 87 pulsars and transients (<http://www.naic.edu/deneva/drift-search>). Papers have been published reporting results of this survey.

This collaboration has total nine members, from different institutes across the world, e.g., Naval Research Laboratory USA, University of New Mexico USA, West Virginia University USA, IMSc India (Manjari Bagchi), Max-Planck-Institut fur Radioastronomie Bonn Germany.

5.1.2 Indian Pulsar Timing Array (InPTA) experiment

** ongoing project **

Pulsar Timing Array (PTA) uses an ensemble of pulsar clocks in an attempt to detect Gravitational Waves (GW) from a stochastic background resulting from a superposition of an ensemble of super-massive black hole binary systems (BSMBH). The Indian PTA (InPTA) experiment is going on since 2015 using the Giant Metrewave Radio Telescope (GMRT) and the Ooty Radio Telescope (ORT). Observations and data analysis is going on. The preliminary results were presented in the 2016 Meeting of International Pulsar Timing Array in South Africa. Presently 10 people are involved in this project, members are affiliated to NCRA-TIFR Pune, TIFR Mumbai, IIT-Hyderabad, West Virginia University (USA), ASTRON (The Netherlands), IMSC Chennai (Manjari Bagchi, Dhruv Pathak). IMSc faculty M. Bagchi is a member (out of three) of InPTA steering committee. M. Bagchi is also the chair of the scientific organising committee of the meeting of the International Pulsar Timing Array to be held in June 2019 in Pune.

5.1.3 Indo-French Program in Mathematics, IFPM

IMSc is now an international research laboratory for "Indo-French Program in Mathematics, IFPM" for four years. This program facilitates exchange of mathematical ideas between these two countries.

5.1.4 Indo-U.S Joint R&D Networked Joint Center Programme: Emergence and Re-modeling of force chains in soft and Biological Matter

A R& D Networked joint Center involving partners at Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru, India, (Srikanth Sastry), Brandeis University, Waltham, MA, USA, (Bulbul Chakraborty), National Centre for Biological Sciences, Bengaluru, (Madan Rao), Institute of Mathematical Sciences, Chennai, (Pinaki Chaudhuri) and Northeastern University, Boston, (Dapeng Bi), to pursue theoretical and computational research on the localization of pathways by which stress propagates in disordered, soft matter and biological systems, and their implications for the propagation of dynamical correlations, and information, in these systems, and in the latter context, their implications for biological function.

5.1.5 Max Planck Partner Group in Mathematical Biology

In the partner group, we are employing concepts from geometry to develop and apply methods based on edges rather than nodes in graphs for differential or comparative analysis of condition-specific biological networks. We are developing general methods that can compare condition-specific networks irrespective of their mathematical representation, and thus, will be applicable to labeled or unlabeled graphs, unweighted or weighted graphs, and undirected or directed graphs. In collaboration with Prof. Jürgen Jost, our partner and host in MPIMIS Leipzig, we have recently introduced an edge-based measure, Forman-Ricci curvature, for the geometrical characterization of complex networks which is applicable to unweighted or weighted graphs and undirected or directed graphs. Forman-Ricci curvature is a concept inspired from Riemannian and polyhedral geometry which quantifies the extent to which the network spreads out at the ends of edges in a complex network. Forman-Ricci curvature is simple to compute in large networks, and its statistics capture global network properties better than more traditional node-based measures in both model and real-world networks. Moreover, the associated Forman-Ricci flow is also a concept inspired by deep results in geometry that offers an elegant scheme for denoising networks. Forman-Ricci curvature also presents a natural method to quantify the difference between multiple networks, via so-called Wasserstein distance, inspired by optimal transport theory. In the partner group, we want to further develop this scheme in collaboration with the group of Prof. Jürgen Jost, and explore its potential applications in a systematic manner to different types of biological networks.

5.1.6 Modeling Soft Glass flow from micro to macro scale (CEFIPRA Project No 5604-1)

The project, funded via CEFIPRA, is a collaboration between Dr. Kirsten Martens, Laboratoire interdisciplinaire de Physique, Universit Grenoble Alpes, Grenoble, and Pinaki Chaudhuri, IMSc, starting from December 2016, for a period of three years. The aim of this project is to understand the complex dynamical features during the yielding and subsequent flow of dense soft disordered materials, via a multi-scale approach, using computational and analytic techniques. Such an approach is necessary in linking macroscopic experimental observations to material's properties at micro-scale, thereby leading to designing new materials. To develop valid descriptions across the scales involved, we start from the scale of individual particles, grains or bubbles, which are modeled using molecular dynamics simulations. Based on these microscopic studies, we aim at coarse-graining the dynamics to stochastic lattice models on the scale of plastic rearrangements. These simpler models are the ideal starting point for a statistical approach to derive stochastic evolution equations for the probability distributions of local observables, relevant for the yielding process. The originality in this bottom up approach, bridging different scales, is the combination of consistent simultaneous studies on the micro and the meso-scale to ensure the validity of the assumptions made for the simplified scenarios, which can thereafter be used to predict effects on larger length-scales.

5.1.7 Survey for Pulsars and Fast Transients with the upgraded GMRT : A Pilot Study

** ongoing project **

A pilot survey to discover new for pulsars and radio transients using the upgraded GMRT (uGMRT) is ongoing. More than 100 hours of observations have been performed and data analysis is ongoing. So far, two new pulsars have been discovered. The results have been presented at various national conferences by various team members.

Members of this project are affiliated to various Indian and foreign Institutes, like NCRA-TIFR Pune, IMSc Chennai (Manjari Bagchi) SINP Kolkata, IUCAA Pune, RRI Bangalore, NISER Bhubaneswar, University of California Berkeley (USA), and ASTRON (The Netherlands), etc. GMRT is operated by NCRA-TIFR, Pune.

5.2 Institute Associateships

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.

Associates who visited the institute during the period 01.04.19 to 31.03.20 are :

Prof. K. Ragavendran

Kalasalingam Academy of Research and Education,
Krishnankoil, Tamil Nadu
03.06.2019 - 03.08.2019 &
07.08.2019 - 06.09.2019

Prof. Sankha S. Basu

Indraprastha Institute of Information Technology, Delhi
05.12.2019 - 26.12.2019

5.3 Conference Participation and Visits to Other Institutions

Bagchi, Manjari

Participated in *SKA General Science Meeting and Key Science Workshop 2019* held at Alderly Park Conference Centre, Macclesfield Cheshire, UK during Apr 8 – Apr 12, 2019. Updates from Indian Neutron Star Community – oral presentation as the representative of Indian Neutron Star community, funded by SKA-India.

Participated in *The Science week of 10th International Pulsar Timing Array (IPTA) annual meeting Pune, India; 10 - 21 June 2019 (student week: 10 - 14 June, science week: 17 - 21 June)*. held at Orcid Hotel, Pune during Jun 17 – Jun 21, 2019. I gave an oral presentation “The Role of Pulsar Surveys in Advancement of Gravitational Science”. I was also the chair of the scientific organising committee.

Remotely participated in *Challenges and Innovations in Computational Astrophysics* held at Saint Petersburg, Russian Federation during Sep 16 – Sep 20, 2019. Gave a remote talk (over skype) on “Understanding and eliminating external dynamical effects from the observed rate of change in the periods of pulsars (or any other objects)”

Visited Saha Institute of Nuclear Physics, Kolkata, India on Dec 5, 2019. I gave a seminar of “Binary radio pulsars as tools to fundamental physics”.

Participated in *3rd National Symposium on Very High Energy Gamma-Ray Astronomy* held at DAE convention Centre, Anushakti Nagar, Mumbai, India during Jan 16 – Jan 18, 2020. Delivered an invited talk “Properties of pulsars located in globular clusters of the Milky Way”.

Participated in *38th meeting of the Astronomical Society of India* held at IISER Tirupati during Feb 14 – Feb 17, 2020. Delivered an invited plenary talk “The most fascinating member of the compact object family: neutron stars as the celestial laboratory to probe fundamental physics”

Coimbatore Balram, Ajit

Visited IISER Pune during Sep 17 – Sep 20, 2019. invited talk and discussions

Visited Nanyang Technical University (NTU), Singapore during Sep 22 – Sep 27, 2019. Gave an invited talk and participated in discussions

Participated in *Novel Phases of Quantum Matter* held at ICTS during Dec 23, 2019 – Jan 3, 2020. Delivered an invited talk

Participated in *Geometric phases in Optics and Topological Matter* held at ICTS during Jan 21 – Jan 24, 2020. Delivered an invited talk

Participated in *APS March meeting* held at Denver, Colorado during Mar 2 – Mar 6, 2020. Presented a 10 min. talk in a focus session

Ganguly, Jyotirmoy

Visited IISER, Pune during Feb 13 – Feb 24, 2020. Academic Visit.

Participated in *Workshop on Group Theory, 2020* held at IISER, Pune during Feb 13 – Feb 15, 2020.

Gopalakrishna, Shrihari

Visited Tezpur University, Assam during Oct 28 – Nov 9, 2019. Twelve pedagogical lectures were delivered on “Standard Model of Particle Physics,” in the SERB Preparatory school on Theoretical High Energy Physics, to graduate students from across India.

Gun, S.

Visited University of Hyderabad during May 10 – May 19, 2019. Gave six hour course in AFS I

Visited University of Paris VI during May 31 – Jun 29, 2019. Research collaboration

Visited RIMS, Japan during Oct 15 – Oct 18, 2019. Invited Speaker

Visited IIT Gandhinagar during Dec 21 – Dec 25, 2019. Invited Speaker

Jakhar, Anuj

Visited Indian Institute of Science Education and Research, Mohali during Aug 1 – Aug 10, 2019.

Visited Indian Institute of Technology, Bombay during Aug 21 – Sep 1, 2019.

Juyal, Abhishek

Visited Harish Chandra Research Institute Prayagraj. during Oct 6 – Oct 25, 2019.

Visited Institute of mathematics and applications, Bhubaneswar during Feb 3 – Feb 7, 2020.

Kaushik, Abhiram

Participated in *QCD with Electron Ion Collider* held at IIT Bombay during Jan 4 – Jan 7, 2020. Presented work on reweighting NNFF1.0 fragmentation functions with RHIC data.

Keshav Sangale, Usha

Participated in *TEW programme* held at IMSc, Chennai during Nov 25 – Nov 30, 2019. Attended the programme and also tutored a course.

Kumar, Veekesh

Participated in *Intercity Number Theory Conference* held at Institute mathematical Sciences, Chennai during Dec 28 – Dec 29, 2019. Participated in Intercity Number Theory Conference, held at IMSC. Gave an invited talk

Participated in *Number Theory Conference* held at Kerala School of Mathematics, Kozhikode, Kerala during Jan 23 – Jan 26, 2020. Participated in the Number Theory Conference held at KSOM, Kerala. Delivered an invited talk “On Linear Independence Results for Values of Jacobi Theta-Constants”

Visited Indian Statistical Institute, Bangalore during Feb 24 – Feb 29, 2020. For research collaboration with Prof. Yann Bugeaud

Mahajan, Meena B.

Participated in *The 14th International Computer Science Symposium in Russia (CSR)* held at Novosibirsk, Russia during Jul 1 – Jul 5, 2019. Gave an invited talk titled “QBF Proof Complexity: An Overview”.

Visited SSN College Of Engineering, TN on Sep 11, 2019. Gave a talk titled “Compute, compute, compute: How hard can it get?” to the ACM student chapter, as part of the ACM India Eminent Speakers Program.

Visited SynTalk (Mumbai, India) on Sep 28, 2019. Invited by SynTalk (Mumbai, India) as a SynTalkr for TNSO (The Not So Obvious, September 28, 2019).
<https://syntalk.wordpress.com/episodes/turn-six/tnso/> .

Participated in *FSTTCS 2019* held at IIT Bombay during Dec 10 – Dec 14, 2019. Member of Steering Committee.

Participated in *Workshop on Proof Complexity* held at Banff International Research Station, Canada. during Jan 19 – Jan 24, 2020.

Visited Friedrich-Schiller University, Jena, Germany. during Jan 25 – Feb 1, 2020. Research collaboration.

Participated in *Dagstuhl Seminar on SAT and Interactions* held at Schloss Dagstuhl, Leibniz Centre for Informatics, Dagstuhl, Germany during Feb 2 – Feb 7, 2020. Was one of the scientific organisers of the seminar.

Visited IIT Kanpur on Feb 14, 2020. Gave a talk titled "Characterising hardness for QBF resolution via circuit complexity".

Participated in *Workshop on Sensitivity, Query Complexity, Communication Complexity and Fourier Analysis of Boolean Functions* held at ISI Kolkata during Feb 19 – Feb 21, 2020.

Mukhopadhyay, Partha

Participated in *First IMSc discussion meeting on extreme QCD matter* held at IMSc, Chennai during Sep 16 – Sep 21, 2019.

Participated in *Chennai Strings Meeting 2019* held at IMSc, Chennai during Nov 21 – Nov 23, 2019. Presented a research seminar.

Prasad, Amritanshu

Participated in *Group algebras, representations and computation* held at International Centre for Theoretical Sciences during Oct 14 – Oct 23, 2019.

Visited Krea University on Dec 19, 2019.

Jayakumar, R.

Visited Indian Statistical Institute, Bengaluru, India during Apr 1 – Apr 11, 2019. Research collaboration.

Visited Indian Institute of Science, on Apr 2, 2019. Gave a talk titled Fruchts theorem and automorphism groups of field extensions over \mathbb{Q} PRIME TIME SEMINARS.

Participated in *CONFERENCE ON TOPOLOGY, GEOMETRY AND RELATED TOPICS* held at The Institute of Mathematical Sciences, Chennai during May 27 – May 28, 2019.

Participated in *IST - Representation Theory (of finite groups) (2019)* held at IISER, Thiruvananthapuram, India during Jun 3 – Jun 15, 2019. Conducted 24 hours of tutorials in Representation Theory.

Visited Department of Mathematics Indian Institute Of Technology Madras , Chennai, India,

on Mar 2, 2020. Gave a talk titled Existence of a unique group of finite order in Student Seminar.

Raghavan, K. N.

Visited Shastri Indo Canadian Institute, Delhi during Apr 29 – Apr 30, 2019. Participated in the Annual Meeting as IMSc Representative

Visited Ambedkar University, Delhi on May 1, 2019. Gave a colloquium talk

Visited IISER Mohali during May 2 – May 4, 2019. Gave a colloquium talk

Visited Panjab University, Chandigarh on May 3, 2019. Gave a colloquium talk

Visited CUSAT, Kochi during Jul 6 – Jul 7, 2019. Meeting of the Board of Studies

Visited Homi Bhabha Centre for Science Education, Mumbai during Jul 8 – Jul 9, 2019. NBHM meetings

Visited Kerala School of Mathematics on Jul 20, 2019. Attended meeting

Participated in *Ramanujan Mathematical Society 34th Annual Conference* held at Pondicherry University during Aug 1 – Aug 3, 2019. Gave an invited talk

Participated in *Orientation Programme for Mathematics Teachers* held at UGC-HRDC Pondicherry University on Aug 1, 2019. Conducted one lecture + tutorial session of three hours duration

Participated in *Refresher Course on Engineering Mathematics* held at NITTR, Taramani, Chennai on Aug 6, 2019. Conducted one three hour session of lecture + tutorial

Visited RKMVU, Belur during Aug 20 – Aug 21, 2019. Gave a colloquium talk

Participated in *Topology of Manifolds and Representation Theory* held at ISI Kolkata during Aug 22 – Aug 24, 2019. Invited speaker

Visited IIT Jammu during Sep 1 – Sep 2, 2019. attended meeting and gave a talk in their seminar

Participated in *Refresher Course in Mathematics Batch XXXIII* held at RIASM, University of Madras during Oct 12 – Oct 15, 2019. Conducted three lecture + tutorial sessions of three hours each on some topics in Differential Geometry

Participated in *Group algebras, representations, and computation* held at ICTS, Bengaluru during Oct 22 – Oct 24, 2019.

Participated in *85th Annual Conference of the Indian Mathematical Society* held at IIT Kharagpur during Nov 22 – Nov 25, 2019. Invited speaker in the symposium on group theory

Participated in *Teachers' Training Programme* held at IISER Thiruvananthapuram during Dec 7 – Dec 8, 2019. Gave three lectures to higher secondary mathematics school teachers

Visited Indian Academy of Sciences on Dec 13, 2019. Selection of summer research fellows

Participated in *Discussion Meeting on Representation Theory* held at IISc during Dec 14 – Dec 16, 2019.

Visited Periyar University, Salem on Dec 20, 2019. gave a lecture as part of Ramanujan Day celebrations

Visited Amrita Viswa Vidyapeetham, Coimbatore on Dec 21, 2019. Gave a lecture as part of Ramanujan Day celebrations

Participated in *ICMAC 2019* held at SSN College, Chennai on Dec 24, 2019. Invited speaker

Participated in *International Conference on Algebra, Analysis, and their applications* held at Madurai Kamaraj Univeristy, Madurai during Jan 9 – Jan 10, 2020. Gave an invited talk

Visited Harish Chandra Research Institute during Feb 10 – Feb 11, 2020. NBHM Meetings

Participated in *Workshop on Group Theory* held at IISER Pune during Feb 13 – Feb 15, 2020. Gave an invited talk

Visited Annamalai University, Chidambaram on Feb 26, 2020. Gave a lecture as part of the Ramanujan Day celebrations

Visited Mysore University during Feb 28 – Mar 1, 2020. Attended meeting

Visited IISER Pune on Mar 3, 2020. Attended meeting

Visited University of Hyderabad on Mar 6, 2020. Meeting of the Board of the School of Mathematics and Statistics

Raman, Venkatesh

Participated in *Recent Trends in Domination in Graphs: Algorithms, Complexity and Applications* held at NIT Warangal, Telengana. on Apr 9, 2019. Gave the following two talks: 1. Parameterized Complexity of dominating set in tournaments, and 2. Parameterized complexity of dominating set in bounded degenerate graphs

Participated in *Computational Thinking* held at SSN College of Engineering during Aug 23 – Aug 24, 2019. Addressed the first year students with a talk on Computational Thinking

Participated in *Ramanujan Math and IT Conference 2019* held at International Institute of Information Technology, Bangalore during Oct 29 – Oct 31, 2019. Gave a talk on ‘Fast Fourier Transform (FFT): Algorithms and Applications’

Rani, Garima

Participated in *2nd Mechanobiology Meeting* held at ICISE, Quy Nhon, Vietnam during Jul 7 – Jul 13, 2019. Delivered a talk titled “Riddles in the cell wall”

Visited Mechanobiology Institute, National University of Singapore during Dec 2 – Dec 25, 2019. Research Collaboration and Delivered a Seminar

Participated in *EMBO Symposia “Mycobacterial Heterogeneity and Host Tissue Tropism”* held at NII and ICGEB, New Delhi during Feb 11 – Feb 15, 2020. Presented poster titled “Ternary Biomimetic Copolymers as Effective Antibacterial Agents”

Samal, Areejit

Participated in *Provectus Plantae 2019 International Conference on Exploring the Scope of Plant Genetic Resources* held at University of Kerala, India during May 22 – May 24, 2019. Invited Talk

Participated in *17th Annual Meeting of SFRR-India (SFRR-INDIA-2020) International Conference on Role and Management of Oxidative Stress in Human Disease* held at DAE Convention Centre, Mumbai, India during Feb 12 – Feb 15, 2020. Invited Talk

Sathiapalan, Balachandran

Visited IIT Bombay during Sep 23 – Sep 25, 2019. Gave a talk in the Physics Department.

Participated in *Chennai String Meeting* held at IMSc during Nov 21 – Nov 23, 2019.

Sharma, Sayantan

Visited IIT Bombay during May 10 – May 18, 2019. Research Collaboration

Participated in *Dynamics of QCD Matter* held at NISER Bhubaneswar during Aug 15 – Aug 17, 2019. Gave an invited overview talk on “Recent results in hot and dense QCD matter”

Participated in *QCD in the non-perturbative regime* held at Tata Institute of Fundamental

Research during Nov 18 – Nov 20, 2019. Gave an invited talk on “Many uses of fermions with exact chiral symmetry on the lattice”

Participated in *DAE-BRNS symposium on “Contemporary and Emerging Topics in High Energy Nuclear Physics 2019 (CETHENP 2019)”* held at VECC, Kolkata during Nov 25 – Nov 27, 2019. Gave an invited overview talk on “Latest updates on the QCD phase diagram from lattice”

Participated in *XVI Workshop on High Energy Physics Phenomenology 2019 (WHEPP 2019)* held at IIT Guwahati during Dec 6 – Dec 10, 2019. Gave an invited talk on “Screening mass and real-time quantities from lattice”

Visited IACS, Kolkata during Jan 20 – Feb 1, 2020. Research collaboration and invited speaker for a workshop

Participated in *Algorithms in lattice gauge theory and spin systems* held at IACS, Kolkata during Jan 27 – Feb 1, 2020. Invited talk on “Recent updates on classical-statistical lattice methods”

Visited IISER Pune during Feb 26 – Feb 29, 2020. Gave an invited lecture series on “Topological properties of QCD at finite temperature and its relevance for axions”

Srinivas, K.

Participated in *Second Symposium in Analytic Number Theory* held at Grand Hotel San Michele, Centrarò, Italy during Jul 8 – Jul 12, 2019. Attended the conference.

Visited Department of Mathematics and the Institute of Mathematical Research, University of Hong Kong, Hong Kong during Jul 18 – Jul 25, 2019. Interacted with Prof. Ben Kane, delivered two talks.

Visited Department of Mathematics, Andhra University, Visakhapatnam, AP during Sep 10 – Sep 11, 2019. Delivered a talk in the department of mathematics.

Participated in *International conference on Class Groups of Number Fields and related topics* held at HRI, Allahabad during Oct 16 – Oct 19, 2019. Delivered an invited talk.

Participated in *VIT MATH FEST 2019* held at Ambedkar Auditorium, VIT, Vellore on Dec 20, 2019. Delivered a talk with the title ‘The Wizard of Mathematics: Srinivasa Ramanujan

Participated in *54th Annual Conference of AMTI* held at Vivekananda Kendra, Kanyakumari during Dec 27 – Dec 28, 2019. Delivered R. C. Gupta Endowment Lecture with the title ‘Some musings on primes’.

Visited BITS-Pilani, Hyderabad Campus, Hyderabad on Jan 9, 2020. Delivered a talk with the title ‘Number theory and secure communication’.

Participated in *International Conference on Number Theory* held at KSoM, Kozhikode, Kerala during Jan 23 – Jan 26, 2020. Delivered a talk with the title ‘zeros of the zeta-functions on the critical line’.

Participated in *Skill Development Workshop* held at Sathyabama Institute of Science and Technology, Chennai. on Feb 7, 2020. Delivered a talk on ‘El Gamal public key cryptosystem’.

Subramanian, C. R.

Participated in *Graphs, Structures and Algorithms* held at The Institute of Mathematical Sciences, Taramani, Chennai. during Nov 27 – Nov 28, 2019. Participated in the workshop.

Visited School of Computer Science, University of Oklahoma, Norman, USA. during Feb 1 – Mar 31, 2020. Visiting University of Oklahoma, USA.

Vemparala, Satyavani

Participated in *Kaleidoscope 2019: A Discussion Meeting in Chemistry* held at The International Centre Goa during Jul 4 – Jul 7, 2019. (Talk)

Participated in *Pressing for Progress 2019, national conference on Gender in physics* held at University of Hyderabad during Sep 19 – Sep 21, 2019. (Panel Discussion)

Participated in *One day symposium on soft, active and living matter* held at IIT Madras on Dec 10, 2019. (Talk)

Viswanath, Sankaran

Visited IISc Bangalore during May 3 – May 7, 2019. Gave 2 talks in the “Algebra and Combinatorics” seminar.

Participated in *NCM Workshop: Combinatorial models in representation theory* held at IMSc during Nov 4 – Nov 16, 2019. Gave 10 lectures on the path model and crystals.

Participated in *Discussion meeting on representation theory* held at IISc Bangalore during Dec 14 – Dec 16, 2019. Gave an invited lecture.

Vivek Ananth, R. P.

Participated in *XIth International Conference on Biology of Yeasts and Filamentous Fungi (ICBYFF-2019)* held at University of Hyderabad, Hyderabad, India during Nov 27 – Nov 29, 2019.

5.4 Visitors from Other Institutions

Faculty Visitors

Teodor Knapik	03.04.19 - 06.04.19	Univ. of New Caledonia
Saumia, P.S	01.04.19 - 22.05.19	Joint Inst. for Nuclear Research
Vaitheeshwaran, G.S.	14.04.19 - 17.04.19	Univ. of Hyderabad
Ramakrishnan, B.	15.04.19 - 24.04.19	HRI, Allahabad
Roy Joshua	22.04.19 - 12.05.19	Ohio State Univ., USA
Madhurima	14.04.19 - 17.04.19	Central Univ. of Tamilnadu, Thiruvapur
Thangadurai, R	25.04.19 - 26.04.19	HRI, Allahabad
Mihir Kumar Chakraborty	25.04.19 - 30.04.19	IEST Shibpur
Nagaraj, D.S	26.04.19 - 26.04.19	IISER, Tirupathi
Thomas Konnad	29.04.19 - 12.05.19	Univ. of KwaZulu-Nata, South Africa
Vasudharani Devanathan	25.04.19 - 26.04.19	IISER, Tirupathi
Indranil Mazumdar	25.04.19 - 27.04.19	TIFR, Mumbai
Stephan Baier	25.04.19 - 27.04.19	RKMVERI, Howrah
John Bechhoefer	22.05.19 - 26.05.19	Simon Fraser Univ.
Vikram Soni	01.04.19 - 03.04.19	JNU, New Delhi
Joseph Samuel	23.05.19 - 24.05.19	RRI, Bangalore
Supurna Sinha	23.05.19 - 24.05.19	RRI, Bangalore
Heim, B	20.05.19 - 25.05.19	Gu Tech, Oman
Stephen Baier	20.05.19 - 29.05.19	RKMVERI, Howrah
Somnath Jha	21.05.19 - 08.06.19	IIT, Kanpur
Mubeena, T	26.05.19 - 05.06.19	Government College Kasaragod, Kerala
Ajit Bhand	20.05.19 - 25.05.19	IISER, Bhopal

Pampa Paul	26.05.19 - 06.06.19	Presidency Univ., Kolkata
Subhashish Banarjee	18.05.19 - 25.05.19	IIT, Jodhpur
Venkat Guruswamy	03.06.19, 06.06.19 & 11.06.19 - 12.06.19	Carnegie Mellon Univ., Pennsylvania
Ragavendran, V.	03.06.19 - 03.08.19	Kalasalingam Univ., Srivilliputhur
Swapan Kumar Majhi	24.05.19 - 20.06.19	Achhrupam Memorial College, Purulia
Satadar Ganguly	23.06.19 - 26.06.19	ISI, Kolkata
Mukund Ramakrishnan	16.06.19 - 18.06.19	IISER Brahampur
Shakir Ali	05.07.19 - 09.07.19	Aligarh Muslim Univ.
Yashodhan Hatwalne	11.07.19 - 12.07.19	RRI, Bengaluru
Saptarshi Mandal	29.06.19 - 02.07.19	Inst. of Physics, Bhubaneswar
Naveen Surendran	29.06.19 - 02.07.19	IIST, Trivandrum
Sandeep K. Goyal	26.06.19 - 07.07.19	IISER, Mohali
Ramakishnan, B	01.07.19 - 12.07.19	HRI, Allahabad
Balachandran, A.P	07.07.19 - 06.08.19	Syracuse Univ.
SachinSubhash Sharma	16.06.19 - 29.06.19	IIT Kanpur
Hai Yang Cheng	14.07.19 - 16.07.19	Academia Sinica, Taiwan
Benjamin Grinstein	16.07.19 & 21.07.19 - 23.07.19	Univ. of California, San Diego
Yashodhan Hatwalne	23.07.19 - 24.07.19	RRI, Bangalore
Sonia Garcha	25.07.19 - 27.07.19	CSPathshala, Pune
Sachin Subhash Sharma	26.06.19 - 29.06.19	IIT, Kanpur
Adhikari, S.D	26.08.19 - 29.08.19	RKMVERI, Howrah
Arun Pakmakanti	02.09.19	Toronto Univ.
Subinoy Das	08.08.19 - 11.08.19	IIA, Bengaluru
Ashish Srivastav	17.07.19 - 19.07.19	BARC, Mumbai
Ranjitha, K	11.07.19 - 20.07.19	IIT, Bangalore

Raja Raman, R	08.08.19 - 12.08.19	New Delhi
Sushmitha Gupta	14.08.19 - 19.08.19	NISER, Bhubaneswar
Parimala Raman	08.07.19 - 02.08.19	Emory Univ., USA
Shaji, N	30.06.19 - 02.07.19	TM Jacob Memorial College, Ernakulam
Debhajyothi Choudhry	29.05.19 - 17.07.19	Univ. of Delhi, Delhi
Balachandran, A.P	07.07.19 - 06.08.19	Syracuse Univ., Syracuse
Kaustav Sanyal	22.07.19 - 23.07.19	JNCASR, Bangalore
Rama Devi, P.	26.07.19 - 30.07.19	IIT Bombay
Raja, S	04.06.19 - 14.07.19	IIT, Tirupati
Sonia Sen	29.07.19 - 30.07.19	TIGS Centre, Bangalore
Akshaa Vatwani	24.08.19 - 27.08.19	IIT Gujarat
Venkatesh, R	01.06.19 - 30.11.19	IISc, Bangalore
Sunitha, V	13.04.19 - 13.07.19	IICT, Gujarat
Raghavendra, K	07.08.19 - 06.09.19	Kalasalinagam Univ.
Medhuri E Kumar	24.06.19 - 03.07.19	IIT,Guwahati
Aritra baink	22.08.19 - 25.08.19	NISER, Bhubaneswar
Amit Chakraborty	24.09.19 - 28.09.19	Central Univ. of Rajasthan
Pushan Majumdar	16.09.19 - 21.09.19	IACS, Kolkata
Rajiv Vasant Rao Gavai	16.09.19 - 21.09.19	TIFR, Mumbai
Stephen Spallone	23.09.19 - 24.9.19	IISER, Pune
Rajeev S. Bhalrao	16.09.19 - 20.09.19	IISER Pune
Minedupawan depa	22.09.19 - 31.10.19	JINR,Dubna,Russia
Vivawani Roy Chowdhury	11.09.19 - 15.09.19	Univ. of California, Los Angeles
Samir Kunin	04.10.19 - 15.09.19	Mahabanada college, Barackpur

Ramij Rahman	02.10.19 - 14.10.19	Presidency Univ., Kolkata
Fahad Panolan	04.10.19 - 11.10.19	IIT , Hyderabad
Swarup Poria	09.10.19 - 27.10.19	Univ. of Calcutta
Leelavathi Narlikar	27.10.19 - 01.11.19	CSIR, National Chemical Lab, Pune
Tavenas Sebastien, R	21.10.19 - 10.11.19	Univ. Savoie Mont Blanc, France
Farhat Habib	28.10.19 - 30.10.19	INMOBI, Bangalore
Abraham	28.10.19 - 30.10.19	IISER,Pune
Oesterle Joseph	01.11.19 - 29.01.20	Sorbenne Univ.
Swapan Kumar Majhi	02.09.19 - 29.09.19 (& 08.10.19 - 10.11.19)	Achharam Memorial College, Jhalda
Palash Pal	01.11.19 - 03.11.19	Univ. of Calcutta
Sree Krishna Dani	01.11.19 - 03.11.19	CEBS, Mumbai
Akhilesh, P	05.11.19 - 10.11.19	Kerala School of Mathematics
Vinod Chandran, N.V	14.11.19 - 17.11.19	Univ. of Nebraska, USA
Sujan Sengupta	15.11.19 - 16.11.19	IIA, Bangalore
Steven Spallore	08.11.19 - 13.11.19	IISER, Pune
Shyam Sundar, R.K	10.11.19 - 12.11.19	IIT, Mumbai
Ramesh, V.P	19.11.19 - 22.11.19	Univ. of Hyderabad
Hitesh J Changlani	24.11.19 - 27.11.19	Florida State Univ.
Sunil Chandran, L	27.11.19 - 01.12.19	IISc, Bangalore
Pavol Hell	27.11.19 - 01.12.19	Fraser Univ., Canada
Lunfried Kohlen	05.12.19 - 09.12.19	Univ. of Heidelberg
Akhilesh, P	04.12.19 - 31.12.19	Kerala School of Mathematics
Christian Schmidt	21.01.19 - 23.11.19	Bielefeld Univ.
Sankha S Basu	05.12.19 - 26.12.19	IIT Delhi

Sabeshwar Paul	12.12.19 - 14.12.19	IISER,TVM
Jean Marc D	09.11.19 - 14.11.19 & (07.12.19 - 11.12.19)	Univ. of Bordeaux
Saumia, P.S	11.12.19 - 07.01.20	BLTP -JINR, Dubina,Russia
Larry Rolen	16.12.19 - 19.12.19	Vanderbit Univ.
Pruisken, A.M.M	10.12.19 - 21.12.19	Univ. of Amsterdam, Netherland
Balchandran, A.P	13.12.19 - 13.02.19	Syracuse Univ.
Kasi Viswanadhan, G	16.12.19-24.12.19	IIISER,Bermapur
Najmul Haque	16.12.19 - 18.12.19	NISER,Bhubaneswar
Yuta Suzuki	24.12.19 - 29.12.19	Nagoya Univ., Japan
Ram Murthy, M	25.12.19 - 29.12.19	Queens university, Canada
Sukumar Das Adhikari	27.12.19 - 07.01.20	Ramakrishna Univ., Belur
Phillippon, P	27.12.19-01.21.20	Univ. of Paris VI
Ramesh, V.P	27.12.19 - 30.12.19	Central Univ. of Tamilnadu, Thiruvapur
Biswa Jyothi Saha	11.12.19 - 01.01.20	Univ. of Hyderabad, Hyderabad
Venkatesan Guruswami	26.12.19 - 02.01.20	Carnegie Mellon Univ., Pennsylvania
Hossein Movasati	01.01.20 - 05.01.20	IMPA, Rio de Janeiro, Brasil
Swapan Kumar Maji	26.12.19 - 04.01.20	Achhurah Memorial College, Kerala
Dileep Jatkar	27.12.19 - 05.01.20	HRI, Allahabad
Nilendra Ganesh Deshpande	06.01.20 - 12.01.20	Univ. of Oregan
Sreejith	08.01.20 - 09.01.20	IISER, Pune
El Houcein El Abdalaoui	28.12.19 - 01.09.20	Univ. de Rouen
Venkatesan Guruswami	10.01.20 - 10.01.20	Carnegie Mellon Univ., Pennsylvania
Parimala Raman	23.12.19 - 12.01.20	Emory Univ.
Pranav Pandit	13.01.20 - 14.01.20	ICTS, Bangalore

Santhosh Kumar Das	09.01.20 - 12.01.20	IIT Goa
Yuri Bilu	05.01.20 - 04.03.20	Univ. of Bordeaux
Pampa Paul	13.01.20 - 14.01.20	Presidency Univ., Kolkata
Dhiraj Kumar	16.01.20 - 17.01.20	ICGEB, Delhi
Vinay Nandicrooz	16.01.20 - 18.01.20	NIT, Delhi
Manoj Changat	10.01.20 - 01.02.20	Univ. of Kerala, Tiruvananthapuram
Sebastin Ferenczi	27.01.20-28.01.20 (02.02.20-10.02.20)	Inst. De Mathematiques De, France
Vishwas Venkatesh	31.01.20 - 02.02.20	IIT, Palakkad
Diptimoy Ghosh	03.02.20 - 06.02.20	IISER, Pune
Sujit Sarkar	04.02.20 - 07.02.20	PPISR, Bangalore
Ramare Oliver	13.02.20 - 21.02.20	CNRS- Maths Department
Andreas Osterloh	15.02.20 - 08.03.20	University of Duisburg- Essen, Germany
Koushik Ray	16.02.20 - 23.02.20	IACS, Kolkata
Ponnurangam Ku- maraguru	16.02.20 - 17.02.20	IIT, Delhi
Jean Marc Deshouillers	23.02.20 - 27.02.20	Univ. of Bordeaux, France
Pushpita Ghosh	24.02.20 - 27.02.20	TIFR, Hyderabad
Vivek Kumar Yadav	25.02.20 - 28.02.20	IIT, Bangalore
Jacabo Toran	28.02.20 - 12.03.20	Univ. of ULM, Germany
Petr Golovoch	01.03.20 - 14.03.20	Univ. of Bergen, Norway
Marc-Hubert Nicole	02.03.20 - 04.03.20	Inst. de Mathematiques de Luminy
Arghya Majee	02.03.20 - 06.03.20	Max Planck Inst. for Intelligent Sys- tems, Germany
Jean Marc Deshouillers	04.03.20 - 08.03.20	Univ. of Bordeaux, France
Sudipto Pal Chowdury	05.03.20 - 09.03.20	Morgan Stanley, Mumbai
Johannes Koebler	05.03.20 - 14.04.20	Humboldt Univ., Berlin

Post Doctoral Visitors

Subramani, M.	01.04.19 - 30.04.19	HRI, Allahabad
Ashmita Das	02.04.19 - 11.04.19	IIT, Guwahati
Arnab Priya Saha	06.04.19 - 14.04.19	HRI, Allahabad
Aravinda, S.	30.03.19 - 08.04.19	ISI, Kolkata
Minati Biswal	18.04.19 - 15.05.19	Inst. of Physics, Bhubaneswar
Arnab Priya Saha	06.04.19 - 14.04.19	HRI, Allahabad
Akshata Shenoy, H.	22.04.19 - 06.05.19	Univ. of Geneva
Sunando Patra	02.05.19 - 17.05.19	IIT, Guwahati
Subhrojit Modak	27.05.19 - 31.05.19	IISER, Kolkata
Krishnakumar Sabapathy	20.05.19 - 31.05.19	Toronto, Canada
Samyadeb Bhattacharya	20.05.19 - 25.05.19	SNBNCBS, Kolkata
Arun Kumar, G.	08.05.19 - 12.05.19	IISER, Mohali
Panch Ram	20.05.19 - 15.08.19	Jawaharlal Nehru Univ., New Delhi
Arghya Mondal	27.05.19 - 08.06.19	TIFR, Mumbai
Sandipan De	16.05.19 - 17.05.19	ISI, Bangalore
Solomon Owerre	05.06.19 - 24.06.19	Perimeter Inst.
Chandreyee Roy	10.06.19 - 14.06.19	SNBNCBS, Kolkata
Kiran Yadav	08.07.19 - 12.07.19	Central Univ. of Rajasthan
Dipanjan Mandal	25.06.19 - 13.07.19	TIFR, Hyderabad
Chandreyee Roy	07.07.19 - 07.10.19	SNBNCBS, Kolkata
Yasir Ameen, P.A	26.06.19 - 10.07.19	IISER, Mohali
Subramani	28.06.19 - 06.07.19	HRI, Allahabad
Arnab Priya Saha	06.07.09 - 16.07.19	HRI, Allahabad
Abhishek Iyer	07.07.19 - 17.07.19	INFN, Naples

Gaurav Prakash Shrivastav	05.08.19 - 08.08.19	TU Vienna
Chandrima Paul	01.07.19 - 31.07.19	Sikkim Univ.
Kannabiran Seshasayanam	28.08.19	CAE Saclay, France
Taushif Ahmed	29.07.19 - 02.08.19	KIT, Germany
Sanga Mitra	18.07.19 - 19.07.19	NIH, USA
Tanmay Mitra	18.18.19 - 28.08.19	HCIR, Germany
Ashwathy, N.	22.07.19 - 24.07.19	JNCASE, Bangalore
Sanjoy Mandal	11.07.19 - 19.07.19	Sainik School, Bhuvaneshwar
Anup Biswanath	15.07.19 - 19.07.19	Dixit, Canada
Priyamvad Srivastav	07.07.19 - 12.07.19	HRI, Allahabad
Biswajith Karmakar	12.07.19 - 29.07.19	PRL, Ahmedabad
Ankit Agarwal	16.07.19 - 19.07.19	Weizmann Inst. of Sciences, Israel
Nirupam Dutta	29.07.19 - 01.08.19	JATNI, Odisha
Chandan Maity	26.07.19 - 21.08.19	ISI, Delhi
Eshita Mazumdar	04.09.19 - 07.09.19	ISI, Bangalore
Pranendu Darbar	06.09.19 - 14.09.19	ISI, Kolkata
Ranadeep Roy	15.09.19 - 15.12.19	IISER, Tirupati
Sandeep Chowdhary	28.08.19 - 28.11.19	IISER, Pune
Prajwal Yash	20.08.19 - 30.05.20	IIST, Trivandrum
Arun Kumar, G	23.08.19 - 26.08.19	IISER, Mohali
Aprameyo Pal	28.08.19 - 30.08.19	Univ. of Duisberg
Prosenjit Kundu	23.09.19 - 30.09.19	NIT, Durgapur
Soumya Kanti Bose	06.09.19 - 15.09.19	IISER, Mohali
Nikhil S. Karthick	04.07.19 - 25.08.19	BNL, Upton, Newyork, USA

Subhrajit Modak	20.08.19 - 11.11.19	IISER, Kolkata
Minati Biswal	14.09.19 - 29.09.19	IOP, Bhubaneswar, Odisha
Himadri Barman	12.08.19 - 19.08.19	Dept. Of Physics, Zhejiang Univ.
Rahul Srivastava	13.08.19 - 18.08.19	AHEP, IFIC
Ankita Chakrabarti	27.08.19 - 29.01.20	Former IMSc Research Scholar
Ranjith Venkatrama	19.09.19 - 25.09.19	Univ. of Cagliari, Italy
Naveen S. Prabhakar	30.09.19 - 04.10.19	TIFR, Mumbai
Prasad, V.V.	30.09.19 - 31.12.19	Weizmann Inst. of Science, Israel
Anilban Polley	10.10.19 - 11.10.19	Columbia Univ.
Nitin Saurabh	06.10.19 - 11.10.19	MPII, Germany
Ravi Kunjwal	14.10.19 - 16.11.19	Perimeter Inst., Canada
Ramakrishnan Natesan	16.10.19 - 18.10.19	Univ. of Pennsylvania
Anirban Karan	23.10.19 - 30.10.19	IIT, Hydrebad
Sudip Kumar Garain	28.11.19 - 01.12.19	Korea Astronomy and Space Science, South Korea
Mohd Suhail Rizvi	21.11.19 - 22.11.19	CNRS, France
Pratyush Pranav	11.12.19 - 13.12.19	ENS Lyon
Snehajit Misra	08.12.19 - 12.12.19	TIFR, Mumbai
Arindam Das	16.12.19 - 20.12.19	Osaka Univ.
Marc Vinyals	15.12.19 - 28.12.19	Technion, Israel
Rameez Raja	15.12.19 - 30.11.19	HRI, Allahabad
Bimla Danu	11.12.19 - 22.12.19	Dulius Maximilians Univ.
Minati Biswal	17.12.19 - 21.12.19	Inst. of Physics
Diptapriyo Manjumdar	16.12.19 - 20.12.19	Univ. of London
Niladri Sarkar	19.12.19 - 21.12.19	Leiden Univ.
Neeraj	18.12.19 - 27.12.19	IIT, Bombay

Azizul Hoque	12.12.19 - 12.03.20	HRI, Allahabad
Saikat Sur	22.12.19 - 26.12.19	IIT, Kanpur
Madhusudhan Raman	28.12.19 - 05.01.20	TIFR, Mumbai
Sandeep Aashish	29.12.19 - 05.01.20	IISER, Bhopal
Aswin Balasubramanian	08.01.20 - 11.01.20	Rutgers Univ.
Nithin Jonathan Paul Williams	01.01.20 - 31.03.20	Univ. of Helsinki, Finland
Prasanna Kumar Dhani	27.12.19 - 30.12.19	INFN, Florence
Anvy Moly Tom	08.01.20 - 29.01.20	Korea Inst. of Advanced Study, South Korea
Sthitadhi Roy	13.01.20 - 14.01.20	Univ. of Oxford, UK
Chandan Maity	01.01.20 - 10.02.20	IISER, Mohali
Pulak Banerjee	26.12.19 - 29.12.19	Paul Scherrer Inst.
Nabanita Ray	06.01.20 - 11.01.20	TIFR, Mumbai
Priyamvad Srivastav	07.01.20 - 09.01.20	HRI Allahabad
Chandrachur Chakraborty	19.01.20 - 22.01.20	Kavli Inst. for Astronomy and Astro-Physics Peking Univ.
Pranabendu Misra	15.12.19 - 15.02.20	MPII
Subhrajit Madak	24.11.19 - 23.02.20	IISER, Kolkata
Iyyappan, I.	09.12.19 - 30.01.20	IISER, Mohali
Manoj Kumar Mandal	19.01.20 - 22.01.20	Univ. of Padova
Javid Ahamad Naiko	20.01.20 - 19.04.20	IIT, Jodhpur
Ranjith V.	21.01.20 - 31.01.20	PPISR, Bangalore
Omkar Srikrishna	27.01.20 - 28.01.20	Seoul National Univ., South Korea
Mallesham K.	27.01.20 - 30.01.20	ISI, Kolkata
Nishad Bharat	31.01.20 - 14.02.20	Univ. of Campinas, Brazil
Shilpa Kastha	31.01.20 - 12.02.20	AEI, Hannover, MPI, Germany

Balagopal	05.02.20 - 09.02.20	Scarland Univ., Germany
Soumya Bhattacharya	07.02.20 - 15.02.20	IIT, Kharagpur
Tanmay Modak	09.02.20 - 15.02.20	National Taiwan Univ.
Anupama Sharma	10.02.20 - 14.02.20	Univ. of Michigan, USA
Prafulla S. Oaf	15.02.20 - 26.02.20	IACS, Kolkata
Archit Somani	18.02.20 - 19.02.20	Technion, Israel
Sweta Kumari	18.02.20 - 19.02.20	Technion, Israel
Himadri Shekar Dhar	22.02.20 - 26.02.20	Imperial College, London
Indrajit Ghosh	23.02.20 - 28.02.20	ISI, Kolkata
Subhadip Chakraborti	24.02.20 - 06.03.20	ICTS, Bangalore
Priyanka Chakraborty	25.02.20 - 28.02.20	Univ. of Kolkata
Projesh Kumar	02.03.20 - 31.03.20	IISC, Bangalore
Ashutosh Rai	02.03.20 - 20.03.20	Charles Univ., Czech Republic
Gopal Chandru Sardar	04.03.20 - 12.03.20	IIT, Jodhpur
Ameya Vaze	05.03.20 - 06.03.20	Ivory Dental Clinic, Indore
Nilanjan Sircar	05.03.20 - 09.03.20	Morgan Stanley, Mumbai
Doctoral Visitors		
Nithin, R.	01.04.19 - 30.06.19	Anna Univ.
Sanchita Sharma	25.01.19 - 24.04.19	IISC, Bangalore
Rajesh, G.	01.04.19 - 30.06.19	Anna Univ.
Veekesh Kumar	15.04.19 - 30.04.19	HRI, Allahabad
Priyamvad Srinivastav	09.04.19 - 13.04.19	HRI, Allahabad
Tanmoy Pandit	16.04.19 - 28.04.19	IISER, Mohali
Ganesh, G	17.04.19 - 08.06.19	Amrita Vishwa Vidyapeetham

Sukanya Pandey	May - April 2019	IISER, Pune
Vibhuti Bhushantha	12.04.19 - 28.04.19	ISRO, Ahmedabad
Supriya, P.I	01.05.19-01.07.19	PSG College, Coimbatore
Navish Kumar	03.05.19 - 27.07.19	IIT, Kanpur
Aishwarya Suryakant Dabhole	01.05.19 - 15.07.19	Fergusson, Pune
Pavithra Elumalai	06.05.19 - 10.06.19	PSG College, Coimbatore
Ananth Krishna Duggirala	01.05.19 - 15.05.19	CMI, Kelambakkam
Ashwath Narayana Madhusudan	07.05.19 - 15.07.19	IISER, Pune
Smith Sen	01.04.19 - 06.07.19	BITS, Pilani
Suman Mandal	05.04.19 - 04.07.19	Newyork Univ.
Amruta Chandrashekar	13.05.19 - 10.06.19	Azim Premji Univ.
Suyog Garg	13.05.19 - 10.10.19	IITDM
Deepthi, P G	13.05.19 - 30.06.19	Central Univ. of Tamilnadu
Amrutha, B Nair	06.05.19 - 06.07.19	IISER, Thiruvananthapuram
Madumita Kundu	05.05.19 - 31.07.19	ISI, Kolkata
Budaraju Sasane	02.05.19 - 31.07.19	IISER, Mohali
Sanchit Srinivastava	23.05.19 - 01.07.19	IISc, Thiruvananthapuram
Chiranjib Mukhopadhyay	03.06.19 - 10.06.19	HRI, Allahabad
Ram, S	15.05.19 - 15.07.19	IIIT, Bangalore
Gautam Sharma	24.06.19 - 28.06.19	HRI, Allahabad
Asweel Ahmed, A Jaleel	10.06.19 - 10.09.19	Pondicherry Univ.
Sundheer Kumar, C.S.	24.06.19 - 28.06.19	IISER, Pune
Surajit Kalita	12.08.19 - 19.08.19	IIT, Bangalore
Dibyajyoti Mohanta	16.07.19 - 28.07.19	Dept. Of Physics

Arjit Mukherjee	28.07.19 - 30.10.19	Univ. of Hyderabad
Sundar Ram, S	22.07.19 - 23.07.19	JNCASR, Bangalore
Prafulla Shrikant	01.08.19 - 21.08.19	Former Reseach Scholar, IMSc
Anbu Arjunan	13.08.19 - 03.09.19	CMI, Kelambakkam
Saswati Dhara	22.07.19 - 30.07.19	IIT, Bombay
Shuvam Kant Tripathi	13.08.19 - 31.08.19	IISER, Pune
Garima Agarwal	15.08.19 - 31.08.19	IISER, Pune
Meduri Chakravartula Kumar	24.06.19 - 03.07.19	IIT, Guwahati
Ankita Chakrabarthi	21.08.19 - 20.11.19	Former IMSc student
Akansha Agarwal	13.08.19 - 15.09.19	BEN-Gurion Univ., Israel
Shaury Chakraborty	26.08.19 - 29.08.19	SNBNCBS, Kolkata
Dharmesh Jain	09.09.19 - 20.09.19	SINP, Kolkata
Amit Kumar Singh	01.08.19 - 31.10.19	IIT, Madras
Sandeep, M	17.09.19 - 16.10.19	Kerala School of Mathematics
Sreejith, M.M	05.10.19 - 07.10.19	Kerala School of Mathematics
Adersh N.K	05.10.19 - 07.10.19	TKM College of Arts & Sciences, Kolam
Aanjaneya Kumar	14.10.19 - 18.10.19	IISER, Pune
Suman Kumbhakar	18.10.19 - 26.10.19	IIT, Bombay
Siddhesh Satish	07.10.19 - 31.10.19	Padral, Univ. of Mumbai
Seethalakshmi, K	01.11.19 - 15.01.20	IISER, Pune
Aparna, S.R	01.11.19 - 29.02.20	Stella Maris College
Sayan Kumar Pal	06.11.19 - 21.11.19	SNBNCBS, Kolkata
Partha Nandi	06.11.19 - 21.11.19	SNBNCBS, Kolkata
Anwesh Chakrabarti	06.11.19 - 21.11.19	SNBNCBS, Kolkata
Pratik Tarafdar	18.11.19 - 22.11.19	SNBNCBS, Kolkata

Namitha, C.V	18.11.19 - 20.11.19	Pondicherry Univ., Kalapet
Avijit Nath	01.11.19 - 30.11.19	Former IMSc student
Shoumay Dutta	25.11.19 - 05.12.19	SNBNCBS, Kolkata
Sreejith, M.M	07.11.19 - 30.12.19	Kerala School of Mathematics
Neha Malik	08.12.19 - 15.12.19	IISER, Pune
Debabrata Deb	14.12.19 - 19.12.19	IEST, Shibpur
Ankit Aggarwal	15.12.19 - 19.12.19	ULB, Brussels, Belgium
Wataru Takeda	24.12.19 - 29.12.19	Nagoya Univ.
Shriya Pai	06.01.20	Univ. of Colorado, Boulder
Sreejith, M.M	01.01.20 - 30.03.20	Kerala School of Mathematics
Mohan, R	06.01.20 - 10.01.20	ISI, Bangalore
Avishek Basu	20.01.20 - 07.02.20	TIFR-NCRA, Pune
Pranandu Darbar	27.01.20 - 15.02.20	ISI, Kolkata
Nimmal Narendra	28.01.20 - 29.01.20	IIT Hyderabad
	28.01.20 - 29.01.20	
Nimmal Narendra	28.01.20 - 29.01.20	
Avishek Basu	20.01.20 - 07.02.20	TIFR NCRA, Pune
Pranandu Darbar	27.01.20 - 15.02.20	ISI, Kolkata
Ankita Budhraja	01.02.20 - 11.02.20	IIS, Bhopal
Devanand T.	04.02.20 - 04.05.20	Former Research Scholar, IMSc
Richa Tripathi	24.02.20 - 23.05.20	IIT, Gandhi Nagar
Dheeraj Kumar	24.02.20 - 01.03.20	Former Research Scholar, IMSc
James Ferguson	08.03.20 - 14.03.20	Univ. of Zurich

Non Doctoral Visitors

Adersh, V.K	01.04.19 - 03.05.19	TKM College of Arts & Science
Arpan Das	08.05.19 - 12.05.19	IOP, Bhubaneswar
Mohit Gupta	12.05.19 - 19.05.19	ICTS-TIFR, Bengaluru
Harini Sudha, J.G.	28.05.19 - 20.07.19	IISER, Pune
Ranganatha, B.R	13.05.19 - 12.07.19	IISER, Tripathi
Shivami, V	15.05.19 - 25.16.19	BITS, Ranchi
Vivek Anand	10.06.19 - 02.08.19	Pennsylvania State Univ.
Deepashree, U	03.06.19 - 18.07.19	Anna Univ.
Kiruthiga, A	3.06.19 - 18.07.19	Anna Univ.
Abiya, R	04.06.19 - 20.03.20	IISER, Tirupathi
Tamil Maran, C	24.06.19 - 31.07.19	TNAU, Coimbatore
Nikhil Ramesh	04.07.19 - 04.10.19	BITS, Goa
Sandeep Chowdhary	13.07.19 - 17.07.19	IISER, Pune
Mitali Rawat	25.07.19 - 31.07.19	Pathshala, C S (Pratham)
Siddharth Paliwal	07.08.19 - 10.08.19	IISc, Bangalore
Shri Vishalini, R	16.07.19 - 31.05.19	Anna Univ.
Evanjalee, A	16.07.19 - 31.05.19	Anna Univ.
Muthupandian, S	08.07.19 - 07.10.19	SAS College
Chandan Kumar Jana	12.08.19 - 14.08.19	ICTS, Bangalore
Sravya, P	26.07.19 - 26.10.19	IISER, Pune
Aditya Lonkar	01.08.19 - 01.08.20	IIT, Madras
Avinandan Das	22.07.19 - 31.05.20	CMI, Kelambakkam
Sathish Kumar, P	10.07.19 - 31.08.19	Univ. of Madras
Aditya Vaswani	01.08.19 - 31.10.19	BITS, Pilani

Anagha, K V	14.05.19 - 14.07.19	NIT, Calicut
Mattam Pottimgari Sree Ganesh Kumar Reddy	01.08.19 - 31.01.20	NIT, Rourkela
Srikara, S	15.07.19 - 30.03.20	IISER, Pune
Parth Rajauria	15.07.19 - 30.03.20	IISER, Tirupati
Khyati Jain	23.05.19 - 18.07.19	BITS, Goa
Anmol Agrawal	01.07.19 - 31.07.19	Shri Shankaracharya, Bhilai
Nidhi Purohit	22.07.19 - 15.12.19	ENS de Lyon (France)
Hareesh, J	15.07.19 - 31.12.19	BITS, Goa
Karthika, R	30.07.19 - 30.11.19	Anna Univ.
Debapom Goswami	01.06.19 - 12.07.19	Univ. of Calcutta
Ujjwal Kumar Sana	01.07.19 - 31.07.19	CMI, Kelambakkam
Sanchit Srivastava	23.05.19 - 25.07.19	IISER, Thiruvananthapuram
Aman Agarwal	18.08.19 - 15.12.19	KK Birla Goa Campus, Goa
Sarvesh Srinivasan	01.08.19 - 15.12.19	Birla Inst. of Technology & Sciences
Divyanshu Gupta	01.08.19 - 21.12.19	BITS, Pilani
Mitali Rawat	26.07.19 - 31.07.19	Whitehal Jr.
Sukanya Pandey	14.08.19 - 01.09.19	IISER, Pune
Murugesan, K	25.09.19 - 31.12.19	Bharathidasan Univ.
Sarath Jyothsna, R	15.05.19 - 15.11.19	PSG College of Tech.,Coimbatore
Sudharsan, V	15.05.19 - 15.11.19	PSG College of Tech.,Coimbatore
Nishant, Gaurav	20.08.19 - 19.11.19	IGNO Univ.
Divya, S	05.09.19 - 04.12.19	TNAU, Coimbatore
Fahad, P.	09.09.19 - 09.03.20	Cochin Univ.
Muthupandian, S	12.10.19 - 31.01.20	SAS College

Sudharsan, V	16.11.19 - 16.12.19	PSG College of Tech., Coimbatore
Sarath Jyotsna, R	16.11.19 - 16.12.19	PSG College of Tech., Coimbatore
Kalyani, S	19.11.19 - 17.12.19	Univ. of Madras
Nishant Gaurav	20.11.19 - 19.07.20	IGNOU
Amartya Muthal	25.11.19 - 25.12.19	ISI, Bangalore
Suyeet Bhalerau	01.12.19 - 31.12.19	IISER, Pune
Shri Poornima, R	01.12.19 - 31.03.20	Anna Univ.
Ranadeep Roy	15.09.19 - 16.12.19	IISER, Tirupati
Madhumita Kundu	06.12.19 - 31.12.19	ISI, Kolkata
Yeshwanth Sripathy	01.12.19 - 31.05.19	Amrita Vishwa Vidyapeetham, Coimbatore
Pratyush Kumar, K	12.12.19 - 04.01.20	BITS, Pilani
Sudharsan, V	15.12.19 - 26.12.19	PSG College of Technology
Abhaya Seetaram Hedge	30.11.19 - 14.12.19	Thiruvananthapuram
Lalatendo Bidyadhar Sahoo	04.12.19 - 25.12.19	NIT, Rourkela
Disha J Kuzhively	16.12.19 - 16.03.20	NISER, Bhubaneswar
Harikar Pradhar	07.12.19 - 31.12.19	NISER, Bhubaneswar
Abhishek Kumar	06.12.19 - 31.12.19	NISER, Bhubaneswar
Nookala Ravali	17.12.19 - 31.12.19	NIT, Rourkela
Murugesan, K	01.01.20 - 31.03.20	Bharathidasan Univ.
Nishan, K	01.01.20 - 30.04.20	Shiv Nadar Univ.
Palak Singla	01.01.20 - 30.06.20	Central Univ. of South Bihar
Saveri Sumadyuti Ayyagari	02.01.20 - 30.06.20	Sastra Univ., Tanjavur
Amandeep	13.01.20 - 18.01.20	IIT, Rourkela
Pragati Gupta	18.01.20 - 26.01.20	IISc, Bengaluru

Komal Diwakar	21.01.20 - 28.02.20	DBS College, Dehradun
Rithika Sharma	27.01.20 - 26.02.20	Central Univ. of Rajasthan
Gourab Pal	05.02.20 - 20.04.20	IIT, Madras
Sampa Dey	15.02.20 - 31.05.20	IIT, Madras
Pragati Gupta	17.02.20 - 30.03.20	IISc, Bangalore
Nikhil Ramesh	26.02.20 - 25.05.20	BITS, Goa

Chapter 6

Infrastructure

6.1 Computer Facilities

Enhancement of Computer Facility during 2019-20

- New laptops were issued to newly inducted faculty and to those faculty on demand for which the laptops are older than 4 years. Macbook book Pro 13, Macbook Pro 16 and Lenovo Thinkpad - P1 were distributed.
- Obsolete and non working LAN switches are replaced with new ones in the following locations: New Guest House, Server room, Library building 2nd and 3rd Floor.
- Portable media hardware viz., A/V Mixer, Preview monitor, Recorder, Streamer, etc., with a DataVideo GO 650 Studio, 4 Channel HD portable Video production studio with accessories and additional 2 input expansion interface ports for the existing DataVideo SE-2800 are installed as a backup solution for the media activity.

Activities :

- Mr. P.Mangala Pandi, Project Technical Assistant(HPC) is relieved from the project on June 4, 2019
- Mr. Imrankhan, H., Project Technical Assistant(HPC) joined under the project Management of IMSc IT Infrastructure: Computing Media, Web : 2019-2022 with effect from the forenoon of 11/09/2019.
- Mr. Imrankhan, H., Project Technical Assistant(HPC) has attended “SETS - National Workshop on Introduction to Quantum Computing” organised by SETS, Chennai during Feb 20-22, 2020.
- After the successful installation of PoS Canteen billing(Cash-less) System, it was planned for the full automation of IMSc Office functionalities with task management through Open ERP (ODOO). Visitor request form module is completed and trial run under process.

6.2 The Library

The Institute Library holds a total collection of 75349 books and bound periodicals as on March 31, 2020. This includes an addition of 574 volumes during the current year April 2019 - March 2020. The NBHM has recognized this Institute library as the Regional Library for Mathematics. An average of about 4000 outside users in a year from colleges, universities and research institutions from different parts of the country make use of the library facilities for their academic and research information needs.

The library has a well balanced collection both print and online on the major subject areas of research such as Theoretical Physics, Mathematics and Theoretical Computer Science. The library subscribes to over 350 national and international journals.

The library has access to over 3500+ online journals from major publishers such as Elsevier, American Mathematical Society, American Physical Society, Springer Verlag, World Scientific, Institute of Physics, Wiley, etc.

Library has also access to Nature online, Science Online, ACM Digital Library, SIAM Journals Archive, Duke Mathematical Journal, and JSTOR Full digital archive. It has also perpetual online access to backfile collection of journals contents from Volume 1 from some of the major publishers like Elsevier under DAE consortium, Springer, World Scientific, Wiley, deGruyter, Cambridge University Press, Turpion, IOP Publishing and Annual Reviews Electronic Backvolume collection.

Access to online journals is restricted to members of the Institute.

Services:

Apart from developing the collection, the library offers reprographic and inter library loan services. Library has migrated from commercial proprietary software Libsys to open source software Koha on a linux platform, the library catalogue has been computerized and made available online to the readers both within and outside the Institute Campus. Online request for acquisition of books and status of borrowings have also been enabled using Koha. Library has implemented RFID based system for self check-in and checkout of library materials. VECC Kolkata has extended their support by providing linux based software applications to use RFID systems. With the help of RFID enabled access control system, the library provides effective 24x7 access to its resources, perhaps the only library of this kind in the country.

Library has a website dedicated to host all the electronic information resources and to provide information about the library and its services.

Library is a member of DAE Libraries Consortium that subscribes to SCIENCE DIRECT SERVICE of Elsevier.

Library is also coordinating the MathSciNet consortium which provides online access to MathSciNet for participating institutions in the southern region.

Library is an institutional member of AMS, MALIBNET, CURRENT SCIENCE Association, and IAPT.

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6.3 ICA, Sports & Games Activities at the Institute



Figure 6.1: Program organised by IMSc Cultural Association, 2019-2020



Figure 6.2: Program organised by IMSc Cultural Association, 2019-2020



Figure 6.3: Cricket Team, 2019-2020, IMSc, Chennai



Figure 6.4: Badminton Tournament, 2019-2020, IMSc, Chennai



Figure 6.5: Badminton Winners, 2019-2020, IMSc, Chennai



Figure 6.6: Badminton Runners, 2019-2020, IMSc, Chennai



Figure 6.7: Chess Winners, (2019-2020) IMSc, Chennai



Figure 6.8: Chess Players, 2019-2020, IMSc, Chennai



Figure 6.9: Chess Tournament, 2019-2020, IMSc, Chennai



Figure 6.10:



Figure 6.11: Foot Ball Teams, 2019-2020



Figure 6.12: Foot Ball Match, 2019-2020



Figure 6.13:



Figure 6.14: