



THE INSTITUTE OF MATHEMATICAL SCIENCES

C. I. T. Campus, Taramani,

Chennai - 600 113.

ANNUAL REPORT

Apr 2022 - Mar 2023

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Foreword

I am very pleased to present the annual report of the Institute for the year 2022-2023 and bring out the distinctive achievements of its members during the year along with a perspective for the future.

During the period April 2022 - March 2023, 144 students were pursuing their Ph.D and 51 scholars as post-doctoral fellows at IMSc. A total of 17 students were awarded Ph.D degree, 7 students got M.Sc degree by Research, and 3 students submitted their PhD thesis.

I am happy to inform you that the research output of the members of the Institute has been excellent throughout the year. Several high-quality research works were reported in national and international journals, and some of them were presented at National/International conferences. A total of 34 lecture courses were conducted at the Institute throughout the year. In addition, we organized and also co-sponsored several workshops and conferences.

The year 2022 marked the 60th foundation year of the institute and to commemorate we conducted a year-long scientific activities that included inviting our Alumni to spend time with us and special colloquia by them. We organised a special series called “The IMSc60 colloquium series” with the aim of celebrating the 60th foundation year. This series was planned to bring together eminent scientists from different areas of research to talk about the developments and also their scientific vision for the next decade. This was a unique series with 59 talks covering a wide variety of topics.

The IMSc60 foundation year ended on a high note with a flagship event namely ”IMSc60 celebration” which took place during Jan 2-5, 2023. It was a unique gathering encompassing scientists, nation-builders, policy-makers, and research scholars aimed not only to honor and recognize remarkable scientific contributions from the past but also to strengthen India’s scientific activities for the next decade and make India to lead the global research landscape. During this 4 day long celebration we organised 66 scientific talks by eminent scientists, invited faculty, IMSc faculty, and a significant number of IMSc students.

Other than the scientific talks, we had a poster session. The highlight of the event was the Release of Special Cover and My Stamp by the Post-Master General Chennai Circle. A cultural dance program followed by a family gathering over a banquet. During the program, TNSF and IMSc jointly released a book for Children called ”Jantar Mantar” and celebrated World book day on Saturday, April 23 at 10:30 am in the Ramanujan auditorium on the IMSc campus. In addition, TNSF and IMSc brought out a set of books in Tamil to commemorate IMSc’s 60th anniversary, and the first set of 7 books was released at this event. More on IMSc60 can be found in: <https://www.imsc.res.in/imsc60/>

As part of the program “Azadi Ka Amrit Mahotsav” (AKAM) - a celebration to mark the 75th anniversary of India’s independence the institute organised several popular scientific talks, distinguished lectures, public outreach programmes, and academic initiatives. As part of Azadi Ka Amrit Mahotsav, under the guidance of the Ministry of Culture, Government of India, we organised an Iconic Week for the Department of Atomic Energy (DAE), during the program to showcase the achievements of the department.

During this event IMSc organised several outreach programmes for school children, teachers, and the general public. These include Vigyan Pratibha Regional Workshop (KVS JNV), Teacher’s Enrichment Workshop, IMSc Ganakam program, and our flagship Science at the

Sabha to name a few. During weekends, some of our research scholars organize special classes for school children who live closer to our Institute.

We are proud to note the awards and honors bestowed on our faculty for their contributions: Prof. Sanoli Gun was elected as President of Asia-Oceania Women in Mathematics (AOWM), the continental organization for women in Mathematics in Asia and Oceania. Prof. Venkatesh Raman was elected as President of ACM India for 2022-2024, by ACM India. Prof. Rajesh Ravindran was elected as a Fellow of the Indian Academy of Sciences, for the year 2023. Dr. Dhiraj Kumar Hazra was awarded N. R. Sen Young Researcher Award, for 2022, by the Indian Association for General Relativity and Gravitation.

This report was compiled through the efforts of the IMSc Annual Report Committee consisting of Prof. Shrihari Gopalakrishna, Prof. S. Viswanath, Dr. Arnab Pal, Dr. Sendeeep Choubey, and Dr. Ramya. C, Dr. Paul Pandian and Shri Maruthu Pandiyan. I owe my gratitude to all of them.

April, 2023

V. Ravindran

Contents

1	The Institute	1
1.1	Governing Board	1
1.2	Executive Council	3
1.2.1	Profiles of Governing Board and Executive Council Members	4
1.2.2	Director’s Advisory Committees	7
1.3	Faculty	11
1.4	Emeritus Faculty Members	13
1.5	Scientific Staff	13
1.6	Administrative & Accounts Staff members	13
1.7	Project Staff	14
1.7.1	Project Staff [Non Academic]	14
1.7.2	Project Staff [Scientific/Academic]	15
1.8	Post-Doctoral Fellows	16
1.9	Ph.D. Students	17
1.10	Summer Students	21
1.10.1	Other Students	22
2	Research and Teaching	23
2.1	Computational Biology	23
2.1.1	Research Summary & Highlights	23
2.1.2	List of Publications	29
2.2	Mathematics	32
2.2.1	Research Summary & Highlights	32

2.2.2	List of Publications	35
2.3	Physics	42
2.3.1	Research Summary & Highlights	42
2.3.2	List of Publications	50
2.4	Theoretical Computer Science	70
2.4.1	Research Summary & Highlights	70
2.4.2	List of Publications	72
2.5	Student Programmes	81
2.5.1	Degrees Awarded	81
2.5.2	Lecture Courses During 2022 – 2023.	84
2.6	Honours and Awards	86
3	Other Professional Activities	87
4	Colloquia	93
4.1	Conferences/Workshops Held at IMSc	93
4.1.1	Boltzmann Day on Jun 28, 2022.	93
4.1.2	Sage Days 114 during Jul 25 – Jul 27, 2022.	94
4.1.3	Teachers Enrichment Workshop on Linear Algebra and Discrete Mathematics during Jan 23 – Jan 28, 2023.	94
4.1.4	Frontiers in Non-Equilibrium Physics (FNEP) during Jan 17 – Jan 20, 2023.	94
4.1.5	Program on astrophysics during Feb 1 – Feb 8, 2023.	95
4.2	Other Conferences/Workshops Organized by IMSc	96
4.2.1	Advanced Instructional School on Representation Theory during Jun 20 – Jul 9, 2022.	96
4.2.2	34th International Conference on Formal Power Series and Algebraic Combinatorics during Jul 18 – Jul 22, 2022 at IISc Bengaluru.	96
4.2.3	Discussion Meeting On Statistical Physics and Complex Systems during Jul 18 – Jul 20, 2022 at IIT Kharagpur.	96
4.2.4	A short summer school on Nonlinear Physics and Statistical Physics during Jul 21 – Jul 23, 2022 at IIT Kharagpur.	96
4.2.5	Annual Foundational School-I (AFS-I) during Dec 5 – Dec 31, 2022.	97
4.2.6	Winter Training Programme - II during Dec 7 – Dec 17, 2022.	97

4.2.7	Chennai-Tirupati number theory conference during Feb 11 – Feb 12, 2023.	98
4.3	IMSc 60 - Celebrating 60 years of Creative Science	99
4.3.1	IMSc 60 Distinguished Lectures	103
4.3.2	IMSc 60 Colloquium Series	107
4.3.3	IMSc 60 Celebrations (Jan 2-5, 2023)	109
4.4	Azadi Ka Amrit Mahotsav (AKAM)	115
4.4.1	DAE Iconic Week (22-28 August 2022)	115
4.4.2	AKAM - Distinguished Lectures	119
4.4.3	AKAM - Heritage Lectures	119
4.4.4	AKAM - Popular Lectures	120
4.5	Outreach Activities	121
4.6	Seminars	126
5	External Interactions	149
5.1	Collaborative Projects with Other Institutions	149
5.1.1	Arecibo 327 MHz Drift Pulsar Survey (AO327)	149
5.1.2	Chemical kinetics and stochastic thermodynamics	149
5.1.3	DST SERB Start-up Research Grant	149
5.1.4	Dynamics of strongly-entangled topological quantum matter	149
5.1.5	Extreme events in dynamical and stochastic systems	150
5.1.6	First passage processes of many body systems	150
5.1.7	Hardness in QBF Proof Complexity	150
5.1.8	Harnessing stochastic motion using automated robots	150
5.1.9	Home-range search processes	150
5.1.10	Indian Pulsar Timing Array (InPTA) experiment	150
5.1.11	Max Planck Partner Group in Mathematical Biology	151
5.1.12	Modelling of amorphous solids for large scale simulations	151
5.1.13	Mpemba effect in non-equilibrium systems	151
5.1.14	SPARC	151
5.1.15	Stochastic resetting and ergodic theory	151

5.1.16	Stochastic resetting experiments using optical traps	152
5.1.17	Stochastic thermodynamics in viscoelastic systems	152
5.2	Conference Participation and Visits to Other Institutions	153
5.3	Visitors from Other Institutions	161
6	Infrastructure	167
6.1	Computer Facilities	167
6.2	The Library	169

Chapter 1

The Institute

1.1 Governing Board

Thiru. **K. Ponmudy**,
Hon'ble Minister for Higher Education,
Government of Tamil Nadu, Fort St.George, Chennai
(**Chairman**)

Dr. **K.N. Vyas**,
Chairman, AEC & Secretary to Government of India,
Department of Atomic Energy, CSM Marg, Mumbai
(**Co-Chairman**)

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

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

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

Prof. **S. Gowri**,
Vice-Chancellor, University of Madras,
Chepauk, Chennai
(**Member**)

Smt. **Sushma Taishete**, CSS,
Joint Secretary (R&D) to Govt. of India,
Department of Atomic Energy,
CSM Marg, Mumbai
(**Member**)

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

Dr. **D. Karthikeyan**, IAS,
Principal Secretary to Government, Higher
Education Department,
Secretariat, Fort St.George, Chennai
(**Member**)

Prof. **V. Ravindran**,
Director, Institute of Mathematical Sciences,
CIT Campus, Taramani, Chennai
(**Member Secretary**)

1.2 Executive Council

Dr. **K.N. Vyas**,
Chairman, AEC, & Secretary to Government of India,
Department of Atomic Energy, CSM Marg, Mumbai
(**Chairman**)

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

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

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

Smt. **Sushma Taishete**, CSS,
Joint Secretary (R&D) to Govt. of India,
Department of Atomic Energy,
CSM Marg, Mumbai
(**Member**)

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

Dr. **D. Karthikeyan**, IAS
Principal Secretary to Government, Higher
Education Department,
Secretariat, Fort St.George, Chennai
(**Member**)

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

1.2.1 Profiles of Governing Board and Executive Council Members



Thiru **K. Ponmudy**, Hon'ble Minister for Higher Education,
Government of Tamilnadu, Chennai
(**Chairman**, *Governing Board*)

Dr. 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*)



Dr. 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. Dr. 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. Dr. Vyas, as an engineer, has played a key role for completion of strategic projects. Dr. Vyas has also participated in design & analysis of the Test Blanket Module planned to be installed in ITER, France.

Dr. 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.

Dr. 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. Mustansir Barma Professor Emeritus, Former Director, TIFR, 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 Former Director, Sir Tarak Nath Palit Professor of Physics, 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.

Prof. Sudhanshu Jha, Former Director, TIFR, 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.

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



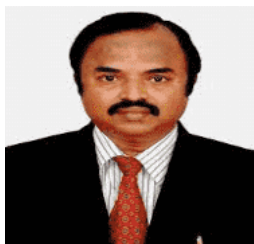
Prof. Manindra Agrawal is a professor at the Department of Computer Science and Engineering and the Deputy Director at the Indian Institute of Technology, Kanpur. He was also the recipient of the first Infosys Prize for Mathematics and the Shanti Swarup Bhatnagar Award in Mathematical Sciences in 2003.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

Prof. V. Ravindran, Director, IMSc Chennai
(**Member Secretary**, *Governing Board & Executive Council*)



Prof. V. Ravindran was a faculty member at Harish-Chandra Research Institute, Allahabad, prior to joining IMSc as a faculty member. His research interests are in theoretical high energy physics and in the perturbative structure of quantum field theories. He is Fellow of Indian Academy of Science (IAS) since 2012, and Fellow of Indian National Science Academy (INSA) since 2019.

Prof. S. Gowri, Vice-Chancellor, University of Madras, Chennai
(**Member**, *Governing Board*)



He has previously been the First Registrar of Anna University of Technology Chennai and Chairman, Faculty of Mechanical Engineering of Anna University of Technology Chennai. He has contributed to SWAYAM MOOCS and DTH of the Central Government. He is also the channel coordinator of DAKSH HD Channel, an educational channel of the MHRD.

Smt. Sushma Taishete, CSS, Joint Secretary (R & D), Department of Atomic Energy, CSM Marg, Mumbai.
(**Member**, *Governing Board & Executive Council*)



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



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



1.2.2 Director's Advisory Committees

Annual Report Committee

Shrihari Gopalakrishna Viswanath, S. Ramya, C. Arnab Pal Sandeep Choubey Paul Pandian	Chair (Librarian)
--	--------------------------------------

Alumni Committee

Indumathi, D. Sundar Meena Mahajan Paul Pandian Raveendra Reddy, B.	Chair
---	-------

Computer Media & Web Committee

Pinaki Chaudhuri Rahul Siddharthan Sanoli Gun Sayantan Sharma Dhiraj Kumar Hazra Sushmita Gupta Raveendra Reddy, B. A student representative	Chair SO'F'(Systems) (nominated by the Chair)
---	---

Events Committee

Areejit Samal Rahul Siddharthan Manjari Bagchi Sayantan Sharma Viswanath, S. Anup Dixit Sushmita Venugopalan Varuni Prabhakar Disha J. Kuzhively	Chair Research Associate Project Assistant
--	--

Internal Complaints Committee (Gender Bias Redressal)

Sushmita Venugopalan Sibasish Ghosh	Chair
--	-------

Vinayalatha, S.	Registrar
Indra, R.	Administrative Officer
Geetha, V.	(External Member)
A Student Representative	(Nominated by the Chair)

Grievance Redressal Committee

Meena Mahajan	Chair
Anirban Mukhopadhyay	
Sanatan Digal	
Sujay Ashok	

Guest House Advisory Committee

Saket Saurabh	Chair
Syed R. Hassan	
Roji Pius	
Anup B Dixit	
Vinayalatha, S.	Registrar
A Student Representative	(Nominated by the Chair)

HBNI Coordinators Committee

Amritanshu Prasad	Dean, Student Affairs
Satyavani Vemparala	Dean, Physical Sciences
Sanatan Digal	Associate Dean, Physical Sciences
Srinivas, K.	Dean, Mathematical Sciences
Sitabhra Sinha	Dean, Life Sciences

Hostel Faculty Counselor Committee

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

Indumathi, D.	Chair
Sayantan Sharma	
Syed R. Hassan	
Prakash Saivasan	
Anup B Dixit	
Sandeep Choubey	

Housing & Up-Keep Committee

Syed R. Hassan	Chair
Anup Dixit	
Arnab Pal	

Sayantana Sharma
Vinayalatha
Indra, R. Registrar
Administrative Officer

Library Committee
Amritanshu Prasad Chair
Sitabhra Sinha
Anirban Mukhopadhyay
Manjari Bagchi
Ajit Balram
Arnab Pal
Ramya, C.
Paul Pandian (Librarian)
Sathish Kumar, V. SRF, (Mathematics)

Official Language Implementation Committee

Ravindran, V. Chair
Srinivas, K.
Anup Dixit
Sayantan Sharma
Vinayalatha, S. Registrar
A Student Representative (nominated by the Chair)

PDF Committees

Sanoli Gun & Dishant Pancholi Mathematics
Dhiraj Kumar Hazra & Sayantan Sharma Physics (HEP)
Arnab Pal & Syed R. Hassan Physics (LEP)
Vikram Sharma TCS
Rahul Siddharthan & Areejit Samal CB

Right To Information Act [RTI] Committee

Anirban Mukhopadhyay Appellate Authority
Vinayalatha, S. Public Information Officer

Space Planning & Allocation Committee

Ravindran, V. Chair
Syed R. Hassan
Subramanian, C.R.
Anup Dixit
Sayantan Sharma
Vinayalatha, S. Registrar

Tender Committee

**Sanatan Digal
Ajit C Balram
Sushmita Gupta**

Sports/GYM Committee

Vikram Sharma Chair

Manjari Bagchi

Sundar, S.

Dishant Pancholi

**Student Members : One student representative for
Cricket, Badminton, Football, and Table Tennis (nominated by the Chair)**

Approval Coordinators

Shrihari Gopalakrishna Physics

Anirban Mukhopadhyay Mathematics

Meena Mahajan TCS

Rahul Siddharthan CB

Colloquium & Committee

Sayantana Sharma Physics

Anup B Dixit Mathematics

Prakash Saivasan TCS

Areejit Samal CB

Summer Research Programme Committee

Sushmita Gupta TCS

Pinaki Chaudhuri Physics

Dishant Pancholi Mathematics

Sandeep Choubey CB

Associateship Programme Committee

Nemani, V.S.

Chair

Vikram Sharma & Sushmita Gupta

TCS

Sanoli Gun & Dishant Pancholi

Mathematics

Roji Pius & Ajit Balram

Physics

Rahul Siddharthan

CB

Academic Coordinators Committee

Sujay Ashok	Physics
Anup B. Dixit	Mathematics
Vikram Sharma	TCS
Rahul Siddharthan	CB

JEST/NBHM/JGEEBILS Coordinators Committee

Sanoli Gun	Mathematics(NBHM)
Subramanian, C R & Prakash Saivasan	TCS
Ajit C Balaram	Physics
Areejit Samal	CB(JGEEBILS)

Group Conveners Committee

Vijay Kodiyalam	Mathematics
Venkatesh Raman	TCS
Rahul Siddharthan	CB
Syed R. Hassan	LEP
Dhiraj Kumar Hazra	HEP

Infrastructure Committee

Syed R. Hassan	Chair
Saket Saurabh	
Sushmita Venugopalan	
Sayantan Sharma	
Vinayalatha, S.	Registrar
Mohan, S.	Scientific Officer E (Electrical)
Sundar, M.	Scientific Officer D(Civil)

Medical Committee

Jaya N. Iyer	Chair
Saket Saurabh	
Sanoli Gun	
Sayed R. Hassan	
Vinayalatha S	Registrar

1.3 Faculty

Name

Userid

Computational Biology

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

Mathematics

Chakraborty, Partha Sarathi	parthac
Chatterjee, Pralay	pralay
Dixit, Anup Biswanath	anupdixit
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
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
Madanagopalan, Padmanath	padmanath
Menon, Gautam I.	menon

Mukhopadhyay, Partha	parthamu
Nemani, Venkata Suryanarayana	nemani
Pal, Arnab	arnabpal
Pius, Roji	rojipius
Rajesh, Ravindran	rrajesh
Ravindran, V.	ravindra
Sayantana Sharma	sayantans
Siddharthan, Rahul	rsidd
Sinha, Nita	nita
Sinha, Rahul	sinha
Sinha, Sitabhra	sitabhra
Vemparala, Satyavani	vani

Theoretical Computer Science

Arvind, V.	arvind
Gupta, Sushmita	sushmitagupta
Mahajan, Meena	meena
Raman, Venkatesh	vraman
Ramanujam, R.	jam
Ramya, C.	ramyac
Saivasan, Prakash	prakashs
Saurabh, Saket	saket
Sharma, Vikram	vikram
Subramanian, C.R.	crs

1.4 Emeritus Faculty Members

Balasubramanian, R.	balu
Rajasekaran, G.	graj

1.5 Scientific Staff

Raveendra Reddy B.	ravi
Paul Pandian M.	pandian
Mohan S.	smohan
Usha Devi P.	usha
Sundar M.	msundar
Maruthu Pandiyan B.	maruthu
Unguturu Nagamalleswara Rao	unrao

1.6 Administrative & Accounts Staff members

Vinayalatha S.
Registrar

Gayatri E. ¹
Accounts Officer

Seenivasa Ragha- ²
van N.
Accounts Officer

Indra R.
Administrative Officer

Shankaran, K.P.
Seenivasa Raghavan N.
Usha Otheeswaran
Archana Shukla
Babu, B.
Johnson, P.
Gopinath, S.
Amulraj, D.
Moorthy, E.
Rajasekaran, N.
Ravichandran, N.

Parthiban, V.
Ashfack Ahmed, G.
Geetha, M.
Padmanabhan, T.
Prema, P.
Jayanthi, S.
Baskaran, R.
Janakiraman, J.
Munuswamy, N.
Ramesh, M.
Tamil Mani, M.

1.7 Project Staff

1.7.1 Project Staff [Non Academic]

<u>Name</u>	<u>Userid</u>
Balachander M.	mbchander
Dhinesh Singh A	dineshs
Doguparthi Ganesh Kumar	dgkumar
Gayathri S.	gayathris
Gayathri Mohan	gayathrim
Hari Priya T.V.	tvhpriya
Hemamalini A.	ahema
Karthikeyan M.	mkarthikeyan
Kirubananth P.	kirubananth
Krishna Balaji R.	rkbalaji
Manikandan Sambasivam	
Moovendan M.	moovendan
Parthasarathi N.	npsarathi
Prashanna K.	prasannak
Rajkumar S.	srajkumar

¹(Upto 30-04-2022)

²(from 02-05-2022)

Rethinasamy D.	drsamy
Sadhana R.	sadhana
Sakthivel Murugan E.	esakthi
Sasikumar K.	sasikumark
Shalieni D.	shalienid
Siva Perumal	sivaperumal
Sivavyrava Balaji	
Sreelakshmi P.K.	lakshmipk
Srinadh G.	gsrinadh
Srinivasan G.	gsvasan
Sree Raj T.P.	sreeraj
Thennarasu S.D.	sdthennarasu
Vaideeswaran	mveswaran
Vijayakumar V.	vvkumar
Vimalraj J.	vimalraj

1.7.2 Project Staff [Scientific/Academic]

<u>Name</u>	<u>Userid</u>
Abhishek Roy	abhishekroy
Anns Mariya Soney	annsmaria
Anuran Pal	anuranp
Bibi Mary Francis	
Charulatha Venkataraman	
Debabrata Deb	debabratadeb
Debsurya Ghosh	debsuvra
Deepak Kumar	deepak
Disha J Kuzhively	dishajk
Gajendra Singh Badwal	
Gokul Balaji	gokulb
Hareesh, J	
Irine Skeiviya	
Ishitva Gupta	ishitvag
Ishwarya M	ishwaryam
Md. Izhar Ashraf	ashraf
Julie Jacob Thomas	
Kamal Tripathi	kamalt
Kishan Kumar	
Madhumita Mondal	madhumitam
Mousumi Kundu	mousumik
Mrinal Kanti Pal	mrinalkantipal13
Nandini Mitra	nmitra
Pavithra Elumalai	pavithrae
Priya Dharshini A	
Priya Shree	priyashree
Ranjith Venkatrama	ranjithv

Saumitra Kulkarni	ranjithv
Shakthi N. Menon	shakthi
Shrikant Utagi	shrikantu
Smruti Dixit	
Sriram Bhyravarapu	sriramb
Sudharshan A.	
Surendra Singh Badwal	
Vanisha Verma	vanishav
Varuni Prabhakar	varuni
Vikash Tripathi	
Vinayak T	vinayakt
Vinay Vaibhav	vinayv
Vinod Kumar T.	tvinodkumar
Yasharth Yadav	yasharthby

1.8 Post-Doctoral Fellows

Name

Userid

Computational Biology

Balamurugan Kanagasabai	balamurugank
Nayana Mukerjee	nayanam
Pinakinarayan A P Swain	pinakiswain
Solinglyur Zimik Kachui	soling
Sushmita Ghosh	susmitag

Mathematics

Dwaipauam Mazumder	mazumderd
Hassain M.	hassainm
Hitesh Raundal	hiteshrr
Jagannath Bhanja	jbhanja
Lalit Vaishya	lalitvaishya
Manikandan, S.	manikandans
Mani Shankar Pandey	mspandey
Mithun Kumar Das	mithundas
Priyanshu Chakraborty	priyanshu
Richa Sharma	richasharma
Sayan Goswami	sayangoswami
Selvakumar A.	selvakumar
Vidhya, A.	sriramb

Physics

Aman Abhishek	amanabhi
Amit Mukherjee	amitm
Aneesh P.B.	aneeshpb
Arkaprabha Ghosal	arkaghosh
Ashutosh Rajendra Dubey	ashutoshrd
Asweel Ahemed A Jaleel	asweel
Debabrata Adak	debuadak
Debabrata Sinha	debabratas
Debodirna Ghosh	debodirna
Deeptak Biswas	deeptakb
Dibyajyoti Mohanta	dibyajyotim
Disha Bhatia	dishabhatia
Iyyappan I.	iyyappan
Jetin E. Thomas	jetinthomas
Moumita Naskar	moumitan
Oindrila Gangauly	oindrilag
Prasad V.V.	prasadvv
Pratik Tarafdar	pratikt
Projesh Roy	projeshkr
Ratan Sarkar	ratansarkar
Rohitashwa Chattopadhyay	rohitashwa
Samapan Sikdar	samapans
Sitender Pratap Kashyap	sitenderpk
Soumyadip Banerjee	soumyadipb
Subramanya, H	subbuh
Subhadeep Roy	sroy
Suprabh Prakash	suprabh
Vishnudath K.N.	vishnudathkn

Theoretical Computer Science

Palak Pandoh	palakpandoh
Satyabrata Jana	satyabrataj
Sayani Das	sayanidas
Shaily Verma	shailyverma
Sriram Bhyravarapu	sriramb

1.9 Ph.D. Students

Name *Userid*

Computational Biology

Ajay Subbaroyan	sajay
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Ajaya Kumar Sahoo	ajayaks
Amrutamaya Behera	amrutamaya
Aniruddha, N.	naniruddha
Chandrani Kumari	chandranik
Devanand T.	devanandt
Farhina Mozaffer	farihinam
Hareesh J	hareeshj
Madhumita Mondal	madhumitam
Nikhil Chivukula	nikhile
Pavitra S.	spavitra
Priyotosh Sil	priyotosh
Rakshika Lakshmi, A.	rakshikal
Reshma M	reshmam
Rohit Kumar Singh	rohits
Roni Saiba	ronis
Saptarshi Chakraborty	saptarshic
Shanmugapriya Priya B.	shanmugapriya
Shreyes Rajam Madhamkar	shreyesrm
Sreevidya T.S	tssreevidya
Sunayanaa Sridharan	sunayanaas
Vadnala Rakesh Netha	rakeshnetha
Vivek Ananth R.P.	vivekananth

Mathematics

Abhirup Chatterjee	abhirupc
Ankur Sarkar	ankurs
Aritra Bhattacharya	baritra
Arunabha Mukhopadhyay	arunabham
Aryan D	aryand
Astrid Swizell Dias	astridsd
Dhananjaya Saha	dhananjayas
Jayakumar R.	rjayakumar
Joseph Judy	josephjudy
Manas Mandal	manasm
Manav Gaddam	manavg
Manika Gupta	manikag
Mrigendra Singh Kushwaha	mrigendra
Namitha C.H	namithach
Neelam	neelam
Piyasa Sarkar	psarkar
Priyamvad Srivastav	priyamvads
Rashi Sanjay Lunia	rashisl
Ratheesh T.V	ratheeshtv
Sathish Kumar, V.	vsathish
Siddheswar Kundu	siddheswark
Soumyadip Sarkar	soumyadips
Sudip Dolai	sudipdolai

Sushant	sushant
Sruthy Murali	sruthym
Sunil L Naik	sunilnaik
Suhas Rao Devraj	suhasrao
Saurav Holme Choudhury	sauravhe
Tanmoy Bera	tanmoyb
Tirtharaj Basu	tirtharajb
Velmurugan S	velmurugan

Physics

Abinash Kumar Nayak	abinashkn
Adarsh Sudhakar	adarshsu
Adarsh Vishwakarma	adarshv
Akhil Antony	akhilantony
Amir Suhail	amirs
Amit Kumar	kamit
Amit Suthar	amitsuthar
Anand Pathak	anandb
Anjali Kundalpady	anjalik
Anupam Sarkar	asarkar
Aparna Sankar	aparnas
Apurba Biswas, G.	apurbab
Arindam Mitra	amitra
Arjun Hariharan	arjunh
Arkajyoti Manna	arka jyotim
Arpan Kundu	akundu
Arup Biswas	
Deep Maity	deepmaity
Gopal Prakash	gopalp
Goutham R	gouthamr
Harshit Pandey	harshitp
Himanshu Badhani	himanshub
Hitesh Garg	hiteshgarg
Jatin Ghai	jghai
Jyotijwal Debnath	jdebnath
Koyena Bose	koyenb
Krishna Jalan	krishnajalan
Mamale Vinod Suryakant	mvinod
Manish	manishd
Manog Negi	manojn
Mohammad Shabbir	mshabbir
Nayan Mondal	nayanm
Nirmal Ghorai	nirmalg
Nishant Gupta	nishantg
Pavan Dharanipragada	pavand
Prabhat Butola	prabhatb
Prateek Chawla	prateekc

Prem Kumar	premk
Rabindranatha Mallick	rmallick
Raghvendra Singh	raghvendra
Rahul Nayak	rahulnayak
Rakesh Dora	prakeshdora
Ravi T	travi
Ravi Shanker	rshanker
Sabiar Shaikh	sabiarshaikh
Sahil	sahilmd
Samim Akhtar	saminakhtar
Sandeep Sharma	sandeeps
Sanjoy Saha	sanjoysaha
Sarbartha Sengupta	sarbartha
Sashikanta Mohapatra	sashikanta
Saurav Goyal	sauravg
Sayak Guin	smallik
Sayantana Ghosh	sayantang
Semanti Dutta	semantid
Shivam Gola	shivamg
Siddhartha Paul	siddarthap
Soumya Sur	soumyasur
Sourav Ballav	sballav
Surabhi Tiwari	surabhit
Subashri, V.	subashriv
Sushovan Mondal	smondal
Sumit Shaw	sumitshaw
Swagatam Tah	swagatamt
Tanishk Shrimal	sayakg
Tanmay Mitra	tmitra
Tanmay Saha	sahatanmay
Tanmoy Sengupta	tsengupta
Toshali Mitra	toshalim
Umang A. Dattani	umangad
Vaibhav Pathak	vaibhavp
Vigneshwaran K.	vigneshwaran
Vinay Vaibhav	vinayv
Vishwajeet Kumar	vishwajeet

Theoretical Computer Science

Abhijit R Nair	abhijitrn
Abhimanyu Choudhury	abhimanyuc
Anannya Upasana	anannyaupad
Bhabani Sankar Tripathy	bhabanist
Gaurav Sood	gauravs
Koduri Siddharth Choudary	kodurisc
Pratik Shastri	pratiks
Pritesh Kumar	priteshk

Ramit Das	ramitd
Sanjay Seetharaman	sanjays
Singanporia Kushal Piyushkumar	kushalps
Sobyasachi Chatterjee	sobyasachic
Sounak Modak	sounakm
Souvik Saha	souviks
Suraj Rajendra Kulkarni	surajrk
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, 2022 - Mar, 2023.

Student

Faculty

Computational Biology

Smruti Dixit, IISER Bhopal	Choubey, Sandeep
Namman Bhargava, PSG College Mumbai	Samal, Areejit
Kundhanathan R, NIT Rourkela	Samal, Areejit
Abhisek Narayan Gorti, IISER Pune	Sinha, Sitabhra

Mathematics

Shriya, M, University of Hyderabad	Prasad, Amritanshu
Divya Aggarwal, IIIT Delhi	Prasad, Amritanshu
Ayanava Mandal, NISER Bhubaneswar	Gun, Sanoli
Sayan Dutta, IISER Kolkata	Gun, Sanoli
Krishna C. Menon, IISER Thiruvananthapuram	Gun, Sanoli
Saunak Bhattacharya, IISER Tirupathi	Dixit, Anup
Dishant Saikia, Tezpur University	Dixit, Anup
Sukanya Naik, Goa University	Kotyada, Srinivas
Saikat Maity, Pondicherry University	Kotyada, Srinivas
Aditya Singla, IIT Kharagpur	Kotyada, Srinivas
Tandrima Chowdhury, NIT Rourkela	Kotyada, Srinivas
Yuvashree. B, Stella Maris College	Kotyada, Srinivas
Siva S, Amrita University	Viswanath, S

Physics

C L Sriram, CUSAT Kochi
Gautham Sathish, Krea University
Suvojit Khatua, IIT Hyderabad
Krishna E, IIST Trivandrum
Ashraya Jayaraj, IISER Trivandrum
Shaileyee Bhowrnick, Vishwa Bharati University
Aniruddha Datta, IISER Kolkata
Baalateja Kataru, KREA Univ A.P

Sinha, Sitabhra
Chaudhuri, Pinaki
Pal, Arnab
Gosh, Sibasish
Gosh, Sibasish
Gosh, Sibasish
Rajesh, R
Ravindran, V

Theoretical Computer Science

Rajni Dabas, Univ. Of Delhi
Gaurav Viramgami, IIT Gandhi Nagar
Yash More, IIT Gandhi Nagar
Ishan Chakraborty, CMI
Ajay Krishnan NK, CMI
Satya Amar, Indian Statistical Institute
Anuraj Chatterjee, IACS
Rahul Bordoloi, IISER Kolkata
T. Karthik Rajendran
Joseph Immanuel Amirtharaj, SSN College of
Engineering

Raman, Venkatesh
Saurabh, Saket
Saurabh, Saket
Saurabh, Saket
Saurabh, Saket
Saurabh, Saket
Saurabh, Saket
Saurabh, Saket
Saurabh, Saket
Saurabh, Saket
Saivasan, Prakash

1.10.1 Other Students

Students also do their projects under the supervision of our faculty during the academic year. The following student has visited the institute during Apr, 2022 - Mar, 2023.

Student

Faculty

Physics

Mallikarjun, Rahul, St. Stephen's College, Delhi

Pal, Arnab

Chapter 2

Research and Teaching

2.1 Computational Biology

2.1.1 Research Summary & Highlights

Active matter

[V] The authors studied Phototactic cyanobacteria as an active matter system. Flocks of birds, schools of fish, mixtures of motors and cytoskeletal filaments, swimming bacteria and driven granular media are systems of interacting motile units that exhibit collective behaviour. These can all be described as active matter systems, since each individual unit takes energy from an internal energy depot and transduces it into work performed on the environment. The authors reviewed a model for cyanobacterial phototaxis, emphasising the differences from other models for collective behaviour in active matter systems. The interactions between individual cells during phototaxis are dominated by mechanical forces mediated by their physical attachments through type IV pili (T4P) and through the production of “slime”, a complex mixture of non-diffusible polysaccharides deposited by cells that acts to decrease friction locally. The slime, in particular, adds a component to the interaction that is local in space but non-local in time, perhaps most comparable to the pheromones laid down in ant trails. Their results suggested that the time-delayed component of the interactions between bacteria qualify their description as a novel active system, which the authors referred to as “damp” active matter.

Cell Biology

[C1] The authors investigate the role of signal transport on efficacy of signal transmission. Cell signaling is essential for individual cells to execute various tasks and respond to changes in their environment. It is carried out via diffusing molecules, whose transport is often aided by directional advection. How diffusion and advection together impact the accuracy of information transmission during signaling remains poorly understood. In this study, the authors studied this problem using a simplified model of signal transport in the presence and absence of crowding. Mutual information, a measure of accuracy, showed three distinct regimes characterized by power-law decay. Surprisingly, crowding has no measurable effect

on information transmission. Their results provided several important insights into the role of transport in cell signaling.

[C2] The authors wrote an invited commentary on a paper that used Bayesian non-parametrics to shed light on mechanisms of gene regulation.

Complex systems

[K] The authors studied solar irradiance variance during the day in clear sky conditions. While intermittent nature of solar irradiance values is primarily attributed to clouds, it is equally important to analyze the solar irradiance variance throughout the day in clear sky conditions. Although a vast amount of research has been conducted so far and a numerous clear sky models have been proposed in the literature, none of them holds true temporally and/or spatially across the earth. Accordingly, the authors proposed a generic framework to identify the most appropriate clear sky model for the location of interest, i.e. Delhi-NCR in this case. They further highlighted the importance of incorporating seasonal and temporal variations while determining the suitable clear sky model.

Developmental Biology

[Kuy3] The authors investigated how cells in developing embryos reliably differentiate to attain location-specific fates, despite fluctuations in morphogen concentrations that provide positional information and in molecular processes that interpret it. They showed that local contact-mediated cell-cell interactions utilize inherent asymmetry in the response of patterning genes to the global morphogen signal yielding a bimodal response. This results in robust developmental outcomes with a consistent identity for the dominant gene at each cell, substantially reducing the uncertainty in the location of boundaries between distinct fates.

Ecology

The authors investigated how temperature drives parasite development rate [Mo]. Environmental temperature is a key driver of malaria transmission dynamics. Using detailed temperature records from four sites: low elevation (1800), mid elevation (2200 m), and high elevation (2600–3200 m) in the western Himalaya, the authors modelled how temperature regulates parasite development rate (the inverse of the extrinsic incubation period, EIP) in the wild. Using a Brière parametrization of the EIP, combined with Bayesian parameter inference, they studied the thermal limits of transmission for avian (*Plasmodium relictum*) and human *Plasmodium* parasites (*P. vivax* and *P. falciparum*) as well as for two malaria-like avian parasites, *Haemoproteus* and *Leucocytozoon*. It was demonstrated that temperature conditions can substantially alter the incubation period of parasites at high elevation sites (2600–3200 m) leading to restricted parasite development or long transmission windows. The thermal limits (optimal temperature) for *Plasmodium* parasites were 15.62–34.92°C (30.04°C) for *P.falciparum*, 13.51–34.08°C (29.02°C) for *P. vivax*, 12.56–34.46°C (29.16°C) for *P. relictum* and for two malaria-like parasites, 12.01–29.48°C (25.16°C) for *Haemoproteus* spp. and 11.92–29.95°C (25.51°C) for *Leucocytozoon* spp. The authors then compared estimates of EIP based on measures of mean temperature versus hourly temperatures to show that EIP days vary in cold versus warm environments. It was further found that human

Plasmodium parasites experience a limited transmission window at 2600 m. In contrast, for avian Plasmodium transmission was not possible between September and March at 2600 m. In addition, temperature conditions suitable for both Haemoproteus and Leucocytozoon transmission were obtained from June to August and in April, at 2600 m. Finally, the authors used temperature projections from a suite of climate models to predict that by 2040, high elevation sites (2600 m) will have a temperature range conducive for malaria transmission, albeit with a limited transmission window. The study highlighted the importance of accounting for fine-scale thermal effects in the expansion of the range of the malaria parasite with global climate change.

[**Mu1**] The authors carried out a spatio-temporal extension of a class of prey–predator models with hunting cooperation in the specialist predator population. Three different types of parametrization of functional response were used and the corresponding pattern formation scenario was studied analytically with supportive numerical simulations. The main outcome of this work was that lower diffusivity of predator than the prey can lead to generation of stationary Turing patterns like spots, stripes and mixture of the two. Other non-Turing patterns like spirals spirals and spatio-temporal chaos were also generated for parameter values outside the Turing domain and vividly discussed. Dispersal of the specialist predator lower than the diffusivity of the prey supports the formation of stationary patches as the hunting cooperation among the predators can support the success in predation.

[**Mu2**] The authors investigated the propagation of a disease through a spatially varying population. They considered a spatio-temporal predator–prey model in which a disease only affects the predator. Diffusion-driven instability conditions were analytically derived for the spatio-temporal model. Authors performed numerical simulation using experimental data given in previous studies and demonstrate that travelling waves, periodicity and chaotic patterns are possible. It was shown that the introduction of disease in the predator species makes the standard Rosenzweig–MacArthur model capable of producing Turing patterns, which is not possible without disease. However, in the absence of infection, both species can coexist in spiral non-Turing patterns. It follows that disease persistence may be predictable, while eradication may not be.

Mechanobiology

The authors studied cell adhesion [**Me2**]. Adhesion of cells to substrates occurs via integrin clustering and binding to the actin cytoskeleton. Oncogenes modify anchorage-dependent mechanisms in cells during cancer progression. Fluid shear devices provide a label-free way to characterize cell–substrate interactions and heterogeneities in cell populations. The authors quantified the critical adhesion strengths of MCF-7, MDAMB-231, A549, HPL1D, HeLa, and NIH3T3 cells using a custom fluid shear device. The detachment response was sigmoidal for each cell type. A549 and MDAMB-231 cells had significantly lower critical adhesion strengths ($\tau \approx 50$) than their non-invasive counterparts, HPL1D and MCF-7. Detachment dynamics inversely correlated with cell invasion potentials. A theoretical model, based provided good fits to results from de-adhesion experiments. Quantification of cell tractions, using the Reg-FTTC method on 10 kPa polyacrylamide gels, showed highest values for invasive, MDAMB-231 and A549, cells compared to non-invasive cells. Immunofluorescence studies showed differences in vinculin distributions; non-invasive cells have distinct vinculin puncta, whereas invasive cells have more dispersed distributions. The cytoskeleton

in non-invasive cells was devoid of well-developed stress fibers, and had thicker cortical actin bundles in the boundary. Fluorescence intensity of actin was significantly lower in invasive cells as compared to non-invasive cells. These correlations in adhesion strengths and traction stresses with cell invasiveness may be useful in cancer diagnostics and other pathologies featuring mis-regulation in adhesion.

Network Biology

[Je] Here the authors studied the role played by the topological structure of biological networks in their dynamics and function. In fact, this topic has been receiving increasing attention over the last decade as large-throughput experiments have provided large volumes of highly resolved data on the interactions between the components of such networks. This has provided new perspectives on systems diseases: for example, there has been a gradual shift in cancer research away from the study of individual molecules and of single gene mutations to the emerging consensus that it is a complex disease involving large-scale disruptions in the intracellular signaling network. One of the drawbacks of a systems- or network-based approach is the large number of cellular agents whose interactions need to be investigated. The authors tried to solve this problem by taking a mesoscopic view of the cancer diseases–genes network, whose modular organization they studied after projecting it onto two networks, one comprising only disease types and the other consisting of only genes related to one or more categories of cancer. Using community partitioning, several modules in these networks were identified. Projecting cancer gene clusters onto an abstract ‘modular space’ allowed the authors to infer the relations between different tumor types. By classifying the functional role of particular genes in terms of their inter- and intra-modular connectivity, they identified a number of genes that play the key role of ‘connector hubs’ in the network. Using data from the human protein–protein interaction network it was shown that genes that are ‘connector hubs’ or ‘global hubs’ are, in fact, much more likely to be related to cancer than other genes. More important from a therapeutic point of view, the authors showed that the connector hubs in the cancer gene network are involved in a significantly larger number of human signaling pathways associated with cancer than other types of cancer genes. Furthermore, the types of cancer linked to connector hub genes have significantly reduced survival rates compared with other types of cancer, thereby enhancing their importance in the search for potential therapeutic targets.

In this paper [Vi3], the authors attempted the task of predicting endocrine disrupting chemicals (EDCs) in the human exposome which is vital for improving current chemical regulations. Notably, androgen mimicking environmental chemicals can bind to Androgen receptor (AR) and can cause severe effects on the reproductive health of males. While QSAR models have been developed to predict androgen binders, a continuous structure-activity relationship (SAR) wherein chemicals with similar structure have similar activity does not always hold. Activity landscape analysis can help map the structure- activity landscape and identify unique features such as activity cliffs. The authors performed a systematic investigation of the chemical diversity along with the global and local structure-activity landscape of a curated list of 144 AR binding chemicals. Specifically, they clustered the AR binding chemicals and visualized the associated chemical space. Thereafter, consensus diversity plot was used to assess the global diversity of the chemical space. Subsequently, the structure-activity landscape was investigated using SAS maps which capture the activity difference and structural similarity among the AR binders. This analysis led to a subset of 41 AR binding

chemicals forming 86 activity cliffs, of which 14 are activity cliff generators. Additionally, SALI scores were computed for all pairs of AR binding chemicals and the SALI heatmap was also used to evaluate the activity cliffs identified using SAS map. Finally, the authors provided a classification of the 86 activity cliffs into six categories using structural information of chemicals at different levels. Overall, their investigation revealed the heterogeneous nature of the structure-activity landscape of AR binding chemicals and provides insights which should be crucial in preventing false prediction of chemicals as androgen binders and developing predictive computational toxicity models in the future.

[**Vi1**] The authors here attempted to Compile, curate, digitize and explore the phytochemical space of Indian medicinal plants that can expedite ongoing efforts toward natural product and traditional knowledge based drug discovery. To this end, the authors presented IMP-PAT 2.0, an enhanced and expanded database, compiling manually curated information on 4010 Indian medicinal plants, 17967 phytochemicals, 1095 therapeutic uses and 1133 traditional Indian medicinal formulations. Notably, IMPPAT 2.0 compiles associations at the level of plant parts, and provides a FAIR compliant non-redundant in silico stereo-aware library of 17967 phytochemicals from Indian medicinal plants. The phytochemical library was annotated with several useful properties to enable easier exploration of the chemical space. The authors also filtered a subset of 1335 drug-like phytochemicals of which majority have no similarity to existing approved drugs. Using cheminformatics, they characterized the molecular complexity and molecular scaffold based structural diversity of the phytochemical space of Indian medicinal plants, and performed a comparative analysis with other chemical libraries. Altogether, IMPPAT is the largest phytochemical atlas of Indian medicinal plants which is accessible at: <https://cb.imsc.res.in/imppat/>.

[**Vi2**] The authors in this study probed medicinal fungi, including mushrooms owing to their well- documented therapeutic uses. In this study, they performed a cheminformatics-based investigation of the scaffold and structural diversity of the secondary metabolite space of medicinal fungi and, moreover, perform a detailed comparison with approved drugs, other natural product libraries, and semi-synthetic libraries. The authors found that the secondary metabolite space of medicinal fungi has similar or higher scaffold diversity in comparison to other natural product libraries analyzed here. Notably, 94% of the scaffolds in the secondary metabolite space of medicinal fungi are not present in the approved drugs. Further, the authors observed that the secondary metabolites, on the one hand, are structurally far from the approved drugs, while, on the other hand, they are close in terms of molecular properties to the approved drugs.

[**Y**] The authors investigated Boolean networks in this study. Boolean networks have been widely used to model gene networks. However, such models are coarse-grained to an extent that they abstract away molecular specificities of gene regulation. Alternatively, bipartite Boolean network models of gene regulation explicitly distinguish genes from transcription factors (TFs). In such bipartite models, multiple TFs may simultaneously contribute to gene regulation by forming heteromeric complexes, thus giving rise to composition structures. Since bipartite Boolean models are relatively recent, an empirical investigation of their biological plausibility is lacking. The authors estimated the prevalence of composition structures arising through heteromeric complexes. Moreover, they presented an additional mechanism where composition structures may arise as a result of multiple TFs binding to cis-regulatory regions and provide empirical support for this mechanism. Next, they compared

the restriction in BFs imposed by composition structures and by biologically meaningful properties. The authors found that though composition structures can severely restrict the number of Boolean functions (BFs) driving a gene, the two types of minimally complex BFs, namely nested canalizing functions (NCFs) and read-once functions (RoFs), are comparatively more restrictive. Finally, the authors found that composition structures are highly enriched in real networks, but this enrichment most likely comes from NCFs and RoFs.

Neuroscience

The authors studied the physics of axonal transport [M]. A combination of intermittent active movement of transient aggregates and a paused state that intervenes between periods of active transport has been proposed to underlie the slow, directed transport of soluble proteins in axons. A component of passive diffusion in the axoplasm may also contribute to slow axonal transport, although quantitative estimates of the relative contributions of diffusive and active movement in the slow transport of a soluble protein, and in particular how they might vary across developmental stages, are lacking. Here, the authors proposed and studied a model for slow axonal transport, addressing data from bleach recovery measurements on a small, soluble, protein, choline acetyltransferase, in thin axons of the lateral chordotonal (lch5) sensory neurons of *Drosophila*. Choline acetyltransferase is mainly present in soluble form in the axon and catalyzes the acetylation of choline at the synapse. It does not form particulate structures in axons and moves at rates characteristic of slow component b ($\approx 1\text{--}10$ mm/day or $0.01\text{--}0.1$ $\mu\text{m/s}$). Using their model, which incorporated active transport with paused and/or diffusive states, the authors predicted bleach recovery, transport rates, and cargo trajectories obtained through kymographs, comparing these with experimental observations at different developmental stages. It was shown that changes in the diffusive fraction of cargo during these developmental stages dominate bleach recovery and that a combination of active motion with a paused state alone cannot reproduce the data. They compared predictions of the model with results from photoactivation experiments. The importance of the diffusive state in reproducing the bleach recovery signal in the slow axonal transport of small soluble proteins was their central result.

In this study [Pat] the authors argued that analyzing the brain in terms of organizational structures at intermediate scales provides an approach to unravel the complexity arising from interactions between its large number of components. Focusing on a wiring diagram that spans the cortex, basal ganglia, and thalamus of the macaque brain, they identified robust modules in the network that provide a mesoscopic-level description of its topological architecture. A key finding was that the modular architecture facilitates rapid communication across the network, instead of localizing activity as is typically expected in networks having community organization. By considering processes of diffusive spreading and coordination, the authors further demonstrated that the specific pattern of inter- and intramodular connectivity in the network allows propagation to be even faster than equivalent randomized networks with or without modular structure. Furthermore, it was found that the physical proximity between areas is insufficient to explain the modular organization, as similar mesoscopic structures can be obtained even after factoring out the effect of distance constraints on the connectivity. By supplementing the topological information about the macaque connectome with physical locations, volumes, and functions of the constituent areas and analyzing this augmented dataset, the authors revealed a counterintuitive role played by the modular architecture of the brain in promoting global coordination of its activity. The work suggested

a possible explanation for the ubiquity of modularity in brain networks.

Public Health

In this paper [S11], the authors investigated the clade-specific sequence of *C. auris* which is a recently discovered antifungal drug-susceptible pathogen causing localized infections first isolated in Japan in 2009 as. Within a decade, this pathogen simultaneously evolved in different parts of the world as distinct clades exhibiting resistance to antifungal drugs at varying levels. The authors compared the genomes of representative strains of the four major clades to identify clade-specific sequences, which were then used to design clade-specific primers. They further proposed the utilization of whole genome sequence data to extract clade-specific sequences for clade-typing. The colony PCR-based method they employed could rapidly distinguish between the four major clades of *C. auris*, with scope for expanding the panel by adding more primer pairs.

[S] The World Health Organization (WHO) recently declared the monkeypox outbreak ‘A public health emergency of international concern’. The monkeypox virus belongs to the same Orthopoxvirus genus as smallpox. Although smallpox drugs are recommended for use against monkeypox, monkeypox-specific drugs are not yet available. Drug repurposing is a viable and efficient approach in the face of such an outbreak. Therefore, the authors present a computational drug repurposing study to identify the existing approved drugs which can be potential inhibitors of vital monkeypox virus proteins, thymidylate kinase and D9 decapping enzyme. The target protein structures of the monkeypox virus were modelled using the corresponding protein structures in the vaccinia virus. They identified four potential inhibitors namely, Tipranavir, Cefiderocol, Doxorubicin, and Dolutegravir as candidates for repurposing against monkeypox virus from a library of US FDA approved antiviral and antibiotic drugs using molecular docking and molecular dynamics simulations. The main goal of this in silico study is to identify potential inhibitors against monkeypox virus proteins that can be further experimentally validated for the discovery of novel therapeutic agents against monkeypox disease.

[P] Infections associated with nephrotic relapses (NR) are often managed according to physician preferences. The authors developed a biomarker-based prediction model and a regression nomogram for the prediction of the probability of infection in children with NR.

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.

[C1]

Sumantra Sarkar*, **Md Zulfikar Ali***, and **Sandeep Choubey**.

Efficacy of information transmission in cellular communication.

Physical Review Research, **5(1)**, 013092, 2023.
<https://doi.org/10.1103/PhysRevResearch.5.013092>

[C2]

Sandeep Choubey.

Gene regulation meets bayesian non-parametrics.

Nature Computational Science, **3(2)**, 126-127, 2023.

<https://doi.org/10.1038/s43588-023-00405-6>

[K]

Mayank Jain*, **Chandrani Kumari**, and **Soumyabrata Dev***.

Identifying the best clear sky model for the delhi-ncr region.

In *IGARSS 2022 - 2022 IEEE International Geoscience and Remote Sensing Symposium*,
page . IEEE, Jul 2022.

<https://doi.org/10.1109/IGARSS46834.2022.9883753>

[M]

Reshma Maiya, **Swagata Dey***, **Krishanu Ray***, and **Gautam I. Menon.**

The interplay of active and passive mechanisms in slow axonal transport.

Biophysical Journal, **122(2)**, 333–345, 2023.

<https://doi.org/10.1016/j.bpj.2022.12.011>

[Me1]

Siva Athreya*, **Gautam I. Menon**, and **Rajesh Sundaresan***.

Covid-19 modeling for india and a roadmap for the future.

Communications of the ACM, **65(11)**, 82-87, 2022.

(Submitted).

<https://doi.org/10.1145/3557798>

[Me2]

Neha Paddillaya*, **Kalyani Ingale***, **Chaitanya Gaikwad***, **Deepak K. Saini***,
Pramod Pullarkat*, **Paturu Kondaiah***, **Gautam I. Menon**, and **Namrata Gundiah***.

Cell adhesion strength and tractions are mechano-diagnostic features of cellular invasiveness.

Soft Matter, **18(23)**, 4378–4388, 2022.

<https://doi.org/10.1039/d2sm00015f>

[Mo]

Farhina Mozaffer, **Gautam I. Menon**, and **Farah Ishtiaq***.

Exploring the thermal limits of malaria transmission in the western himalaya.

Ecology and Evolution, **12(9)**, e9278, 2022.

<https://doi.org/10.1002/ece3.9278>

[Mu1]

Nayana Mukherjee and **Malay Banerjee***.

Hunting cooperation among slowly diffusing specialist predators can induce stationary turing patterns.

Physica A: Statistical Mechanics and its Applications, **599**, 127417, 2022.

<https://doi.org/10.1016/j.physa.2022.127417>

[Mu2]

Nayana Mukherjee, Stacey R. Smith*, and Mainul Haque*.

Spatio-temporal patterns resulting from a predator-based disease with immune prey.

Chaos, Solitons & Fractals, **168**, 113197, 2023.

<https://doi.org/10.1016/j.chaos.2023.113197>

[P]

Venkata Y. Narayana*, Viswas Chhapola*, Soumya Tiwari*, Ekta Debnath*, Meenakshi Aggarwal*, and Om Prakash.

Diagnosis of bacterial infection in children with relapse of nephrotic syndrome: a personalized decision-analytic nomogram and decision curve analysis.

Pediatric Nephrology, 2023 (Online First).

<https://doi.org/10.1007/s00467-023-05915-z>

[S]

Ajaya K. Sahoo, Priya D. Augusthian, Ishwarya Muralitharan, R. Vivek-Ananth, Kishan Kumar, Gaurav Kumar, Geetha Ranganathan, and Areejit Samal.

In silico identification of potential inhibitors of vital monkeypox virus proteins from FDA approved drugs.

Molecular Diversity, , 2022 (Online First).

<https://doi.org/10.1007/s11030-022-10550-1>

[Si1]

Aswathy Narayanan*, Pavitra Selvakumar, Rahul Siddharthan, Kaustuv Sanyal*

·
ClaID: a Rapid Method of Clade-Level Identification of the Multidrug Resistant Human Fungal Pathogen *Candida auris*.

Microbiology Spectrum, **10(2)**, e00634-22 2023.

<https://doi.org/10.1128/spectrum.00634-22>

[V]

P. Varuni, Shakti N. Menon, and Gautam I. Menon.

Phototactic cyanobacteria as an active matter system.

Indian Journal of Physics, **96**, 2589–2595, 2022.

<https://doi.org/10.1007/s12648-022-02371-7>

[Vi1]

R. Vivek-Ananth, Karthikeyan Mohanraj, Ajaya K. Sahoo, and Areejit Samal.

IMPPAT 2.0: An Enhanced and Expanded Phytochemical Atlas of Indian Medicinal Plants.

ACS OMEGA, **8(9)**, 8827–8845, 2023.

<https://doi.org/10.1021/acsomega.3c00156>

[Vi2]

R. Vivek-Ananth, Ajaya K. Sahoo, Shanmuga P. Baskaran, and Areejit Samal.

Scaffold and structural diversity of the secondary metabolite space of medicinal fungi.

ACS OMEGA, **8(3)**, 3102–3113, 2023.

<https://doi.org/10.1021/acsomega.2c064283102ACS>

[Vi3]

R.P. Vivek-Ananth, Ajaya Kumar Sahoo, Shanmuga Priya Baskaran, Janani Ravichandran and Areejit Samal Areejit Samal.

Identification of activity cliffs in structure-activity landscape of androgen receptor binding chemicals.

Science of The Total Environment, **873**,162263, 2023.

<https://doi.org/10.1016/j.scitotenv.2023.162263>

[Y]

Yasharth Yadav, Ajay Subbaroyan, Olivier C. Martin*, and Areejit Samal.

Relative importance of composition structures and biologically meaningful logics in bipartite boolean models of gene regulation.

SCIENTIFIC REPORTS, **12**, 18156, 2022.

<https://doi.org/10.1038/s41598-022-22654-7>

2.2 Mathematics

2.2.1 Research Summary & Highlights

Algebraic Number Theory

In [Gun5], the authors prove a fully explicit generalized Brun-Titchmarsh theorem for an imaginary quadratic field K . More precisely, for any finite family of linearly independent linear forms with coefficients in \mathcal{O}_K , the authors count the number of integers at which all these linear forms take prime values in \mathcal{O}_K .

Let K be a number field and q an integral ideal in \mathcal{O}_K . A result of Tatzuza from 1973, computes the asymptotic (with an error term) for the number of ideals with norm at most x in a class of the narrow ray class group of K modulo q . This result bounds the error term with a constant whose dependence on q is explicit but dependence on K is not explicit. In [Gun6], the authors, using geometry of numbers, prove a fully explicit bound for the error term in the asymptotic.

Let n be a positive integer and $f_n(x) = 1 + x + \frac{x^2}{2!} + \dots + \frac{x^n}{n!}$ denote the n -th Taylor polynomial of the exponential function. Let $K = \mathbf{Q}(\theta)$ be an algebraic number field where θ is a root of $f_n(x)$ and \mathbf{Z}_K denote the ring of algebraic integers of K . In [Kot1], it is shown that for any prime p , p does not divide the index of the subgroup $\mathbf{Z}[\theta]$ in \mathbf{Z}_K if and only if $p^2 \nmid n!$.

Analytic Number Theory

Poissonian pair correlation of real sequences modulo one have been studied in higher dimension. Several examples of higher dimensional sequences obeying this law was constructed.

As a natural generalization of Euler's constant gamma, Ihara introduced the notion of Euler-Kronecker constant for any number field and made some conjectures on these constants. In the recent past, there has been tremendous development in this study. In joint work with Ram Murty, in [D3], the authors proved several results concerning the average estimates of these constants, its connection to Siegel zeros and applications to the study of error terms in prime number theorem for arithmetic progression. In the process, the authors improved various known results in the literature. This work will be published in Acta Arithmetica.

Let $\omega(n)$ and $\omega_y(n)$ denote the number of prime divisors of n and number of prime divisors of n less than y respectively. The famous Erdos-Kac theorem states that $(\omega(n) - \log \log n) / \sqrt{\log \log n}$ has a Gaussian distribution. In an earlier work (Hardy-Ramanujan Journal 43 (2020), 17-23), Anup Dixit and Ram Murty initiated the study of $\omega_y(n)$ and established a localized Erdos-Kac theorem in this setting. Taking this further, in [D2], Anup Dixit and Ram Murty prove a localized Erdos-Kac theorem for $\omega_y(p+a)$, where p runs over primes and a is a constant. Such a result has curious connections to Ihara's conjectures for Euler-Kronecker constants. This work has appeared in Hardy Ramanujan journal.

A Diophantine m -tuple is a set $\{a_1, a_2, \dots, a_m\}$ such that $a_i a_j + 1$ is a perfect square for all $i \neq j$. A classical question, considered by Diophantus, but posed by Fermat and later Euler is, how large can the cardinality of a Diophantine tuple consisting of integers be. This question was answered in 2016 by Togbé and Ziegler, who showed that there are no Diophantine quintuples. In an earlier work Anup Dixit, Ram Murty and Seoyoung Kim (Bulletin of the Australian Mathematical Society 103(2), 2020, 230-243) considered the higher power analog of this problem, i.e., $a_i a_j + n$ is a k -th power for $k > 2$. They show that the cardinality of this set cannot exceed a constant times $\log n$. In [D5], Saunak Bhattacharjee, Anup Dixit and Dishant Saikia establish the effective version of this earlier result, explicitly evaluating the implied constants for each of the bounds. This work is submitted for publication.

The q -analogues of classical functions have been studied in the literature for a long time. Natural questions which arise are regarding the irrationality and linear independence of values of the q -analogue of the exponential function and certain cognate functions. Unlike the classical exponential function, not much is known in this case. In [D4], Anup Dixit, Veekesh Kumar and Siddhi Pathak prove certain linear independence results for q -exponentials and their derivatives at different values.

In [Kot2], infinite families of congruences for (ℓ, k) -regular and (ℓ, k, r) -regular partitions are derived modulo m for several values of ℓ, k, r and m .

Combinatorics

Ram and Prasad [P6, P7, P1] have obtained several exciting new results on the enumeration of subspaces of a finite vector space that transform under a given linear operator in a specified manner. These results give a finite-field interpretation of a classical problem on enumerating chord diagrams on a row of nodes by their number of crossings, going back to the work of

Touchard, Riordan, and Read in the 1950's. These combinatorial problems were linked to the q -Hermite orthogonal polynomial sequence by Ismail, Stanton and Viennot.

Modular forms

Let τ denote the Ramanujan tau function. In a recent work, Bennett, Gherga, Patel and Siksek proved that for any prime p and integer $m \geq 2$, the largest prime factor $P(\tau(p^m))$ of $\tau(p^m)$ satisfies

$$P(\tau(p^m)) > \alpha \cdot \frac{\log \log(p^m)}{\log \log \log(p^m)}$$

provided $\tau(p) \neq 0$. Here α is an absolute positive constant. In [Gu5], the authors prove that for any $r > 0$ and integer $m \geq 1$,

$$P(\tau(p^m)) > (\log p)^{1/8} (\log \log p)^{3/8-r}$$

for almost all primes p . The above results are also valid for any non-CM normalized Hecke eigenforms with integer Fourier coefficients.

The authors in [Gu1] investigate a non-Archimedean analogue of a question of Atkin and Serre. More precisely, they derive lower bounds for the largest prime factor of non-zero Fourier coefficients of non-CM normalized Hecke eigen cusp forms of weight k , level N with integer Fourier coefficients. In particular, the authors show that for such a form f and for any real number $r > 0$, the largest prime factor of the p -th Fourier coefficient $a_f(p)$ of f , denoted by $P(a_f(p))$, satisfies

$$P(a_f(p)) > (\log p)^{1/8} (\log \log p)^{3/8-r}$$

for almost all primes p . This improves on earlier bounds. The authors also investigate a number field analogue of a recent result of Bennett, Gherga, Patel and Siksek about the largest prime factor of $a_f(p^m)$ for $m \geq 2$.

Pila and Tsimerman proved in 2017 that for every k there exists at most finitely many k -tuples (x_1, \dots, x_k) of distinct non-zero singular moduli with the property “ x_1, \dots, x_k are multiplicatively dependent, but any proper subset of them is multiplicatively independent”. The proof was non-effective, using Siegel's lower bound for the class number. In 2019 Riffaut obtained an effective version of this result for $k = 2$. Moreover, he determined all the instances of $x^m y^n \in^\times$, where x, y are distinct singular moduli and m, n non-zero integers. In [Gu2], the authors obtain a similar result for $k = 3$. Authors show that $x^m y^n z^r \in^\times$ (where x, y, z are distinct singular moduli and m, n, r non-zero integers) implies that the discriminants of x, y, z do not exceed 10^{10} .

The article [Gu4] is concerned with the Fourier coefficients of cusp forms (not necessarily eigenforms) of half-integer weight lying in the plus space. The authors give a new proof that there are infinitely many fundamental discriminants D such that the Fourier coefficients evaluated at $|D|$ are non-zero. By adapting the resonance method, the authors also demonstrate that such Fourier coefficients must take quite large values.

Operator Algebras

In [Ko], the authors show that Euler's 36 officers problem has infinitely many quantum solutions.

Representation Theory

Problems such as saturation for various generalizations of Schur polynomials are being studied.

The determination of the multiplicity of an irreducible representation in the tensor product of two irreducible representations (specially in the context of symmetric groups) is called the Kronecker problem. An algebra called the *Kronecker Hecke algebra* has been introduced to study this problem. The dimensions of the simple modules of this algebra are the multiplicities of interest. The commutativity of the Kronecker-Hecke algebra is equivalent to all multiplicities being equal to one.

Transcendental number theory

The study of linear independence of $L(k, \chi)$ for a fixed integer $k > 1$ and varying χ depends critically on the parity of k vis-à-vis χ . This has been investigated by a number of authors for Dirichlet characters χ of a fixed modulus and having the same parity as k . The focal point of [Gu3] is to extend this investigation to families of Dirichlet characters modulo distinct pairwise co-prime natural numbers. The interplay between the resulting ambient number fields brings in new technical issues and complications hitherto absent in the context of a fixed modulus (consequently a single number field lurking in the background). This entails a very careful and hands-on dealing with the arithmetic of compositum of number fields which the authors undertake in this work. Results of this article extend earlier works of the first author with Murty-Rath as well as the works of Okada, Murty-Saradha and Hamahata.

Modular forms

The goal of the article [Gu4] is to study Fourier coefficients of cusp forms, not necessarily Hecke eigenforms, of half-integer weight lying in the plus space. The focal point of the authors are the Fourier coefficients of the form $c(|D|)$ supported at fundamental discriminants D . These coefficients encode deep arithmetic content and are much more intractable than those not arising from fundamental discriminants. In current work, the authors gave a new proof that there are infinitely many fundamental discriminants D such that the Fourier coefficients evaluated at $|D|$ are non-zero. The authors also demonstrated that such Fourier coefficients must take quite large values. These lower bounds obtained in the work are best known, even in the situation of Hecke eigenforms.

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.

[A1]

Abhijeet Ghanwat*, **Suhas Pandit***, and **Selvakumar A.**

Lefschetz open book embeddings of 4-manifolds.

STUDIA SCIENTIARUM MATHEMATICARUM HUNGARICA, **59(2)**, 142–159, 2022.

<https://doi.org/10.1556/012.2022.01520>

[A2]

Abhijeet Ghanwat*, **Suhas Pandit***, and **Selvakumar A.**

Lefschetz open book decomposition of 4-manifolds.

Journal of Knot Theory and Its Ramifications, 2023.

(To be published).

<https://doi.org/10.1142/S0218216523500268>

[A3]

Suhas Pandit* and **Selvakumar A.**

Trisection embeddings of 4-manifolds in s^8 .

PROCEEDINGS OF THE INDIAN ACADEMY OF SCIENCES-MATHEMATICAL SCIENCES, **132(2)**, Paper No. 64, 8 pp, 2022.

<https://doi.org/10.1007/s12044-022-00710-6>

[B]

Karthick C. Babu and **Anirban Mukhopadhyay**.

Quadratic residue pattern and the galois group of q (root $a(1)$, root $a(2)$,..., root $a(n)$).

In *Proceedings of the American Mathematical Society*, **150(10)**, 4277–4285. American Mathematical Society, May 2022.

<https://doi.org/10.1090/proc/15987>

[Ba]

Ramachandran Balasubramanian, **Olivier Ramare***, and **Priyamvad Srivastav***.

Product of three primes in large arithmetic progressions.

International Journal of Number Theory, **19(4)**, 843–857, 2023.

<https://doi.org/10.1142/S1793042123500422>

[D1]

Anup Dixit.

On limit theorem of zeta functions.

In *Proceedings for conference in honour of Prof. Subbarao*, Jun 2022.

(To be published).

[D2]

Anup Dixit and **Ram Murty***.

A localized erdos-kac theorem for $\omega_y(p+a)$.

Hardy Ramanujan Journal, **45**, 74–83, 2022.

[D3]

Anup Dixit and **Ram Murty***.

On ihara's conjectures for euler-kronecker constants.

Acta Arithmetica, 2022.

(To be published).

[D4]

Anup Dixit, Siddhi Pathak*, and Veekesh Kumar*.

Linear independence of values of the q -exponentials and related functions.
2022.

(Submitted).

[D5]

Anup Dixit, Dishant Saikia*, and Saunak Bhattacharjee*.

An effective bound on generalized diophantine m -tuples.

2022.

(Submitted).

[G]

Sayan Goswami and Jyotirmoy Poddar*.

Central sets theorem along filters and some combinatorial consequences.

Indagationes Mathematicae, **33(6)**, 1312–1325, 2022.

<https://doi.org/10.1016/j.indag.2022.08.006>

[Gu1]

Y. Bilu*, S. Gun, and S. L. Naik.

On non-Archimedean analogue of Atkin-Serre Question.

2022.

(Submitted).

[Gu2]

Y. Bilu*, S. Gun, and E. Tron*.

Effective multiplicative independence of 3 singular moduli.

2022.

(Submitted).

[Gu3]

S. Gun, N. Kandhil, and P. Philippon*.

On linear independence of Dirichlet L values.

Journal of Number Theory, **244**, 63–83, 2023.

<https://doi.org/10.1016/j.jnt.2022.09.016>

[Gu4]

S. Gun, W. Kohnen*, and K. Soundararajan*.

Large Fourier coefficients of half-integer weight modular forms.

American Journal of Mathematics, 2023.

(To be published).

[Gu5]

S. Gun and S. L. Naik.

On the largest prime factor of non-zero Fourier coefficients of Hecke eigenforms.
2022.
(Submitted).

[Gun1]

Yuri Bilu*, **Sanoli Gun**, and **Haojie Hong***.

Uniform explicit Stewart's theorem on prime factors of linear recurrences.

Acta Arithmetica, **206(3)**, 223, 2022.

<https://doi.org/10.4064/aa211116-13-11>

[Gun2]

Sanoli Gun and **Neelam Kandhil**.

On an extension of a question of Baker.

International Journal of Number Theory, **19(2)**, 375–388, 2022.

<https://doi.org/10.1142/S1793042123500173>

[Gun3]

Sanoli Gun and **Neelam Kandhil**.

On an extension of a question of Baker.

International Journal of Number Theory, **19(2)**, 375, 2023.

<https://doi.org/10.1142/S1793042123500173>

[Gun5]

Sanoli Gun, **Olivier Ramare***, and **Jyothsna Sivaraman***.

An application of counting ideals in ray classes.

2022.

(Submitted).

[Gun6]

Sanoli Gun, **Olivier Ramare***, and **Jyothsna Sivaraman***.

Counting ideals in ray classes.

JOURNAL OF NUMBER THEORY, **243**, 13–37, 2023.

<https://doi.org/10.1016/j.jnt.2022.08.005>

[I]

Kalyan Banerjee*, **Jaya N. Iyer**, and **James D. Lewis***.

Pushforwards of Chow groups of smooth ample divisors, with an emphasis on Jacobian varieties.

Mathematische Nachrichten, **295(12)**, 2301–2317, 2022.

<https://doi.org/10.1002/mana.202000125>

[J]

Abhishek Juyal and **Dustin Moody***.

Pairs of Heron and right triangles with a common area and a common perimeter.

PUBLICATIONES MATHEMATICAE-DEBRECEN, **100(3-4)**, 449–460, 2022.

<https://doi.org/10.5486/pmd.2022.9191>

[K1]

Neelam Kandhil and Purusottam Rath*.

Around a question of baker.

In *Proceedings of the Subbarao Symposium (to be published by the Fields Institute)*, Apr 2022.
(To be published).

[K2]

Neelam Kandhil.

A note on dedekind zeta values at $1/2$.

International Journal of Number Theory, **18(6)**, 1289–1299, 2022.

<https://doi.org/10.1142/S1793042122500658>

[K3]

Neelam Kandhil, Rashi Lunia, and Jyothsnaa Sivaraman*.

Explicit upper bounds on average of euler-kronecker constants of narrow ray class fields.
2022.

(Submitted).

[Ko]

Suhail A. Rather*, N. Ramadas*, Vijay Kodiyalam, and Arul Lakshminarayanan*.

Equivalence of absolutely maximally entangled states and infinite quantum solutions to the
problem of 36 officers of Euler.

2023.

(Submitted).

[Kot1]

Anuj Jakhar* and Srinivas Kotyada.

A short note on number fields defined by exponential taylor polynomials.

2023.

(Preprint: arXiv:2303.08100).

[Kot2]

Kathiravan T*, Srinivas K, and Usha K Sangale* .

Some congruences for (ℓ, k) and (ℓ, k, r) -regular partitions.

2023.

arXiv:2303.13906 (Submitted).

[Ku]

Veekesh Kumar and R. Thangadurai*.

On simultaneous approximation of algebraic numbers.

Mathematika, **68(4)**, 1153–1175, 2022.

<https://doi.org/10.1112/mtk.12161>

[M]

Manas Mandal and Parameswaran Sankaran*.

Cohomology of generalized dold spaces.

Topology and its Applications, **310**, 108040, 2022.

<https://doi.org/10.1016/j.topol.2022.108040>

[Ma]

S. Manikandan.

On holomorphic sectional curvature of kahler quotients.

Archiv der Mathematik, **120**, 331–338, 2023.

<https://doi.org/10.1007/s00013-022-01825-y>

[Mu1]

Karthick Babu*, **Anirban Mukhopadhyay**, and **A. Sankaranarayanan***.

Residue pattern for infinitely many primes.

International Journal of Number Theory, **19(3)**, 511–529, 2023.

<https://doi.org/10.1142/S1793042123500240>

[Mu2]

Pranendu Darbar*, **Anirban Mukhopadhyay**, and **Kasi Viswanadham***.

Bounded gaps between product of two primes in imaginary quadratic number fields.

Research in Number Theory, **9**, article no.11, 2022.

<https://doi.org/10.1007/s40993-022-00421-x>

[N]

Sunil L. Naik.

On the number of prime divisors and radicals of non-zero fourier coefficients of hilbert cusp forms.

Forum Mathematicum, **34(6)**, 1519, 2022.

<https://doi.org/10.1515/forum-2022-0055>

[P1]

Amritanshu Prasad and Samrith Ram*.

Enumeration of anti-invariant subspaces and the q-Hermite Catalan triangle.

Nov 2022.

(Submitted).

[P2]

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

Simultaneous conjugacy classes as combinatorial invariants of finite groups.

Communications in Algebra, **50(10)**, 4549, 2022.

<https://doi.org/10.1080/00927872.2022.2065494>

[P3]

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

Simultaneous conjugacy classes of finite p-groups of rank ≤ 5 .

Journal of the Ramanujan Mathematical Society, 2023.

(To be published).

[P4]

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

Some restriction coefficients for the trivial and sign representations.

2022.

arXiv:2211.15252 (Submitted).

[P5]

Amritanshu Prasad.

The Frobenius characteristic of character polynomials.

Journal of the Indian Institute of Science, **102(3)**, 947, 2022.

<https://doi.org/10.1007/s41745-022-00327-8>

[P6]

Amritanshu Prasad and Samrith Ram*.

Set partitions, tableaux, and subspace profiles of regular diagonal operators.

Seminaire Lotharingien de Combinatoire, **86B**, 35, 2022.

[P7]

Amritanshu Prasad and Samrith Ram*.

Splitting subspaces and a finite field interpretation of the Touchard-Riordan formula.

European Journal of Combinatorics, **110**, 103705, 2023.

<https://doi.org/10.1016/j.ejc.2023.103705>

[Pr]

Devendra Prasad.

Bhargava factorials and irreducibility of integer-valued polynomials.

Rocky Mountain Mathematics Consortium, **52(3)**, 1031 – 1038, 2022.

<https://doi.org/10.1216/rmj.2022.52.1031>

[R]

Mrigendra S. Kushwaha*, **K. N. Raghavan**, and **Sankaran Viswanath**.

Simple procedures for Left and Right Keys of Semi-standard Young Tableaux.

2023.

(Preprint: <https://arxiv.org/abs/2302.08279>).

[Ro]

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

An equivariant ppv theorem and paschke-higson duality.

Annals of K-Theory, **7(2)**, 237–278, 2022.

<https://doi.org/10.2140/akt.2022.7.237>

[S]

Piyasa Sarkar and S. Sundar.

Examples of multiparameter CCR flows with non-trivial index.

Proceedings of the Edinburgh Mathematical Society, **65(3)**, 799–832, 2022.

<https://doi.org/10.1017/S0013091522000359>

[Se]

R. Selvi and P. Shukla*.

Analytical Solutions of Non-Newtonian Fluid through a Reiner-Rivlin Liquid Sphere with Cell Surface.

IAENG International Journal of Applied Mathematics, **52(4)**, ., 2022.

[Sh]

Sundar Shanmugasundaram.

Decomposable product systems associated to non-stationary poisson processes.

International Mathematics Research Notices, ., 1-21, 2022.

<https://doi.org/10.1093/imrn/rnac158>

[Su1]

S. Sundar.

On a theorem of cooper.

New Zealand Journal of Mathematics, **53**, 11–25, 2022.

<https://doi.org/10.53733/197>

[Su2]

S. Sundar.

Representations of the weak weyl commutation relation.

NEW YORK JOURNAL OF MATHEMATICS, **28**, 1512–1530, 2022.

<https://doi.org/10.48550/arXiv.2205.03657>

2.3 Physics

2.3.1 Research Summary & Highlights

Astrophysics and Cosmology

An Indian Pulsar Timing Array (InPTA) experiment has started in 2015 using the upgraded Giant Metrewave Radio Telescope (uGMRT). IMSc members are involved in this experment since then. Like other Pulsar Timing AArray (PTA) experiments, this experiment aim to detect nano-Hertz gravitational waves using radio pulsars as tools.

InPTA become associate member of IPTA very soon and after continuing the experiment successfully for more than 5 years, become a full member of IPTA consortia in February 2021. InPTA data will now be pooled to International Pulsar Timing Array consortium data base and will contribute to eventual detection of nano-Hertz gravitational waves.

InPTA experiment is a joint venture among various Indian institutes (IMSc, TIFR, NCRA-TIFR, IIT-Hyderabad, RRI, etc) as well as Kumamoto University of Japan. Four IMSc members (one faculty, one postdoc, one research associate, and one student) are part of this experiment.

IMSc astrophysics group is also studying the effect of the light bending phenomenon on the signal of a pulsar in a binary system within the full general relativistic framework.

Computational Physics

Estimating the burden of COVID-19 in India is difficult because the extent to which cases and deaths have been undercounted is hard to assess. The authors have used a 9-component, age-stratified, contact-structured epidemiological compartmental model, which we call the INDSCI-SIM model, to analyse the first wave of COVID-19 spread in India [H8]. The authors have used INDSCI-SIM, together with Bayesian methods, to obtain optimal fits to daily reported cases and deaths across the span of the first wave of the Indian pandemic, over the period Jan 30, 2020 to Feb 15, 2021. The authors account for lock-downs and other non-pharmaceutical interventions (NPIs), an overall increase in testing as a function of time, the under-counting of cases and deaths, and a range of age-specific infection-fatality ratios. They first used their model to describe data from all individual districts of the state of Karnataka, benchmarking our calculations using data from serological surveys. They then extended this approach to aggregated data for Karnataka state. They modeled the progress of the pandemic across the cities of Delhi, Mumbai, Pune, Bengaluru and Chennai, and then for India as a whole. They estimated that deaths were undercounted by a factor between 2 and 5 across the span of the first wave, converging on 2.2 as a representative multiplier that accounts for the urban-rural gradient. Their estimate an overall under-counting of cases by a factor of between 20 and 25 towards the end of the first wave. Their estimates of the infection fatality ratio (IFR) are in the range 0.05 - 0.15, broadly consistent with previous estimates but substantially lower than values that have been estimated for other LMIC countries. The authors have found that approximately 35 percent of India had been infected overall by the end of the first wave, results broadly consistent with those from serosurveys. These results contribute to the understanding of the long-term trajectory of COVID-19 in India.

Condensed Matter Physics

The authors numerically study the zero-temperature relaxation dynamics of several glass-forming models to their inherent structures, following quenches from equilibrium configurations sampled across a wide range of initial temperatures [Chau3]. In a mean-field Mari-Kurchan model, they found that relaxation changes from a power law to an exponential decay below a well-defined temperature, consistent with recent findings in mean-field p-spin models. By contrast, for finite-dimensional systems, the relaxation is always algebraic, with a nontrivial universal exponent at high temperatures crossing over to a harmonic value at low temperatures. They demonstrated that this apparent evolution is controlled by a temperature-dependent population of localized glassy excitations. Their work unifies several recent lines of studies aiming at a detailed characterization of the complex potential energy landscape of glass formers, and challenges both mean-field and real space descriptions of glasses.

Using numerical simulations, the failure of an amorphous solid under athermal quasistatic expansion, starting from a homogeneous high-density state, has been studied [Da]. During the expansion process, plastic instabilities occur, manifested via sudden jumps in pressure and energy, with the largest event happening via cavitation leading to the material's yielding. They demonstrated that all these plastic events are characterized by saddle-node bifurcation, during which the smallest nonzero eigenvalue of the Hessian matrix vanishes via a square-root singularity. They found that after yielding and prior to complete fracture, the statistics of pressure or energy jumps corresponding to the plastic events show subextensive system-size

scaling, similar to the case of simple shear but with different exponents. Thus, overall, their paper reveals universal features in the fundamental characteristics during mechanical failure in amorphous solids under any quasistatic deformation protocol.

The dynamical properties, specially the collective modes, of an equimolar, glass-forming AB mixture with a large size ratio are investigated using molecular dynamics simulations [V1]. While the large A particles show a glass transition around the critical density of mode-coupling theory, the small B particles remain mobile with a relatively weak decrease in their self-diffusion coefficient D_B with increasing density. Surprisingly, around the critical density, the self-diffusion coefficient of species A, D_A , also starts to show a rather weak dependence on density. They showed that this is due to finite-size effects that can be understood from the analysis of the collective interdiffusion dynamics. Subsequently, They investigated the flow behaviour of this binary mixture [V2]. The rheological response to applied shear is studied in the regime where the larger species are spatially predominant. They demonstrated that the macroscopic rigidity that emerges with increasing density occurs in the regime where the larger species undergo a glass transition while the smaller species continue to be highly diffusive. They analysed the interplay between the timescale imposed by the shear and the quiescent relaxation dynamics of the two species to provide a microscopic insight into the observed rheological response. Finally, by tuning the composition of the mixture, They illustrated that the systematic insertion of the smaller particles affects the rheology by lowering of viscosity of the system.

In soft amorphous materials, shear cessation after large shear deformation leads to configurations having residual shear stress. The origin of these states and the distribution of the local shear stresses within the material is not well understood, despite its importance for the change in material properties and consequent applications. The authors used molecular dynamics simulations of a model dense non-Brownian soft amorphous material to probe the non-trivial relaxation process towards a residual stress state [Chau4]. They found that, similar to thermal glasses, an increase in shear rate prior to the shear cessation leads to lower residual stress states. They rationalised their findings using a mesoscopic elasto-plastic description that explicitly includes a long range elastic response to local shear transformations. They found that after flow cessation the initial stress relaxation indeed depends on the pre-sheared stress state, but the final residual stress is majorly determined by newly activated plastic events occurring during the relaxation process, a scenario consistent with the phenomenology of avalanche dynamics in the low shear rate limit of steadily sheared amorphous solids. Their simplified coarse grained description not only allows capturing the phenomenology of residual stress states but also rationalising the altered material properties that are probed using small and large deformation protocols applied to the relaxed material.

They investigated the effect of a two-dimensional, incompressible, turbulent flow on soft granular particles and show the emergence of a crystalline phase due to the interplay of Stokesian drag and short-range interparticle interactions [Chau2]. They quantified this phase through the bond order parameter and local density fluctuations and find a sharp transition between the crystalline and noncrystalline phases as a function of the Stokes number. Furthermore, the nature of preferential concentration, characterized by the correlation dimension, is significantly different from that of particle-laden flows in the absence of repulsive potentials.

Popular summary that the authors submitted for the journal
(<https://journals.aps.org/prx/abstract/10.1103/PhysRevX.12.021008>) [C2]:

A complex system of many interacting particles can be more than the sum of its parts. A classic example that has captured the imagination of physicists for four decades is the fractional quantum Hall (FQH) effect: a phenomenon where electrons confined to two dimensions and in strong magnetic fields condense into unusual quantum fluids. In many FQH fluids, by binding together quantized vortices of the magnetic field, electrons transform their identity to that of new particles called composite fermions. Here, the authors theoretically showed that when some FQH fluids are taken far out of their equilibrium states, they manifest surprising dynamical behavior that can no longer be described by composite fermions.

At sufficiently high energies, the properties of these FQH phases reveal the emergence of a new kind of particle called a parton, which behaves as a fraction of the electron. Similar to quarks in the nucleus, partons can be seen only when a lot of energy is injected into the system. Based on this idea, they proposed an experiment to reveal the presence of partons, which they described using methods of effective field theory and numerical simulations.

The identification of dynamical signatures of partons illustrates the need for better understanding of nonequilibrium properties of FQH phases. While direct observation of partons remains the key goal for future experiments, on the theory side, the methods developed in this paper may lead to a better understanding of the more fragile FQH phases, including some enigmatic states with properties applicable to quantum information technology.

The $5/2$ fractional quantum Hall state in GaAs quantum wells, modeled as a p-wave paired state of composite fermions, has attracted much attention because of the prediction that it supports exotic quasiparticles obeying non-Abelian statistics. A natural question is whether pairs with other symmetry may be realized. The authors considered here composite fermions at half-filled Landau levels in monolayer graphene using a Bardeen-Cooper-Schrieffer formalism, and find that the composite-fermion Fermi sea is unstable to an f-wave pairing in the $n=3$ graphene Landau level. This potentially opens another platform for studying non-Abelian quasiparticles.

<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.130.126201>

Nonperturbative QCD, lattice Gauge Theory, QGP

Today Quantum ChromoDynamics (QCD) is well-accepted to be the theory of strong interaction, the fundamental interaction that is the key to the formation of stable nuclear matter and more than 90% of the mass in the visible universe. Even so, several aspects of strong interactions and the theory of QCD remain to be understood from the first principles. For example, in the spectrum of hadrons, the particles that communicate via strong interactions, there remain several excitations that lack an ab-initio theoretical understanding. In this recent work, we perform the first lattice QCD study of the heavy dibaryons in which all six quarks have the bottom (beauty) flavor. We find clear evidence for a deeply bound $\Omega_{bbb} - \Omega_{bbb}$ dibaryon in the 1S_0 channel, as a pole singularity in the S-wave $\Omega_{bbb} - \Omega_{bbb}$ scattering amplitude with a binding energy $-81(^{+14}_{-16})$ MeV. Despite such a deep binding, Coulomb repulsion serves only as a perturbation on the ground state wave function of the parametrized strong potential and may shift the strong binding only by a few percent. Considering the scalar channel to be the most bound for single flavored dibaryons, we conclude this state is the heaviest possible most deeply bound dibaryon in the visible universe. [P]

The influence and visibility of this recent work [P] is evident from the Altmetric score (41) [<https://aps.altmetric.com/details/127888393>], since the publication on 16th March 2023.

Particle Physics Phenomenology and Neutrino Physics

tau neutrinos at INO: Both phenomenological and experimental activity have continued on the India-based Neutrino Observatory (INO) and the magnetised iron calorimeter (ICAL) proposed to be located there. A simulation study of tau neutrino events at the ICAL detector in INO was conducted [Khi1]. First of all, novel methods of studying tau events at ICAL were proposed. It was then shown that such an analysis will be able to improve the sensitivity of ICAL to the neutrino oscillation parameters, especially in the 2–3 sector.

Magnetic field measurements at mini-ICAL prototype: The first measurements of the magnetic field at the prototype scale mini-ICAL detector at Madurai have been made [Khi2] using Hall probes. The precision with which the magnetic field can be measured, and the errors due to calibration were determined. This is a very important input into the analysis of neutrino oscillation events as the magnetic field will determine the sign of charge as well as the momentum of the charged muons that are produced by atmospheric muon neutrino interactions in ICAL. Comparison of these with simulations is on-going. In addition, the impact of the errors in the measurement of the magnetic field on the precision measurements of the neutrino oscillation parameters has been studied and the paper is under internal review.

Two INO students are about to write up their thesis based on the above work.

Dark matter annihilation in finite temperate field theory: It was earlier shown that the cross section for dark matter annihilation into fermion pairs is infra-red (IR) finite to all orders in thermal field theory. The finite remainder is now being computed to next-to-leading (NLO) order. Some preliminary results were shown in the DAE symposium in Mohali in Dec, 2022.

Perturbative QCD: Next to Soft plus Virtual corrections to Drell-Yan and Higgs productions

A framework [Aj1] that resums threshold enhanced large logarithms to all orders in perturbation theory has been proposed for the first time to study the production of a pair of leptons in Drell-Yan process and of Higgs boson in gluon fusion as well as in bottom quark annihilation. This is restricted to contributions from diagonal partonic channels. These logarithms include the distributions $(\ln(1z)/(1-z))_+$ resulting from soft plus virtual (SV) and the logarithms $\ln(1z)$ from next-to-SV (NSV) contributions. Collinear factorisation and renormalisation group invariance are used to achieve this. The former allows one to define a Soft-Collinear (SC) function which encapsulates soft and collinear dynamics of the perturbative results to all orders in strong coupling constant. The logarithmic structure of these results are governed by universal infrared anomalous dimensions and process dependent functions of Sudakov differential equation that the SC satisfies. The solution to the differential equation is obtained by proposing an all-order ansatz in dimensional regularisation, owing to several state-of-the-art perturbative results available to third order. The z

space solutions thus obtained provide an integral representation to sum up large logarithms originating from both soft and collinear configurations, conveniently in Mellin N space. It is shown in N space that the tower of logarithms can be summed to all orders in the coupling constant in a systematic fashion. In [Aj2] the above framework was extended to threshold enhanced logarithms in the coefficient functions of deep inelastic scattering (DIS) and semi-inclusive $e+e$ annihilation (SIA) processes and setup a framework to sum them up to all orders in perturbation theory.

In [Aj3], as a first application, the numerical impact of the results of resummation of NSV terms has been studied for Drell-Yan process. The N -dependent coefficients and the N -independent constants to desired accuracy were derived for the study. The resummed results are matched through the minimal prescription procedure with the fixed order results. We find that the resummation, taking into account the NSV terms, appreciably increases the cross section while decreasing the sensitivity to renormalisation scale. It was observed that observe that, at 13 TeV LHC energies, the SV+NSV resummation at NLL(NNLL) gives about 8% (2%) corrections respectively to the NLO (NNLO) results for the considered Q range: 150-3500 GeV. In addition, the absence of quark gluon initiated contributions to NSV part in the resummed terms leaves large factorisation scale dependence indicating their importance at NSV level. The numerical impact of N -independent constants and the ambiguity involved in exponentiating them are studied. Finally predictions are made for the neutral Drell-Yan process at various center of mass of energies.

In [Aj4], by studying the K factors at different logarithmic accuracy, it is found that the perturbative expansion shows better convergence improving the reliability of the prediction at NNLO+NNLL accuracy. For instance, the cross-section at NNLO+NNLL accuracy reduces by 3.15% as compared to the NNLO result for the central scale $R=F=m_H/2$ at 13 TeV LHC. We also observe that the resummed SV+NSV result improves the renormalisation scale uncertainty at every order in perturbation theory. The uncertainty from the renormalisation scale R ranges between (+8.85%,10.12%) at NNLO whereas it goes down to (+6.54%,8.32%) at NNLO+NNLL accuracy. However, the factorisation scale uncertainty is worsened by the inclusion of these NSV logarithms hinting the importance of resummation beyond NSV terms. The predictions are also made for SV+NSV resummed result at different collider energies.

Statistical Mechanics

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 the lattice model with the first k next-nearest neighbours excluded on a triangular lattice. The class of the phase transitions are characterised using partition function zeros, non-convexity properties of the entropy and analysis of the thermodynamic quantities like compressibility and susceptibility [Ja1].

The Mpemba effect refers to the counterintuitive result that, when quenched to a low temperature, a system at a higher temperature may equilibrate faster than one at intermediate temperatures. The closeness to the final state is defined in terms of a distance measure. For driven granular systems, the Mpemba effect has been illustrated in terms of an ad-hoc

measure of mean kinetic energy as the distance function. Here, by studying four different distance measures based on the mean kinetic energies as well as velocity distribution, it is shown that the Mpemba effect depends on the definition of the measures [Bi]

Physical phenomena where aggregation of particles is the primary growth process are ubiquitous. A biased Monte Carlo algorithm is developed to measure probabilities of rare events in cluster-cluster aggregation for arbitrary collision kernels. Given a trajectory with a fixed number of collisions, the algorithm modifies both the waiting times between collisions, as well as the sequence of collisions, using local moves. It is shown that the algorithm is ergodic by giving a protocol that transforms an arbitrary trajectory to a standard trajectory using valid Monte Carlo moves. The algorithm can sample rare events with probabilities of the order of 10^{-40} and lower. The algorithm's effectiveness in sampling low-probability events is established by showing that the numerical results for the large deviation function of constant kernel aggregation reproduce the exact results. It is shown that the algorithm can obtain the large deviation functions for other kernels, including gelling ones, as well as the instanton trajectories for atypical times [Ra2].

Polymers are usually expected to be in an extended conformation in the presence of attractive crowders/solvents. Here the counterintuitive phenomena of the polymer collapsing due to attraction with crowders is studied. It is shown that for low crowder densities, the polymer predominantly shows three phases as a function of both intra-polymer and polymer crowder-interactions: (1) extended or coil polymer conformations (2) globular conformations due to intra-polymer conformations, and (3) globular conformation due to polymer-crowder attraction. The detailed phase diagram giving the phase boundaries delineating the different phases is obtained. The dependence of the phase diagram on strength of crowder-crowder attractive interactions and crowder density is clarified. A unified explanation of the observed re-entrant swollen/extended conformations of earlier simulations of weak and strongly self-interacting polymers in terms of crowder-crowder attractive interactions is provided [G].

The exact solution of the Euler equation, which describes the time evolution of a blast wave created by an intense explosion, is a classic problem in gas dynamics. However, it has been found that the analytical results do not match with results from molecular dynamics simulation of hard spheres in two and three dimensions. It is shown that the mismatch between theory and simulations can be resolved by considering the Navier-Stokes equation. From the direct numerical simulation of the Navier-Stokes equation in two and three dimensions, it is shown that the inclusion of heat conduction and viscosity terms is essential to capture the results from molecular dynamics simulations [Ku1].

Collagen fibrils, when subjected to cyclic loading, are known to exhibit hysteretic behaviour with energy dissipation that is partially recovered on relaxation. A kinetic model for a collagen fibril incorporating the presence of hidden loops and stochastic fragmentation as well as the reformation of sacrificial bonds is developed. It is shown that the model reproduces well the characteristic features of reported experimental data on the cyclic response of collagen fibrils, such as moving hysteresis loops, the time evolution of residual strains and energy dissipation, recovery on relaxation, etc. It is also shown that the approach to the steady state is controlled by a characteristic cycle number for both residual strains as well as energy dissipation and is in good agreement with reported existing experimental data [Su1].

The specific role of the interplay between hardening and disorder characteristics of a representative quasi-brittle material on its failure mechanisms using a random spring network model is investigated. The model incorporates quasi-brittleness in its spring constants and

disorder in the failure strain threshold and is shown to be effective in simulating the experimentally observed tensile and fracture behaviour of a quasi-brittle epoxy resin-based polymer. It is shown that rapid localization of deformation and associated damage growth occurs for a weakly hardening solid while for a linear elastic material, damage nucleates at multiple independent sites, and there is significant growth of damage, independent of other nucleating sites, prior to maximum load. The failure mechanism is shown to crossover from an avalanche-dominated fracture for a linear elastic material to nucleation-dominated fracture for a weakly hardening material [Ra3].

The deformation and mixed-mode fracture of a single phase and two-phase system is studied. A square domain with an edge crack is discretized using a square lattice to develop a random spring network model. The model is based on each lattice point interacting with nearest and next nearest neighbours using extensional and torsional springs. From the mixed-mode fracture simulations, it is shown that the lattice architecture results in anisotropic fracture behaviour locally which is resolved by incorporating disorder in the failure strain threshold of the springs. It is further shown that for a crack propagating in a two-phase solid, the inherent differences in the two phases result in an inclined crack path in mixed mode loading and additional disorder in the individual phases are not vital for realistic simulations of the fracture process [Ra1]

Ballistic aggregation on a two dimensional square lattice, where particles move ballistically in between momentum and mass conserving coalescing collisions is studied. Three models are studied based on the shapes of the aggregates: in the first the aggregates remain point particles, in the second they retain the fractal shape at the time of collision, and in the third they assume a spherical shape. The exponents describing the power law temporal decay of number of particles and energy as well as dependence of velocity correlations on mass are determined using large scale Monte Carlo simulations. It is shown that the exponents are universal only for the point particle model. In the other two cases, the exponents are dependent on the initial number density and correlations vanish at high number densities. The fractal dimension for the second model is close to 1.49 [F]

String Theory in Three dimensional Anti-de Sitter Space

Anti-de Sitter space-times play a central role in the study of holography in quantum gravity. Moreover, string theory provides a theory of quantum gravity in which holography is on a firm footing. Thus, obtaining a better understanding string theory in asymptotically anti-de Sitter space-times remains an important task.

The dynamics of fundamental strings in three-dimensional asymptotically AdS black hole (the BTZ black hole) with Neveu-Schwarz-Neveu-Schwarz flux is analyzed in detail in [As3]. Explicit expressions for the classical energy of winding strings based on time-like or space-like geodesics in the black hole background were obtained and this was supplemented with a direct analysis in terms of the Nambu-Goto plus flux action of a long string probe. A physical ambiguity in the definition of the model was pointed out and a resolution was obtained in the Lorentzian Wess-Zumino-Witten model.

It would be of great interest to show that non-perturbative fundamental string theory exhibits a unitary evolution in the presence of a black hole. At present, we are far from attaining this unification grail of theoretical physics. A more modest goal is to study perturbative scattering amplitudes on a black hole background. A prime candidate geometry to ponder

is the asymptotically AdS3 BTZ black hole. It has an asymptotic structure that allows for holography on the one hand, and for a deceptively simple algebraic world sheet description on the other. Indeed, the BTZ black hole background with Neveu-Schwarz Neveu-Schwarz flux is described by an orbifold of a Wess-Zumino-Witten model on the universal cover of the group $G=SL(2,R)$.

The partition function of both particles and strings in a BTZ black hole background, arising as a hyperbolic orbifold of the covering group G is carried out in [As2]. The particle case is done by exploiting our previous work on the coadjoint orbit quantization [As1]. This provides us with a direct derivation and interpretation of the Hilbert space for a particle on both AdS3 and the BTZ black hole. The string partition function on the BTZ turns out to be more subtle. Extending the intuition developed in finite temperature AdS3, we identify pole regions in the Euclidean BTZ partition sum that correspond to the contribution of long string winding modes that surround the black hole. Short winding string contributions are then identified in a saddle point approximation, and are associated to quasinormal winding modes. An important outcome is the identification of a bound on their $sl(2, R)$ spin from this analysis.

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.

[A]

Gunther Turk*, Rajesh Singh*, and Ronojoy Adhikari.

Stokes traction on an active particle.

PHYSICAL REVIEW E, **106**, 014601, 2022.

<https://doi.org/10.1103/PhysRevE.106.014601>

[Aj1]

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

Going beyond soft plus virtual.

Physical Review D, **105(9)**, L091503, 2022.

<https://doi.org/10.1103/PhysRevD.105.L091503>

[Aj2]

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

Next to soft corrections to drell-yan and higgs boson productions.

Physical Review D, **105(9)**, 094035,2022.

<https://doi.org/10.1103/PhysRevD.105.094035>

[Aj3]

A. H. Ajjath, Pooja Mukherjee, V. Ravindran, Aparna Sankar, and Surabhi Tiwari.

Next-to-soft-virtual resummed rapidity distribution for the Drell-Yan process to NNLO +

NNLL.
Physical Review D, **106(3)**, 034005, 2022.
<https://doi.org/10.1103/PhysRevD.106.034005>

[Aj4]
A. H. Ajjath, Pooja Mukherjee, V. Ravindran, Aparna Sankar, and Surabhi Tiwari.

Resummed higgs boson cross section at next-to SV to NNLO + NNLL.
The European Physical Journal C, **82**, 774, 2022.
<https://doi.org/10.1140/epjc/s10052-022-10752-9>

[An1]
Akhil Antony, Fabio Finelli*, Dhiraj K. Hazra, and Arman Shafieloo*.
Discordances in cosmology and the violation of slow-roll inflationary dynamics.
Physical Review Letters, **130(11)**, 111001, 2023.
<https://doi.org/10.1103/PhysRevLett.130.111001>

[An2]
Akhil Antony and Shweta Jain*.
Effect of damped oscillations in the inflationary potential.
The European Physical Journal C, **82**, 687, 2022.
<https://doi.org/10.1140/epjc/s10052-022-10616-2>

[As1]
Sujay K. Ashok and Jan Troost*.
Path integrals on $sl(2, r)$ orbits.
Journal of Physics A: Mathematical and Theoretical, **55(33)**, 335202, 2022.
<https://doi.org/10.1088/1751-8121/ac802c>

[As2]
Sujay K. Ashok and Jan Troost*.
Long strings and quasinormal winding modes.
Journal of High Energy Physics, **2022(9)**, 172, 2022.
[https://doi.org/10.1007/JHEP09\(2022\)172](https://doi.org/10.1007/JHEP09(2022)172)

[As3]
Sujay K. Ashok and Jan Troost*.
Twisted strings in three-dimensional black holes.
The European Physical Journal C, **82**, 913, 2022.
<https://doi.org/10.1140/epjc/s10052-022-10903-y>

[B]
Y. Maan*, M. P. Surnis*, B. C. Joshi*, and M. Bagchi.
Magnetar xte j1810-197: Spectro-temporal evolution of average radio emission.
ASTROPHYSICAL JOURNAL, **931(1)**, 67, 2022.
<https://doi.org/10.3847/1538-4357/ac68f1>

[Ba1]

Bhal C. Joshi*, **Achamveedu Gopakumar***, **Arul Pandian***, **Thiagaraj Prabu***, **Lankeswar Dey***, **Manjari Bagchi**, **Shantanu Desai***, and **Pratik Tarafdar**.

Nanohertz gravitational wave astronomy during SKA era: An InPTA perspective.

Journal of Astrophysics and Astronomy, **43(2)**, 98, 2022.

<https://doi.org/10.1007/s12036-022-09869-w>

[Ba2]

K. Nobleson*, **Nikita Agarwal***, **Raghav Girgaonkar***, **Arul Pandian***, **Bhal Chandra Joshi***, **M. Krishnakumar***, **Abhimanyu Susobhanan***, **Shantanu Desai***, **T. Prabu***, **Adarsh Bathula***, **Timothy T. Pennucci***, **Sarmistha Banik***, **Manjari Bagchi**, **Neelam Dhanda Batra***, **Arpita Choudhary**, **Subhjit Dandapat***, **Lankeswar Dey***, **Yashwant Gupta***, **Shinnosuke Hisano***, **Ryo Kato***, **Divyansh Kharbanda***, **Tomonosuke Kikunaga***, **Neel Kolhe***, **Yogesh Maan***, **Piyush Marmat***, **P. Arumugam***, **P. Manoharan***, **Dhruv Pathak**, **Jaikhomba Singha***, **Mayuresh P. Surnis***, **Sai Chaitanya Susarla***, and **Keitaro Takahashi***.

Low-frequency wideband timing of inpta pulsars observed with the ugmrt.

Monthly Notices of the Royal Astronomical Society, **512(1)**, 1234–1243, 2022.

<https://doi.org/10.1093/mnras/stac532>

[Bas1]

G. Baskaran.

Theory of confined high T_c superconductivity in monovalent metals.

International Journal of Modern Physics B, **36(27)**, 250184, 2022.

<https://doi.org/10.1142/S0217979222501843>

[Bas2]

L. Govindaraj*, **S. Arumugam***, **R. Thiyagarajan***, **Dinesh Kumar***, **M. Kannan***, **Dhruba Das***, **T. Suraj***, **V. Sankaranarayanan***, **K. Sethupathi***, **G. Baskaran**, **Raman Sankar***, and **Ramachandra M. Rao***.

Wohllleben effect and emergent p - n junctions in superconducting boron doped diamond thin films.

Physica C: Superconductivity and its Applications, **598**, 1354065, 2022.

<https://doi.org/10.1016/j.physc.2022.1354065>

[Bi]

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

Mpemba effect in driven granular gases: role of distance measures.
2023.

ArXiv:2303.10900 (Submitted).

[Bis]

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In *Recent Advances in Applied Mechanics: Proceedings of Virtual Seminar on Applied Mechanics (VSAM 2021)*, 247–260. Springer Singapore, Apr 2022.

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A monte carlo algorithm to measure probabilities of rare events in cluster-cluster aggregation.

Computer Physics Communications, **288**, 108727, 2023.

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[Rav]

Arunima Bhattacharya*, **M. Kumar***, **Prakash Mathews***, and **V. Ravindran**.

Next-to-soft-virtual resummed prediction for pseudoscalar higgs boson production at NNLO + NNLL.

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Simulation of mixed-mode fracture in a single phase and two-phase composite material.

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Quantum annealing and computation: challenges and perspectives.

Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, **381(2241)**, 20210419, 2023.

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Subhadeep Dasgupta*, **Rajasekaran M.***, **Projesh K. Roy**, **Foram M. Thakkar***, **Amar D. Pathak***, **Ganapathy K. Ayappa***, and **Prabal K. Maiti***.

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Journal of Membrane Science, **664**, 121044, 2022.

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[Ro2]

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PHYSICAL REVIEW E, **106(1)**, 014141, 2022.

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[Ro3]

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Influence of the coordination defects on the dynamics and the potential energy landscape of two-dimensional silica.

The Journal of Chemical Physics, **157(17)**, 174506, 2022.

<https://doi.org/10.1063/5.0118797>

[Roy]

Projesh Kumar Roy, **Pinaki Chaudhuri**, and **Satyavani Vemparala**.

Effect of ring stiffness and ambient pressure on the dynamical slowdown in ring polymers.

Soft Matter, **18(15)**, 2959–2967, 2022.

<https://doi.org/10.1039/D1SM01754C>

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Subhadeep Roy and Soumyajyoti Biswas*.

Opinion dynamics: public and private.

Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, **380(2224)**, 20210169, 2022.

<https://doi.org/10.1098/rsta.2021.0169>

[Roys2]

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Modeling crack propagation in heterogeneous materials: Griffith's law, intrinsic crack resistance, and avalanches.

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Modular linear differential equations for four-point sphere conformal blocks.

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[https://doi.org/10.1007/JHEP02\(2023\)158](https://doi.org/10.1007/JHEP02(2023)158)

[Se]

R. T. Senthil, D. Indumathi, and Prashant Shukla*.

Simulation study of tau neutrino events at the ICAL detector in INO.

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[Sh]

Suresh Govindarajan* and **Mohammad Shabbir**.

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Nuclear Physics B, **989**, 116127, 2023.

[Sha1]

Sourav Laha*, **Alex W. Billington***, **Argha Banerjee***, **R. Shankar**, **H. Nainwal***, and **Michele Koppes***.

Estimation of ice ablation on a debris-covered glacier from vertical debris-temperature profiles.

Journal of Glaciology, **69(273)**, 1 – 12, 2023.

<https://doi.org/10.1017/jog.2022.35>

[Sha2]

Harish C. Nainwal*, **R. Shankar**, **Aditya Mishra***, **Sumit Mishra***, **Ankit Pandey***, **Sunil S. Shah***, **Gambhir S. Chauhan***, and **Deepak Kumar***.

A comprehensive and quantitative assessment of raunthi gad flash flood, rishi ganga catchment, central himalaya, uttarakhand, india.

Natural Hazards, **114(1)**, 157–181, 2022.

<https://doi.org/10.1007/s11069-022-05385-w>

[Sha3]

A. Pruisken*, **Bimla Danu***, and **R. Shankar**.

Superuniversality of dimerized SU (N+M)spin chains.

PHYSICAL REVIEW B, **105(15)**, 155111, 2022.

<https://doi.org/10.1103/PhysRevB.105.155111>

[Shan]

Jitendra K. Pattanaik*, **Atul Singh***, **Haldhar Kumar***, **Sunil S. Shah***, **Prabhat Semwal***, **Sujith M. Naik***, **Kalyani Nayak***, **Manoj K. Jaiswal***, **Argha Banerjee***, **Harish C. Nainwal***, and **Ramachandran Shankar**.

Luminescence chronology of late quaternary palaeo-lake deposits from the upper alaknanda basin, uttarakhand, india: Implication to palaeoclimate and depositional settings author links open overlay panel.

Journal of Asian Earth Sciences, **227**, 105079, 2022.

<https://doi.org/10.1016/j.jseaes.2022.105079>

[Shar]

Rasmus N. Larsen*, **Sayantana Sharma**, and **Edward Shuryak***.

Correlating confinement to topological fluctuations near the crossover transition in qcd.

Physical Review D, **105(7)**, L071501, 2022.

<https://doi.org/10.1103/PhysRevD.105.L071501>

[Shr]

Emilio Pelaez*, **Minh Pham***, and **U. Shrikant**.

Quantum technologies i: Information, communication, and computation.

In *Lecture Notes on Data Engineering and Communications Technologies*, **133**, 1–54. Springer, 2022.

https://doi.org/10.1007/978-3-031-04613-1_1

[Si]

Samapan Sikdar, **Manidipa Banerjee***, and **Satyavani Vemparala**.

Correction: Role of disulphide bonds in membrane partitioning of a viral peptide.

The Journal of Membrane Biology, **256(1)**, 105, 2022.

<https://doi.org/10.1007/s00232-022-00218-0>

[Sin]

Raghvendra Singh and **Dawood Kothawala***.

Covariant formulation of the generalized uncertainty principle.

PHYSICAL REVIEW D, **105(10)**, ., 2022.

<https://doi.org/10.1103/PhysRevD.105.L101501>

[Sinh]

Siddharth P. Maharathy*, **Rohini M. Godbole***, **Sanjoy Mandal***, **M. Mitra***, and **Nita Sinha**.

Interference effect in lnv and lnc meson decays for left-right symmetric model.

In *Springer Proceedings in Physics*, **277**, 243–246. Springer, Oct 2022.

https://doi.org/10.1007/978-981-19-2354-8_44

[Sr]

T. Sreevidya, Somavally Dalvi*, Prasanna Venkatraman*, and Satyavani Vemparala.

Structural insights on the effects of mutation of a charged binding pocket residue on phosphopeptide binding to 14-3-3950; protein.

PROTEINS, **90(5)**, 1179–1189, 2022.

<https://doi.org/10.1002/prot.26300>

[Su1]

Amir Suhail, Anuradha Banerjee*, and R. Rajesh.

Kinetic model description of dissipation and recovery in collagen fibrils under cyclic loading.

Physical Review E, **106(4)**, 044407, 2022.

<https://doi.org/10.1103/PhysRevE.106.044407>

[T]

Amrutha Manikandan*, Sreevidya T S, Manoj N*, Satyavani Vemparala, and Madhulika Dixit*.

In-silico identification of tyr232 in ampk-alpha2 as a dephosphorylation site for the protein tyrosine phosphatase ptp-pest.

PROTEINS-STRUCTURE FUNCTION AND BIOINFORMATICS, **91(6)**, 831-846, 2023.

<https://doi.org/10.1002/prot.26470>

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Carter-penrose diagrams for emergent spacetime in axisymmetrically accreting black hole systems.

Physical Review D, **106(4)**, 044062, 2022.

<https://doi.org/10.1103/PhysRevD.106.044062>

[Ta2]

Arpan K. Mitra*, Aishee Chakraborty*, Pratik Tarafdar, and Tapas K. Das*.

Multi-criticality and related bifurcation in accretion discs around non-rotating black holes: an analytical study.

General Relativity and Gravitation, **54(11)**, 149, 2022.

<https://doi.org/10.1007/s10714-022-03032-0>

[Ta3]

Pratik Tarafdar, K. Nobleson*, Purna Rana*, Jaikhomba Singha*, M. Krishnakumar*, Bhal Chandra Joshi*, Avinash Kumar Paladi*, Neel Kolhe*, Neelam Dhanda Batra*, Nikita Agarwal*, Adarsh Bathula*, Subhajit Dandapat*, Shantanu Desai*, Lankeswar Dey*, Shinnosuke Hisano*, Prathamesh Ingale*, Ryo Kato*, Divyansh Kharbanda*, Tomonosuke Kikunaga*, Piyush Marmat*, B. Arul Pandian*, T. Prabu*, Aman Srivastava*, Mayuresh Surnis*, Sai Chaitanya Susarla*, Abhimanyu Susobhanan*, Keitaro Takahashi*, P. Arumugam*, Manjari Bagchi, Sarmistha Banik*, Kishalay De*, Raghav Girgaonkar*, A. Gopakumar*, Yashwant Gupta*, Yogesh Maan*, P. Manoharan*, Arun Naidu*, and Dhruv Pathak.

The indian pulsar timing array: First data release.
Publications of the Astronomical Society of Australia, **39**, e053, 2022.
<https://doi.org/10.1017/pasa.2022.46>

[V1]

Vinay Vaibhav, Juergen Horbach*, and **Pinaki Chaudhuri**.

Finite-size effects in the diffusion dynamics of a glass-forming binary mixture with large size ratio.

Journal of Chemical Physics, **156(24)**, 244501, 2022.

<https://doi.org/10.1063/5.0090330>

[V2]

Vinay Vaibhav, Juergen Horbach*, and **Pinaki Chaudhuri**.

Rheological response of a glass-forming liquid having large bidispersity.

Soft Matter, **18(23)**, 4427, 2022.

<https://doi.org/10.1039/D2SM00326K>

[Ve]

Haruko Takahashi*, **Iva Sovadinova***, **Kazuma Yasuhara***, **Satyavani Vemparala**, **Gregory A. Caputo***, and **Kenichi Kuroda***.

Biomimetic antimicrobial polymers design, characterization, antimicrobial, and novel applications.

WILEY INTERDISCIPLINARY REVIEWS NANOMEDICINE AND NANOBIO TECHNOLOGY, 2022.

<https://doi.org/10.1002/wnan.1866>

[Vi]

Srubabati Goswami*, **K. Vishnudath**, **Ananya Mukherjee***, and **Nimmala Narendra***.

Leptogenesis and eV scale sterile neutrino.

Physical Review D, **105(9)**, 095040, 2022.

<https://doi.org/10.1103/PhysRevD.105.095040>

[Vis]

Jonathan L. Feng*, **Felix Kling***, **Mary H. Reno***, and **Vishnudath K. Vishnudath**.
The Forward Physics Facility at the High-luminosity LHC.

Journal of Physics G: Nuclear and Particle Physics, **50(3)**, 030501, 2023.

<https://doi.org/10.1088/1361-6471/ac865e>

2.4 Theoretical Computer Science

2.4.1 Research Summary & Highlights

Computational Complexity

In [M2], a *tight characterisation of proof size in resolution for quantified Boolean formulas (QBF) via circuit complexity* is provided. Such a characterisation had previously been obtained for a hierarchy of QBF Frege systems, but the most important case of QBF resolution had been left open. Different from the Frege case, the characterisation in [M2], uses a new version of decision lists as its circuit model, which is stronger than the CNFs the system works with. This decision list model is well suited to compute countermodels for QBFs. The characterisation works for both *Q-Resolution and QU-Resolution*.

Further, using this characterisation, a *size-width relation for QBF resolution* in the spirit of the celebrated result for propositional resolution due to ben-Sasson and Wigderson is obtained. However, the new result is not just a replication of the propositional relation – intriguingly ruled out for QBF in previous research – but shows a different dependence between size, width, and quantifier complexity. An essential ingredient is an improved relation between the size and width of term decision lists; this may be of independent interest.

The *new technique is demonstrated to elegantly reprove known QBF hardness results* and unifies previous lower-bound techniques in the QBF domain.

In [M3], the MaxSAT Resolution (MaxRes) rule is studied in the context of certifying unsatisfiability. It is shown that it can be exponentially more powerful than tree-like resolution on some formulas, and when augmented with weakening (the system MaxResW), p -simulates tree-like resolution. In devising a lower bound technique specific to MaxRes (and not merely inheriting lower bounds from resolution), a new proof system called the SubCubeSums proof system is defined. This system, which p -simulates , can be viewed as a special case of the semialgebraic Sherali–Adams proof system. In expressivity, it is the integral restriction of conical juntas studied in the contexts of communication complexity and extension complexity. The work of [M3] shows that it is not simulated by resolution. Using a proof technique qualitatively different from the lower bounds that MaxResW inherits from resolution, it is shown that Tseitin contradictions on expander graphs are hard to refute in SubCubeSums. Finally a lower bound technique via lifting is established: for formulas requiring large degree in SubCubeSums, their XOR-ification requires large size in SubCubeSums.

The Merge Resolution proof system (MRes) for QBFs, proposed by Beyersdorff, Blinkhorn and Mahajan in 2019, explicitly builds partial strategies inside refutations. The original motivation for this approach was to overcome the limitations encountered in long-distance Q-Resolution proof system (), where the syntactic side-conditions, while prohibiting all unsound resolutions, also end up prohibiting some sound resolutions. However, while the advantage of over many other resolution-based QBF proof systems was already demonstrated, a comparison with LDQRes itself had remained open. In [M1], this question is settled by showing that MRes has an exponential advantage over not only LDQRes, but even over LQU⁺Res and IRM, the most powerful among currently known resolution-based QBF proof systems. Combining this with other known results, it is thus shown that MRes is incomparable with LQURes and LQU⁺Res.

The proof method from [M1] reveals two additional and curious features about MRes: (i) MRes is not closed under restrictions, and is hence not a natural proof system, and (ii) weakening axiom clauses with existential variables provably yields an exponential advantage over MRes without weakening. It is further shown that in the context of regular derivations, weakening axiom clauses with universal variables provably yields an exponential advantage over MRes without weakening. These results suggest that MRes is better used with weakening, though whether MRes with weakening is closed under restrictions remains

open. It is noted that even with weakening, MRes continues to be simulated by QBF-eFrege (the simulation of ordinary MRes was shown recently by Chew and Slivovsky).

Graph Theory and Combinatorics

In an earlier work (which has been conditionally accepted), an efficiently realisable policy was presented for approximating maximum weighted independent sets in a given vertex weighted stochastic graphs (vertices are stochastically active) under the probe-and-commit model. Continuing this further, a similar efficiently realisable policy can be designed for approximating weighted induced k -colorable subgraphs in weighted stochastic graphs. The details are being written up for submission.

In an earlier work, a divide-and-conquer paradigm was reported on approximating weighted maximum independent sets in arbitrary graphs and it was illustrated with applications to intersection graphs on L_p spheres for $p \geq 2$. Further applications of this paradigm have been obtained and the details are being written up for submission.

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.

[A1]

V. Arvind, Chatterjee Abhranil, and Mukhopadhyay Partha.

Black-box identity testing of noncommutative rational formulas of inversion height two in deterministic quasipolynomial time.

In *Leibniz International Proceedings in Informatics (LIPIcs)*, **245**, 23:1–23:22. Dagstuhl Research Online Publication Server (DROPS), Sep 2022.

<https://doi.org/10.4230/LIPIcs.APPROX/RANDOM.2022.23>

[A2]

V. Arvind and Joglekar S. Pushkar.

On efficient noncommutative polynomial factorization via hightman linearization.

In *Leibniz International Proceedings in Informatics (LIPIcs)*, **234**, 12:1–12:22. Dagstuhl Research Online Publication Server (DROPS), Jul 2022.

<https://doi.org/10.4230/LIPIcs.CCC.2022.12>

[A3]

C. Aiswarya*, V. Arvind, and Saket Saurabh.

Theory research in india: 2019-2022.

Communications of the ACM, **65(11)**, 88–93, 2022.

<https://doi.org/10.1145/3550496>

[A4]

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

On the Weisfeiler-Leman dimension of fractional packing.

Information and Computation, **288**, 104803, 2022.

<https://doi.org/10.1016/j.ic.2021.104803>

[Ar]

Vikraman Arvind, Roman Nedela*, Iliia Ponomarenko*, and Peter Zeman*.

Testing isomorphism of chordal graphs of bounded leafage is fixed-parameter tractable (extended abstract).

In *Lecture Notes in Computer Science*, **13453**, 29–42, Springer, 2022.

https://doi.org/10.1007/978-3-031-15914-5_3

[B1]

Sriram Bhyravarapu, Satyabrata Jana, Fahad Panolan*, Saket Saurabh, and Shaily Verma.

List homomorphism: Beyond the known boundaries.

In *Lecture Notes in Computer Science*, **13568**, 593–609, Springer, 2022.

https://doi.org/10.1007/978-3-031-20624-5_36

[B2]

Sriram Bhyravarapu and Subrahmanyam Kalyanasundaram*.

A tight bound for conflict-free coloring in terms of distance to cluster.

Discrete Mathematics, **345(11)**, 113058, 2022.

<https://doi.org/10.1016/j.disc.2022.113058>

[Bi]

Arindam Biswas, Varunkumar Jayapaul*, Venkatesh Raman, and Srinivasa R. Satti*.

Finding kings in tournaments.

Discrete Applied Mathematics, **322**, 240–252, 2022.

<https://doi.org/10.1016/j.dam.2022.08.014>

[D]

Arkadev Chattopadhyay*, Yogesh Dahiya, and Meena Mahajan.

Query complexity of search problems.

2023.

(Preprint: ECCC TR23-039).

[Da]

Sayani Das and Sounaka Mishra*.

Approximation algorithm for minimum 119902;-dominator partization problem.

Discrete Mathematics, Algorithms and Applications, 2023 (Online First).

<https://doi.org/10.1142/S1793830922501889>

[G1]

Sushmita Gupta, Pallavi Jain*, Daniel Lokshantov*, Sanjukta Roy*, and Saket

Saurabh.

Gehrlein stable committee with multi-modal preferences.

In *International Symposium on Algorithmic Game Theory*, **13584**, 508–525, Springer, Sep 2022.

https://doi.org/10.1007/978-3-031-15714-1_29

[G2]

Sushmita Gupta, Pallavi Jain*, and **Sanjay Seetharaman.**

More effort towards multiagent knapsack.

In *SOFSEM 2023: Theory and Practice of Computer Science*, **13878**, 47–62, Springer, Jan 2023.

https://doi.org/10.1007/978-3-031-23101-8_4

[G3]

Sushmita Gupta, Sanjukta Roy*, **Saket Saurabh**, and **Meirav Zehavi***.

Resolute control: Forbidding candidates from winning an election is hard.

Theoretical Computer Science, **915**, 74–89, 2022.

<https://doi.org/10.1016/j.tcs.2022.02.031>

[J]

Ashwin Jacob, Fahad Panolan*, **Venkatesh Raman**, and **Vibha Sahlot***.

Structural parameterizations with modulator oblivion.

Algorithmica, **84(8)**, 2335–2357, 2022.

<https://doi.org/10.1007/s00453-022-00971-7>

[Ja]

Sujoy Bhore*, **Satyabrata Jana**, **Supantha Pandit***, and **Sasanka Roy***.

The balanced connected subgraph problem for geometric intersection graphs.

THEORETICAL COMPUTER SCIENCE, **929**, 69–80, 2022.

<https://doi.org/10.1016/j.tcs.2022.06.030>

[K1]

Manas J. Kashyop and **N. Narayanaswamy***.

An invitation to dynamic graph problems: Basics i.

Resonance, **27(10)**, 1443–1451, 2022.

<https://doi.org/10.1007/s12045-022-1436-9>

[K2]

Manas J. Kashyop and **N. Narayanaswamy***.

An invitation to dynamic graph problems: Lower bounds iii.

Resonance, **27(10)**, 1777–1787, 2022.

<https://doi.org/10.1007/s12045-022-1471-6>

[K3]

Manas J. Kashyop and **N. Narayanaswamy***.

An invitation to dynamic graph problems: Upper bounds ii.

Resonance, **27(10)**, 1607–1624, 2022.
<https://doi.org/10.1007/s12045-022-1452-9>

[L]

P. Habeeb*, **Nabarun Deka***, **Deepak D Souza***, **Kamal Lodaya**, and **Pavithra Prabhakar***.

Verification of camera-based autonomous systems.

IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, 2023 (Online First).

<https://doi.org/10.1109/TCAD.2023.3240131>

[M1]

Meena Mahajan and **Gaurav Sood**.

QBF merge resolution is powerful but unnatural.

In *The 25th International Conference on Theory and Applications of Satisfiability Testing*, **236**, 22:1–22:19, LIPIcs, Schloss Dagstuhl, Aug 2022.

<https://doi.org/10.4230/LIPIcs.SAT.2022.22>

[M2]

Olaf Beyersdorff*, **Joshua Blinkhorn***, **Meena Mahajan**, and **Tomáš Peitl***.

Hardness characterisations and size-width lower bounds for QBF resolution.

ACM Transactions on Computational Logic, **24(2)**, 10:1–30, 2023.

<https://doi.org/10.1145/3565286>

[M3]

Yuval Filmus*, **Meena Mahajan**, **Gaurav Sood**, and **Marc Vinyals***.

Maxsat resolution and subcube sums.

ACM Transactions on Computational Logic, **24(1)**, 8:1–27, 2023.

<https://doi.org/10.1145/3565363>

[Me]

Martin Koutecky*, **Asaf Levin***, **Syed M. Meesum**, and **Shmuel Onn***.

Approximate separable multichoice optimization over monotone systems.

Discrete Optimization, **44(2)**, 100629, 2022.

<https://doi.org/10.1016/j.disopt.2021.100629>

[R1]

R. Ramanujam.

Big ideas from logic for mathematics and computing education.

In *Lecture Notes in Computer Science (Including its subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, **13963**, 79–91. Springer, Feb 2023.

https://doi.org/10.1007/978-3-031-26689-8_6

[R2]

Sujata Ghosh* and **R. Ramanujam**.

Preface.

Journal of Logic, Language and Information, **32**, 1–2, 2022.

[Ra]

Mo Liu*, Anantha Padmanabha*, R. Ramanujam, and Yanjing Wang*.

Generalized bundled fragments for first-order modal logic.

In *Leibniz International Proceedings in Informatics (LIPIcs)*, **241**, 70:1–70:14. Dagstuhl Research Online Publication Server (DROPS), Aug 2022.

<https://doi.org/10.4230/LIPIcs.MFCS.2022.70>

[Ram1]

Niranka Banerjee*, Manoj Gupta*, Venkatesh Raman, and Saket Saurabh.

Output sensitive fault tolerant maximum matching.

In *Lecture Notes in Computer Science*, **13296**, 115–132. Springer, Jun 2022.

https://doi.org/10.1007/978-3-031-09574-0_8

[Ram2]

Pratibha Choudhary*, Michael T. Goodrich*, Siddharth Gupta*, Hadi Khodabandeh*, Pedro Matias*, and Venkatesh Raman.

Improved kernels for tracking paths.

Information Processing Letters, **181**, 106360, 2023.

<https://doi.org/10.1016/j.ipl.2023.106360>

[Ram3]

Pratibha Choudhary* and Venkatesh Raman.

Structural parameterizations of Tracking Paths problem.

Theoretical Computer Science, **934**, 91–102, 2022.

<https://doi.org/10.1016/j.tcs.2022.09.009>

[Ram4]

Hemangee K. Kapoor*, Mausam*, and Venkatesh Raman.

Welcome back!

Communications of the ACM, **65(11)**, 40–42, 2022.

<https://doi.org/10.1145/3564603>

[S1]

Akanksha Agrawal*, Madhumita Kundu*, Abhishek Sahu, Saket Saurabh, and Prafullkumar Tale*.

Parameterized complexity of maximum edge colorable subgraph.

Algorithmica, **84(10)**, 3075–3100, 2022.

<https://doi.org/10.1007/s00453-022-01003-0>

[S2]

Jan Derbisz*, Lawqueen Kanesh*, Jayakrishnan Madathil*, Abhishek Sahu, Saket Saurabh, and Shaily Verma.

A polynomial kernel for bipartite permutation vertex deletion.

Algorithmica, **84(11)**, 3246–3275, 2022.

<https://doi.org/10.1007/s00453-022-01040-9>

[S3]

Abhishek Sahu and Saket Saurabh.

Kernelization of arc disjoint cycle packing in 945;-bounded digraphs.

Theory of Computing Systems volume, **67(2)**, 221–233, 2023.

<https://doi.org/10.1007/s00224-022-10114-8>

[Sa1]

Parosh A. Abdulla*, **Mohamed F. Atig***, **Ahmed Bouajjani***, **Bengt Jonsson***,
Narayan K. Kumar*, and **Prakash Saivasan.**

Consistency and persistency in program verification: Challenges and opportunities.

In *Principles of Systems Design*, **13660**, 494–510. Springer, 2022.

https://doi.org/10.1007/978-3-031-22337-2_24

[Sa2]

Parosh A. Abdulla*, **Mohamed F. Atig***, **Ahmed Bouajjani***, **Narayan K. Kumar***,
and **Prakash Saivasan.**

Verifying reachability for tso programs with dynamic thread creation.

In *International Conference on Networked Systems*, **13464**, 283–300. springer, 2022.

https://doi.org/10.1007/978-3-031-17436-0_19

[Sak1]

Bandyapadhyay Sayan*, **Lochet William***, **Lokshtanov Daniel***, **Saurabh Saket,**
and **Xue Jie***.

True contraction decomposition and almost eth-tight bipartization for unit-disk graphs.

In *Leibniz International Proceedings in Informatics (LIPIcs)*, **224**, 11:1–11:16. Dagstuhl Research Online Publication Server(DROPS), Jun 2022.

<https://doi.org/10.4230/LIPIcs.SoCG.2022.11>

[Sak2]

Abhinav Ankit*, **Bandopadhyay Susobhan***, **Banik Aritra***, **Kobayashi Yasuaki ***,
Nagano Shunsuke*, **Otachi Yota***, and **Saurabh Saket.**

Parameterized complexity of non-separating and non-disconnecting paths and sets.

In *47th International Symposium on Mathematical Foundations of Computer Science (MFCS 2022)*, **241**, 6:1–6:15. DROPS, Aug 2022.

<https://doi.org/10.4230/LIPIcs.MFCS.2022.6>

[Sak3]

Agrawal Akanksha*, **Saurabh Saket,** and **Zehavi Meirav***.

A finite algorithm for the realizabilty of a delaunay triangulation.

In *Leibniz International Proceedings in Informatics (LIPIcs)*, **249**, 1:1–1:16. Dagstuhl Research Online Publication Server (DROPS), Dec 2022.

<https://doi.org/10.4230/LIPIcs.IPEC.2022.1>

[Sat]

Agrawal Akanksha*, **Bhattacharjee Sutanay***, **Jana Satyabrata,** and **Sahu Abhishek***.

Parameterized complexity of perfectly matched sets.

In *Leibniz International Proceedings in Informatics (LIPIcs)*, **249**, 2:1–2:13. Dagstuhl Research Online Publication Server (DROPS), Dec 2022.

<https://doi.org/10.4230/LIPIcs.IPEC.2022.2>

[Sau]

Ankit Abhinav *, **Susobhan Bandopadhyay ***, **Aritra Banik***, and **Saket Saurabh**.

Parameterized algorithms for finding highly connected solution.

Theoretical Computer Science, **942**, 47–56, 2023.

<https://doi.org/10.1016/j.tcs.2022.11.024>

[Saur1]

Fedor V. Fomin*, **Petr A. Golovach***, **Tanmay Inamdar***, **Nidhi Purohit***, and **Saket Saurabh**.

Exact Exponential Algorithms for Clustering Problems.

In *Leibniz International Proceedings in Informatics (LIPIcs)*, **249**, 13:1–13:14. Schloss Dagstuhl Leibniz-Zentrum für Informatik, Dec 2022.

<https://doi.org/10.4230/LIPIcs.IPEC.2022.13>

[Saur2]

D. Lokshtanov*, **F. Panolan***, **Saket Saurabh**, **J. Xue***, and **M. Zehavik***.

Document details - subexponential parameterized algorithms on disk graphs (extended abstract).

In *Proceedings of the Annual ACM-SIAM Symposium on Discrete Algorithms*, 2005–2031, Apr 2022.

<https://doi.org/10.1137/1.9781611977073>

[Saur3]

Daniel Lokshtanov*, **Marcin Pilipczuk***, **Micha322; Pilipczuk***, and **Saket Saurabh**.

Fixed-parameter tractability of graph isomorphism in graphs with an excluded minor.

In *Proceedings of the 54th Annual ACM SIGACT Symposium on Theory of Computing*, 914–923. Association for Computing Machinery, Jun 2022.

<https://doi.org/10.1145/3519935.3520076>

[Saur4]

Akanksha Agrawal*, **Daniel Lokshtanov***, **Pranabendu Misra***, **Saket Saurabh**, and **Meirav Zehavi***.

Erd337; sPosa property of obstructions to interval graphs.

Journal of Graph Theory, **102(4)**, 702–727, 2023.

<https://doi.org/10.1002/jgt.22895>

[Saur5]

Akanksha Agrawal*, **Pranabendu Misra***, **Fahad Panolan***, and **Saket Saurabh**.

Fast exact algorithms for survivable network design with uniform requirements.

Algorithmica, **84(9)**, 2622–2641, 2022.

<https://doi.org/10.1007/s00453-022-00959-3>

[Saur6]

P. S. Ardra*, **R. Krithika***, **Saket Saurabh**, and **Roohani Sharma***.

Balanced substructures in bicolored graphs.

In *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 13878 LNCS, **13878**, 177–191. Springer, 2023.

https://doi.org/10.1007/978-3-031-23101-8_12

[Saur7]

Avinandan Das*, **Lawqueen Kanesh***, **Jayakrishnan Madathil***, **Komal Muluk***, **Nidhi Purohit***, and **Saket Saurabh**.

On the complexity of singly connected vertex deletion.

Theoretical Computer Science, **934**, 47–64, 2022.

<https://doi.org/10.1016/j.tcs.2022.08.012>

[Saur8]

Fedor V. Fomin*, **Daniel Lokshtanov***, **Daniel Marx***, **Marcin Pilipczuk***, **Micha322; Pilipczuk***, and **Saket Saurabh**.

Subexponential Parameterized Algorithms for Planar and Apex-Minor-Free Graphs via Low Treewidth Pattern Covering.

SIAM Journal on Computing, **51(6)**, 1703–1930, 2022.

(Submitted).

[Saur9]

Fedor V. Fomin*, **Fahad Panolan***, **M.S. Ramanujan***, and **Saket Saurabh**.

On the optimality of pseudo-polynomial algorithms for integer programming.

Mathematical Programming, **198(1)**, 561–593, 2023.

<https://doi.org/10.1007/s10107-022-01783-x>

[Saur10]

Petr A. Golovach*, **Fahad Panolan***, and **Ashutosh Rai***.

Parameterized Complexity of Set-Restricted Disjoint Paths on Chordal Graphs.

In *Lecture Notes in Computer Science (Including its subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, **13296**, 152–169. Springer, 2022.

https://doi.org/10.1007/978-3-031-09574-0_10

[Saur11]

Pranabendu Misra*, **Saket Saurabh**, **Roohani Sharma***, and **Meirav Zehavi***.

Sub-exponential time parameterized algorithms for graph layout problems on digraphs with bounded independence number.

Algorithmica, 2023 (Online First).

<https://doi.org/10.1007/s00453-022-01093-w>

[Saur12]

Saket Saurabh, **Ueverton d. Souza***, and **Prafullkumar Tale***.

On the parameterized complexity of grid contraction.

Journal of Computer and System Sciences, **129**, 22–38, 2022.
<https://doi.org/10.1016/j.jcss.2022.04.004>

[Saur13]

Saket Saurabh and Meirav Zehavi*.

Parameterized complexity of multi-node hubs.

Journal of Computer and System Sciences, **131**, 64–85, 2023.

<https://doi.org/10.1016/j.jcss.2022.08.001>

[Sr]

Bhyravarapu Sriram, Kalyanasundaram Subrahmanyam*, and **Mathew Rogers***.

Conflict-free coloring on claw-free graphs and interval graphs.

In *Leibniz International Proceedings in Informatics (LIPIcs)*, **241**, 19:1–19:14. Dagstuhl Research Online Publication Server (DROPS), Aug 2022.

<https://doi.org/10.4230/LIPIcs.MFCS.2022.19>

[Su1]

Aditya Narasimhan*, **Sridhar Radhakrishnan***, **Mohammad Atiquzzaman***, and **C. Subramanian**.

High-speed packet classification: A case for approximate sorting.

In *GLOBECOM 2022 - 2022 IEEE Global Communications Conference*, 5765–5770. IEEE Xplore, Dec 2022.

<https://doi.org/10.1109/GLOBECOM48099.2022.10001397>

[Su2]

Kunal Dutta* and **C. Subramanian**.

On induced paths, holes, and trees in random graphs.

SIAM Journal on Discrete Mathematics, **31(1)**, 279–303, 2023.

(Submitted).

[V]

Arvind V, **Abhranil Chatterjee***, **Utsab Ghosal***, **Partha Mukhopadhyay***, and **Ramya C**.

On identity testing and noncommutative rank computation over the free skew field.

In Yael Tauman Kalai, editor, *14th Innovations in Theoretical Computer Science Conference (ITCS 2023)*, **251**, 6:1. Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Jan 2023.

<https://doi.org/10.4230/LIPIcs.ITCS.2023.6>

2.5 Student Programmes

2.5.1 Degrees Awarded

Doctoral Degrees Awarded during 2022 – 2023

Mathematics

Name: **Kandhil, Neelam**

Thesis Title: Around non-vanishing, linear independence and transcendence of L values at rational and integer points

Thesis Advisor: Gun, S.

University: HBNI

Name: **Narayanan, Sridhar P.**

Thesis Title: Two restriction problems in the representation theory of symmetric groups

Thesis Advisor: Prasad, Amritanshu

University: HBNI

Physics

Name: **Sankar, Aparna**

Thesis Title: Higher order corrections and resummation in perturbative QCD

Thesis Advisor: Ravindran, V.

University: HBNI

Name: **Manna, Arkajyoti**

Thesis Title: Scattering Amplitudes from Generalized Recursion

Thesis Advisor: Ashok, Sujay K.

University: HBNI

Name: **Kumar, Deepak**

Thesis Title: Mechanics of crushing of staggered square honeycombs: experiments and simulations

Thesis Advisor: Rajesh, R.

University: IIT Madras

Name: **Sen, Pritam**

Thesis Title: A study of infra-red behaviour of gauge theories involving dark matter

Thesis Advisor: Indumathi, D.

University: HBNI

Name: **Sain, Ria**

Thesis Title: Model independent study of the rare decay of b-Baryon

Thesis Advisor: Sinha, Rahul

University: HBNI

Name: **Khatuva, Subhankar**

Thesis Title: Low Energy Theories of Quantum Magnets: Emergent Descriptions and Order by Singularity.

Thesis Advisor: Ganesh, R.

University: HBNI

Name: **Dutta, Semanti**

Thesis Title: Exact Renormalization Group and the $O(N)$ Model.

Thesis Advisor: Suryanarayana, Nemani V.

University: HBNI

Name: **Vaibhav, Vinay**

Thesis Title: Thermo-mechanical response of glassy systems

Thesis Advisor: Chaudhuri, Pinaki P.

University: Homi Bhabha National Institute

Theoretical Computer Science

Name: **Sahu, Abhishek**

Thesis Title: Packing and Covering: New Paradigms and Algorithms

Thesis Advisor: Saurabh, Saket

University: HBNI

Name: **Chatterjee, Abhranil**

Thesis Title: New Algorithmic Results using Noncommutative Algebraic Complexity

Thesis Advisor: Arvind, V.

University: HBNI

Name: **Jacob, Ashwin**

Thesis Title: New Directions for Parameterized Deletion Problems

Thesis Advisor: Raman, Venkatesh

University: HBNI

Name: **M, Jayakrishnan**

Thesis Title: Cross and Part: Beyond the Known Boundaries

Thesis Advisor: Saurabh, Saket

University: HBNI

Computational Biology

Name: **Kuyyamudi, Chandrashekar**

Thesis Title: Contact-mediated signaling in developmental pattern formation

Thesis Advisor: Sinha, Sitabhra

University: HBNI

Name: **Ravichandran, Janani**

Thesis Title: Exposome and health: Characterization and network-based exploration of diverse environmental chemical spaces

Thesis Advisor: Samal, Areejit

University: Homi Bhabha National Institute

Name: **Ghosh, Ria**

Thesis Title: Emergent patterns of activity in disordered biological systems

Thesis Advisor: Sinha, Sitabhra

University: HBNI

Doctoral Theses Submitted during 2022 – 2023

Physics

Name: **Antony, Akhil**

Thesis Title: A Primordial Solution to Tensions in Cosmology

Thesis Advisor: HAZRA, Dhiraj Kumar

University: The Institute of Mathematical Sciences, Chennai

Theoretical Computer Science

Name: **Sood, Gaurav**

Thesis Title: A study of QBF Merge Resolution and MaxSAT Resolution

Thesis Advisor: Mahajan, Meena B.

University: HBNI

Computational Biology

Name: **R P, Vivek Ananth**

Thesis Title: Compilation, curation and exploration of natural product spaces to enable traditional knowledge based drug discovery

Thesis Advisor: Samal, Areejit

University: HBNI

Masters Theses during 2022 – 2023

Mathematics

Name: **Kumar, S Dheeraj**

Thesis Title: Understanding some public-key cryptosystems

Thesis Advisor: Srinivas, K.

University: IISER, Tirupati

Name: **Mythreyi, S. S.**
Thesis Title: Study of Interlacing Families of Polynomials
Thesis Advisor: Kodiyalam, Vijay
University: BITS Pilani, Hyderabad

Name: **M, Shriya**
Thesis Title: On Enumeration of Vector Partitions
Thesis Advisor: Prasad, Amritanshu
University: University of Hyderabad

Physics

Name: **Bose, Koyena**
Thesis Title: Interplay of fractional quantum Hall effect and superconductivity
Thesis Advisor: Coimbatore Balram, Ajit
University: HBNI

Name: **Kumar, Prem**
Thesis Title: Dynamics of open quantum Systems: Different approaches to non-Markovianity
Thesis Advisor: Ghosh, Sibasish
University: HBNI

Name: **Shanker, Ravi**
Thesis Title: The fate of anomalous axial symmetry in QCD and its topological origin
Thesis Advisor: Sharma, Sayantan
University: HBNI

Name: **pathak, Vaibhav**
Thesis Title: Resummed predictions from Perturbative QCD
Thesis Advisor: Ravindran, V.
University: HBNI

2.5.2 Lecture Courses During 2022 – 2023.

The following **lecture courses** were offered during 2022 – 2023.

Course Title	Period	Lecturer
Mathematics		
Complex Analysis	Oct-Jan 2022	Gun, S.
Topology-I	Oct-Jan 2022	Roy, Indrava
Functional Analysis	Jan-Apr 2022	Prasad, Amritanshu
Algebra II	Feb-Jun 2022	Kodiyalam, Vijay
Analytic theory of algebraic numbers	Feb-Jun 2022	Dixit, Anup B.
Topology-II	Feb-Jun 2022	Raghavan, K. N.

Algebraic Combinatorics (online course on NPTEL)	Jan-Apr 2023	Prasad, Amritanshu
Introduction to Diophantine geometry	Jan-May 2023	Dixit, Anup B.

Physics

General Relativity and Cosmology	Feb-May 2022	HAZRA, Dhiraj Kumar
Physical Biology	Sep-Mar 2022	Sinha, Sitabhra
Electrodynamics	Oct-Jan 2022	Sharma, Sayantan
Quantum Mechanics - I	Oct-Jan 2022	Bagchi, Manjari
Statistical Mechanics II	Oct-Jan 2022	Chaudhuri, Pinaki P.
Protein Structure	Nov-Feb 2022	Vemparala, Satyavani
Advanced condensed matter physics	Feb-Jun 2022	Coimbatore Balram, Ajit
Computational Physics	Feb-Jun 2022	Sharma, Sayantan
Computational Physics	Feb-May 2022	HAZRA, Dhiraj Kumar
Statistical Mechanics	Feb-Jun 2022	Vemparala, Satyavani
Mathematical Methods I	Aug-Dec 2022	Rajesh, R.
Mathematical Methods II	Aug-Dec 2022	Ashok, Sujay K.
Quantum Mechanics - I	Aug-Nov 2022	Bagchi, Manjari
Statistical Mechanics II	Aug-Dec 2022	Chaudhuri, Pinaki P.
Advanced Condensed Matter	Jan-Mar 2023	Chaudhuri, Pinaki P.
Advanced condensed matter physics	Jan-May 2023	Coimbatore Balram, Ajit
Quantum Mechanics II	Jan-Apr 2023	Ghosh, Sibasish
Stochastic Processes	Jan-May 2023	Pal, Arnab

Theoretical Computer Science

Discrete Mathematics	Oct-Feb 2022	Arvind, V.
Theory of Computation	Oct-Feb 2022	Subramanian, C. R.
Extremal Combinatorics	Mar-Jul 2022	Mahajan, Meena B.
Algebraic Complexity Theory	Aug-Dec 2022	Ramya, C
Design and Analysis of Algorithms	Aug-Dec 2022	Raman, Venkatesh
Theory of Computation	Aug-Dec 2022	Subramanian, C. R.
Parameterized Complexity	Jan-Mar 2023	Raman, Venkatesh

Computational Biology

Biology-1	Oct-Feb 2022	Samal, Areejit
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2.6 Honours and Awards

Gun, S. was awarded President, (AOWM), for 2022, by the Continental organization for women in mathematics in Asia and Oceania for President of Asia-Oceania Women in Mathematics (AOWM), the continental organization for women in mathematics in Asia and Oceania.

Raman, Venkatesh was elected as President of ACM India for 2022-2024, by the ACM India. (<https://india.acm.org>).

Ravindran, Rajesh was elected as a Fellow of the Indian Academy of Sciences, for the year 2023.

A, Selvakumar was awarded NBHM Post-doctoral Fellowship, for 2022, by the NBHM.

HAZRA, Dhiraj Kumar was awarded N. R. Sen Young Researcher Award , for 2022, by the Indian Association for General Relativity and Gravitation.

HAZRA, Dhiraj Kumar received the Indo-Italy DST 3 year mobility grant as the Principal investigator.

HAZRA, Dhiraj Kumar received Indo-French CEFIPRA grant as joint collaborator for CSRP project no. 6704-1 – "Testing flavors of the early universe beyond vanilla models with cosmological observations"

HAZRA, Dhiraj Kumar as PI, received Indo-Italy mobility grant for the proposal "RELIC - Reconstructing Early and Late events In Cosmology ". DST sanction number: INT/Italy/P-39/2022 (ER).

HAZRA, Dhiraj Kumar as PI, received 2022 - 2023 Fulbright-Nehru Academic and Professional Excellence Fellowships.

Chapter 3

Other Professional Activities

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

Bagchi, Manjari

Lecturer at IMSc, Chennai on Aug 27, 2022. “Neutron stars: The best (natural) laboratories to do physics experiments”. Lecture to the school students attending the event “Stimulating High School Students Towards a Future in Basic Sciences” celebrating Azadi ka Amrit Mahotsav and 60 years of IMSc

Convener of Local Organising Committee for Program on astrophysics held at IMSc during Feb 1 – Feb 8, 2023.

Chaudhuri, Pinaki P.

Convener of Local Organising Committee for Frontiers in Non-Equilibrium Physics held at IMSc during Jan 17 – Jan 20, 2023.

Dixit, Anup B.

Member of Local Organising Committee for IMSc 60 Celebration held at IMSc during Jan 2 – Jan 5, 2023.

Industrial visit at IMSc on Feb 9, 2023. Hosted about 15 members of VIT, Vellore including faculty members and students at IMSc as part of their industrial program. Interaction with PhD students and short lectures by faculty members was arranged for the visitors.

Ghosh, Sibasish

Invited talk at Anna Centenary Library, Kotturpuram, Chennai on Oct 15, 2022. Gave a popular level talk entitled, “Quantum Entanglement” before a heterogeneous audience consisting of students, teachers, science enthusiasts, etc. – to give a brief description about the Nobel Prize in Physics for the year 2022.

Invited speaker at SRM Institute of Science and Technology, Kattankulathur, Tamilnadu. on Nov 19, 2022. Gave a talk entitled, “Introduction to quantum metrology and sensing” at the “6 days FDP on Enhanced Teaching, Learning and Research In Applied Physics 2022”, held during 17- 22 November, 2022 in SRM. 2022

Invited speaker at A. B. N. Seal College, Coochbehar, West Bengal on Mar 16, 2023. Gave a pedagogical talk on quantum operations and channels – in front of an audience consisting mostly of undergraduate students – in the “Topical Research School on Quantum Foundation and Quantum Information 2023”, held during 14-16 March, 2023.

Gun, S.

Managing Editor of IMSc monograph series during Apr 2015 – Mar 2023.

Editor of RMS newsletter during Jul 2019 – Dec 2022.

Member of Assessment Committee meeting of the Career Advancement Scheme (CAS) for faculty of the Department of Mathematical Sciences, IISER Mohali during Jul – Jul, 2022.

Member of Indian women in Mathematics Executive committee during Aug 2022 – Mar 2023.

Member of Expert panel for review of the Department of Mathematics and Statistics, IIT Kanpur during Sep – Sep, 2022.

Member of National Organising Committee for Chennai-Tirupati number theory conference held at Chennai Mathematical Institute during Feb 11 – Feb 12, 2023.

Kodiyalam, Vijay

Lecture on “Rotations and quaternions” at IMSc on Oct 10, 2022. Lecture for visiting college students

Mahajan, Meena B.

Member. Chair for the year 2022 of EATCS Presburger Award Committee during Oct 2019 – Jun 2022.

Member of Award Committee for Abacus Medal 2022 of the International Mathematics Union during Apr 2020 – Jun 2022.

Member of Programme Committee, 25th International Conference on Theory and Applications of Satisfiability Testing SAT 2022 during Feb – Aug, 2022.

Invited talk at Nehru Science Centre, Mumbai on Dec 24, 2022. As part of the National Mathematics Day Celebrations, gave a popular talk about the limits of computation to school children.

Pal, Arnab

Convener of Local Organising Committee for IMSc 60 held at IMSc during Jan 1, 2022 – Jan 5, 2023.

Convener of Local Organising Committee for Boltzmann Day held at IMSc on Jun 28, 2022.

Convener of National Organising Committee for Discussion Meeting On Statistical Physics and Complex Systems held at IIT Kharagpur during Jul 18 – Jul 20, 2022.

Convener of National Organising Committee for A short summer school on Nonlinear Physics and Statistical Physics held at IIT KGP during Jul 21 – Jul 23, 2022.

Convener of Local Organising Committee for Frontiers in Non-Equilibrium Physics (FNEP) held at IMSc during Jan 17 – Jan 20, 2023.

Convener of Local Organising Committee for IMSc - CELEBRATING 60 YEARS OF CREATIVE SCIENCE held at IMSc during Jan 2 – Jan 5, 2023.

Prasad, Amritanshu

Convener of National Organising Committee for Advanced Instructional School on Representation Theory held at Chennai Mathematical Institute during Jun 20 – Jul 9, 2022.

Convener of Local Organising Committee for Sage Days 114 held at IMSc during Jul 25 – Jul 27, 2022.

Member of Advisory Committee for 34th International Conference on Formal Power Series & Algebraic Combinatorics held at Indian Institute of Science, Bangalore during Jul 18 – Jul 22, 2022.

Convener of Local Organising Committee for Teachers Enrichment Workshop on Linear Algebra and Discrete Mathematics held at IMSc during Jan 23 – Jan 28, 2023.

Raghavan, K. N.

Lecture given to mathematics students and faculty at Presidency College, Chennai on Apr 26, 2022.

Secretary of Forum D'Analystes

Convener Southern Region of NBHM Library Committee

Associate Editor of Journal of the Ramanujan Mathematical Society

Member of Editorial Board of the Indian Journal of Pure and Applied Mathematics

Member of School Board for School of Physical Sciences, Central University of Karnataka

Member of Board of Studies (Mathematical Sciences) of HBNI

Member (Board), Chair (Exams) of National Board for Higher Mathematics

External Member of Board of the Department of Mathematics and Statistics, University of Hyderabad

Member of Research Council of the Kerala School of Mathematics

Member of Science Education Panel, Indian Academy of Sciences

Member of National Organising Committee for FPSAC 2022 held at Indian Institute of Science during Jul 18 – Jul 22, 2022.

Chair of AIS (Advanced Instructional School) Programme Committee of NCM (National Centre for Mathematics) during Aug 2022 – Mar 2023.

Lecture given to mathematics students and faculty at Stella Maris College, Chennai on Oct 17, 2022.

Office Bearer of CMI-NASI Chennai Chapter during Oct 2022 – Mar 2023.

Convener of National Organising Committee for Annual Foundational School-I (AFS-I) held at MEPCO SCHLENK Engineering College during Dec 5 – Dec 31, 2022.

Convener of Local Organising Committee for Winter Training Programme - II held at Ramanujan Institute for Advanced Study in Mathematics during Dec 7 – Dec 17, 2022.

IMU appointed member of Commission for Developing Countries (CDC) of the International Mathematical Union (IMU) during Jan – Mar, 2023.

Raman, Venkatesh

Member of Board of Studies in Computer Science at Stella Maris College, Chennai during Apr 2017 – Mar 2023.

Member of Board of Studies in Mathematics at PSG College of Technology, Coimbatore during Apr 2021 – Mar 2023.

President of ACM India Executive Council during Jun 2022 – Mar 2023.

Speaker at IIT Palakkad on Feb 18, 2023. Gave a talk on ‘Research Career: What? Why? How?’ in the ACM workshop on Research Career in Computer Science.

Srinivas, K.

Member of Editorial Board of Journal of Indian Mathematical Society

Managing Editor of Hardy Ramanujan Journal

Member of Research Publication Committee, RMS

Member of Board of Studies, NIT Pondicherry

Convener for TEW programmes of NCM Programme Committee

Member of Project Advisory Committee, DST

Member of Selection Committee, IIIT Kurnool during Jan – Jan, 2023.

Subramanian, C. R.

Member of Programme Committee of CALDAM-2023 during Apr 2022 – Feb 2023.

Viswanath, Sankaran

Member of Local Organising Committee for Sage Days 114 held at IMSc during Jul 25 – Jul 27, 2022.

Chapter 4

Colloquia

4.1 Conferences/Workshops Held at IMSc

4.1.1 Boltzmann Day on Jun 28, 2022.

The Boltzmann medal (or Boltzmann award) is a distinguished prize awarded to physicists for outstanding achievements in statistical physics; it is named after the physicist Ludwig Boltzmann. The "Boltzmann Day" at the Institute of Mathematical Sciences is to celebrate and honor the achievements of these eminent scientists. The lectures in this series are given by the awardees and are aimed at a general scientific audience.

This is a flagship event initiated by Arnab Pal for the first time at IMSc.



Figure 4.1: Prof. John Hopfield

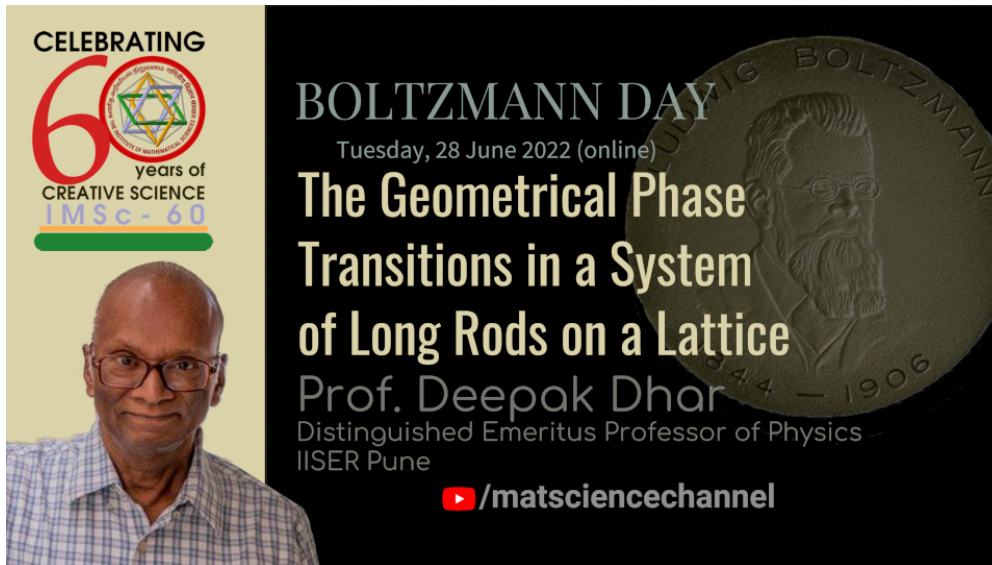


Figure 4.2: Prof. Deepak Dhar

4.1.2 Sage Days 114 during Jul 25 – Jul 27, 2022.

Sage Mathematical Software is python-based computer algebra software that is developed, maintained and used mainly by the mathematics research and teaching community. This workshop was meant to help participants use and contribute to Sage.

Organizers: Amritanshu Prasad, S. Viswanath

4.1.3 Teachers Enrichment Workshop on Linear Algebra and Discrete Mathematics during Jan 23 – Jan 28, 2023.

The objective of this workshop was to develop basic linear algebra in a conceptually, mathematically and pedagogically sound manner, and to illustrate applications to other areas. There was a special focus on applications to graph theory, and physical, geometric, computational and combinatorial aspects of the determinant.

4.1.4 Frontiers in Non-Equilibrium Physics (FNEP) during Jan 17 – Jan 20, 2023.

While the formalism of equilibrium physics is established in an elegant way within the Boltzmannian description, understanding of non-equilibrium systems remains elusive although they are prevalent in nature. For example, nonequilibrium is essential for fluid motions or sustaining life in a single cell. The last two decades have seen a tremendous growth on this subject and lots of efforts have been made to put forward unifying principles and general truths. This conference is to bring together leading and young scientists, early career researchers and students working in different areas of the broad field of non-equilibrium physics

in the pursuit of cross-talks across disciplines and promoting collaborations. The conference will not be restricted to certain areas but broad themes would be: random processes and applications, stochastic thermodynamics, non-equilibrium phenomena in soft and biophysics.

Organizing committee: Arnab Pal (IMSc) and Pinaki Chaudhuri (IMSc)

4.1.5 Program on astrophysics during Feb 1 – Feb 8, 2023.

This 8-day long program was divided into three parts:

(i) Neutron Stars: The celestial clocks that probe extreme physics an international conference in the hybrid mode during the period of 01-February-2023 (Wednesday) to 03-Feb-2023 (Friday).

(ii) Outreach event for school kids on 04-Feb-2023 (Saturday): This event had two talks "Pulsars: Timekeepers of the Cosmos" by Prof. Maura McLaughlin (WVU) and "How to become an astronomer" by Dr. Prerna Rana, followed by a quiz session. About 125 students (of class IX and XI) mostly from Kendriya Vidyalaya participated.

(iii) Discussion and work together meeting for the Indian Pulsar Timing Array consortium during the period of 06-February-2023 (Monday) to 08-Feb-2023 (Wednesday).

Organizer : Manjari Bagchi

4.2 Other Conferences/Workshops Organized by IMSc

4.2.1 Advanced Instructional School on Representation Theory during Jun 20 – Jul 9, 2022.

Representation Theory is the study realizations of groups as matrices. Having its origins in algebra and number theory, it is now a vast subject with links to Physics, Harmonic Analysis, Combinatorics, Chemistry, Differential Equations, Complexity Theory, etc.

This workshop focused on the representation theory of finite groups. Assuming that participants are familiar with groups, rings, and modules, the organizers developed the basic character theory of representations in characteristic zero. They discussed techniques for constructing representations of groups, specially Clifford theory. They also discuss projective representations of finite groups, the Frobenius-Schur index, and end with an introduction to representation theory in positive characteristic.

4.2.2 34th International Conference on Formal Power Series and Algebraic Combinatorics during Jul 18 – Jul 22, 2022 at IISc Bengaluru.

This is an annual international conference, which was held for the first time in India. Topics include all aspects of combinatorics and their relation to other parts of mathematics, physics, computer science, chemistry and biology.

Amritanshu Prasad was a member of the program committee. K. N. Raghavan and S. Viswanath were members of the organizing committee.

4.2.3 Discussion Meeting On Statistical Physics and Complex Systems during Jul 18 – Jul 20, 2022 at IIT Kharagpur.

The discussion meeting focused on equilibrium and non-equilibrium statistical physics (classical and quantum) and its applications to condensed matter systems; quantum field theories; active matter/soft matter/biology, fluids (strong and weak turbulence), dynamo, geophysical flows, astrophysical flows, etc.

Arnab Pal was the member of the Organizing Committee.

4.2.4 A short summer school on Nonlinear Physics and Statistical Physics during Jul 21 – Jul 23, 2022 at IIT Kharagpur.

Pedagogical school on a series of pedagogical lectures and expository research seminars. Lectures included:

Introduction to nonlinear dynamics, Pattern- forming instability in fluids.

Nonlinear phenomena in classical and quantum fields.

Solitary waves and Solitons. Non-topological and Topological solitons. Water waves. The KdV equation. Bäcklund transformation. Non-linear superposition and Multi soliton solutions. Sine-Gordon equation, Degenerate vacua. Topological solitons. Elementary Toda systems.

Introduction to Game Theory and Evolutionary Game Theory. Nonlinear Dynamics of Games. Replicator Equations: From Basics to Research Topics.

Non-equilibrium dynamics of quantum fields/systems.

Subject lectures were given by

- Krishna Kumar, IIT Kharagpur
- Krishnendu Sengupta, IACS Kolkata
- Sagar Chakraborty, IIT Kanpur
- Sugata Pratik Khastagir, IIT Kharagpur

Special lectures/research seminars were given by

- Arul Lakshminarayan, IIT Madras.
- Madan Rao, NCBS Bangalore
- Sanjay Puri, JNU New Delhi

4.2.5 Annual Foundational School-I (AFS-I) during Dec 5 – Dec 31, 2022.

AFS is conducted by National Centre for Mathematics. The main objectives of AFS are to bring up students with diverse background to a common level and help them acquire basic knowledge in these subjects required in Advanced Instructional Schools.

K. N. Raghavan was one of the organisers of the event. He was also a resource person for the first week of the four week programme.

For details, see https://www.imsc.res.in/~knr/past/AFS-I_2022_mepco/index.html

4.2.6 Winter Training Programme - II during Dec 7 – Dec 17, 2022.

Raghavan, K. N. helped to organise this programme which was sponsored by the CMI-NASI Chennai Chapter.

4.2.7 Chennai-Tirupati number theory conference during Feb 11 – Feb 12, 2023.

The Chennai-Tirupati Intercity Number Theory Conference is a two-day meeting, initiated by mathematicians from IMSc, CMI, IIT Madras, IISER Tirupati and IIT Tirupati who are working in number theory and related areas. The aim of the meeting is to foster interactions between mathematicians working at academic institutes located in Chennai and Tirupati. It also serves as a platform for graduate students and post-docs to announce and communicate their work to experts in the field.

Sanoli Gun was one of the organisers of the event.

<https://sites.google.com/view/inter-city-nt-conf-cmi/home>

4.3 IMSc 60 - Celebrating 60 years of Creative Science

The Institute of Mathematical Sciences (IMSc), founded by Alladi Ramakrishnan in 1962, is a national institution for research in frontier areas of computational biology, computer sciences, mathematics, and theoretical physics. The institute members are also actively engaged in training young researchers through a vibrant doctoral program and also sharing the wonders of theoretical and computational sciences with school and college students.

The year 2022 marked the 60th foundation year of the institute and had a year long scientific and outreach activities by honoring young and experienced scientists who have made fundamental contributions in their areas of research.

The kick-off event was inaugurated by Prof. V Ravindran, Director of the Institute on January 2, 2022. To mark this momentous occasion, a virtual event was organized by the institute to start a year-long celebration which will include lectures, conferences and academic events across all research groups.

The brief schedule for this IMSc60 kick-off event was as follows: Short address by Prof. V. Ravindran (Director, IMSc) Brief addresses by former Directors / Joint-Directors of IMSc, Prof. G. Rajasekaran, Prof. R. Ramachandran, Prof. R. Balasubramanian, and Prof. V. Arvind.

There were reminiscences of current and past members of the institute.

The event also consisted of the release of special volumes of the Tamil Nadu Science Forum (TNSF) science outreach magazines Thulir and Jantar Mantar featuring the contributions of IMSc members over the years. There was a poster exhibition that featured covers of the magazines and IMSc members in TNSF events.

Following these events, there was the inception of "The IMSc 60 colloquium series" that was designed with the aim of celebrating the 60th foundation year. The colloquia had wide variety of topics by both young and experienced researchers, who are working at the forefront in their respective fields of research. It was both online and offline talks by speakers across the globe. There were a total fifty nine distinguished seminars as a part of this series.

The year-long colloquium series was a huge success with gaining wide publicity and fostering interactions between the inhouse IMSc students, postdocs, faculty members and the eminent speakers.

Much of the details can be found here: <https://www.imsc.res.in/imsc60/>

As a part of this celebration, a flagship event namely "Boltzmann Day" was launched. The Boltzmann medal (or Boltzmann award) is a distinguished prize awarded to physicists for outstanding achievements in statistical physics; it is named after the physicist Ludwig Boltzmann. The "Boltzmann Day" at the Institute of Mathematical Sciences is to celebrate and honor the achievements of these eminent scientists. The lectures in this series are given by the awardees and are aimed at a general scientific audience. This took place on June 28, 2022 and the talks were given by the 2022 Boltzmann Awardees Prof. Deepak Dhar from TIFR Mumbai and Prof. John Hopfield from Princeton University. The program was coordinated by Arnab Pal.

Event details can also be found here: <https://www.imsc.res.in/imsc60/boltzmannday.html>

The IMSc60 foundation year ended on a high note with a flagship event namely "IMSc60 celebration" which took place during Jan 2-5, 2023. It was planned to celebrate all areas of science and bring together the scientific community encompassing scientists, nation-builders, policy-makers and research scholars not only to honor and recognize remarkable scientific contributions from the past but also to strengthen India's scientific vision for the next decade and help India lead the global research landscape.

Members of the IMSc60 committee were: Sanoli Gun, Anup Dixit, Ramya C, Rahul Sidharthan, Saket Saurabh, Sayantan Sharma, Arnab Pal, Areejit Samal, and V Ravindran.



Figure 4.3: Inaguration of IMSc 60 Celebrations on 2 January, 2023



Figure 4.4: Book release by TNSF for Children "Jantar Mantar" to commemorate IMSc60

There were 66 scientific talks including those by eminent scientists, invited faculty, IMSc faculty and a significant number by the IMSc students. These were in-person talks and were conducted at the Ramanujan Auditorium. Other than the scientific talks, we had a poster session, a Release of Special Cover and My Stamp by the Post-Master General Chennai Circle to commemorate IMSc60, a cultural dance event followed by family gathering over a banquet, and a book release by TNSF for Children "Jantar Mantar".



Figure 4.5: Release of Special Cover and My Stamp by the Post-Master General Chennai Circle to commemorate IMSc60



Figure 4.7: IMSc 60 Poster Session



Figure 4.8: Release of book titled "Kanithamethai Srinivasa Ramanujan : Valkaiyum Padaippum" authored by Prof. Srinivasa Rao

There was also a panel discussion on "Chennai as a Science hub" which had the following eminent panelists: Soumya Swaminathan (former DG ICMR, former Chief Scientist WHO), B Venkatraman (Director, IGCAR Kalpakkam), Smita Srivastava (faculty incharge, IIT Madras Bioincubator), Madhavan Mukund (Director, Chennai Mathematical Institute), Rajeeva Karandikar (former Director, CMI), GN Hariharan (Executive Director, MSSRF Chennai), V Ravindran (Director, IMSc Chennai).



Figure 4.6: panel discussion on "Chennai as a Science hub" on 2 January, 2023

IMSc and The Tamil Nadu Science forum (TNSF) held a book release event to celebrate World Book Day, on Saturday, April 23 at 10:30 am in the Ramanujan auditorium on the IMSc campus. TNSF brought out a set of books in Tamil to commemorate IMSc's 60th anniversary, and the first set of 7 books were released at this event. Mr. Sudhan (IAS), State Project Director of Samagra Shiksha, TN Education Department was the chief guest at this event.



Figure 4.9: IMSc and The Tamil Nadu Science forum (TNSF) held a book release event



Figure 4.10: 7 Mathematics books in Tamil

Overall, IMSc60 celebrations was a tremendous success and has aptly highlighted the immense contribution of our institute to Indian Science.

All the details of the program can be found here: <https://www.imsc.res.in/imsc60/celebration/>

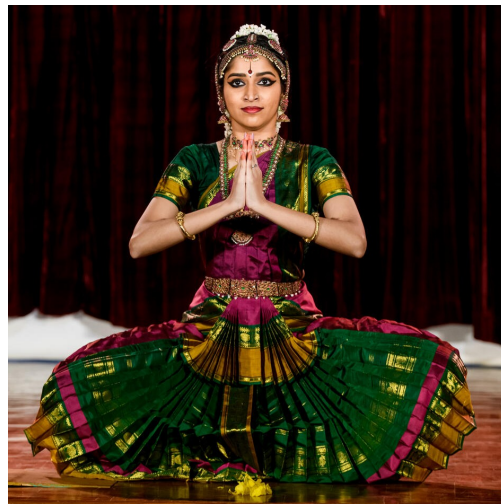


Figure 4.11: Cultural dance event by Smt. Sudharma Vaidyanathan

4.3.1 IMSc 60 Distinguished Lectures

Date	Speaker and Affiliation	Title of the Talk
18-04-2022	Prof. Loic Merel Institut de Mathematiques de Jussieu-Paris Rive Gauche, Universite Paris Cite, France	The elusive prediction of L-values https://youtu.be/hs7s9vfehJM
11-05-2022	Prof. N. D. Hari Dass Retd. Senior Professor, IMSc	Dispersion Relations: From Classical Optics to String Theory https://youtu.be/6BclcvZBOLw

13-05-2022 Prof. Dr. Frithjof Karsch
Bielefeld University

Supercomputing the properties of
strong interaction matter
<https://youtu.be/fXnUsoQZJz8>



Figure 4.12: Prof. Dr. Frithjof Karsch, Bielefeld University

18-05-2022 Prof. Rob Pisarski
Brookhaven National Laboratory

A Golden Age in High Energy Nuclear
Physics
<https://youtu.be/dmtxET6-hS0>

01-06-2022 Prof. Gert Aarts
ECT* Trento and Swansea
University

Machine learning for lattice field
theory and back
<https://youtu.be/eHYmkYrGpwg>

08-06-2022 Prof. Thomas Schaefer
North Carolina State University

The QCD critical point
https://youtu.be/U_medet81ew

15-06-2022 Prof. Gerald Dunne
University of Connecticut

Decoding the Path Integral:
Resurgence and Nonperturbative
Physics
<https://youtu.be/c0MKRX40dgw>

29-06-2022 Prof. Dr. Guy Moore
Technische Universität
Darmstadt

Topology at High Temperature from
the Lattice
<https://youtu.be/kEwJaZUFK8Q>

14-07-2022	Prof. Venkat Venkatasubramanian Center for the Management of Systemic Risk, Department of Chemical Engineering, Columbia University, New York	A unified theory of emergent equilibrium phenomena in active and passive matter https://youtu.be/faS7rFq81Ac
15-07-2022	Prof. Sougato Bose Department of Physics and Astronomy, University College London	Quantum Coherent Nature of Gravity through a Table-Top Experiment https://youtu.be/wttNXYJwkl4
27-07-2022	Prof. Barry Sanders Department of Physics and Astronomy, University of Calgary, Canada	Observing a changing Hilbert-space inner product https://youtu.be/IpT4RTc6lvs
10-08-2022	Prof. Krishnendu Sengupta Indian Association for the Cultivation of Science, Kolkata	Emulating strong correlation using ultracold atoms https://youtu.be/2peKF1yjOvQ
12-08-2022	Prof. Shailesh Chandrasekharan Duke University	Building our Universe with Qubits https://youtu.be/vElGIhVKy1k
19-08-2022	Prof. Ueli Grossniklaus Department of Plant and Microbial Biology, University of Zürich	Signaling Processes during Plant Reproduction https://youtu.be/hlRaIeJGaBM
07-09-2022	Prof. Antonio Gonzalez-Arroyo IFT UAM-CSIC, Universidad Autónoma de Madrid	The challenges of Yang-Mills theory https://youtu.be/iRsYpHs6Hxw
14-09-2022	Prof. Raju Venugopalan Brookhaven National Laboratory, New York	Classical lumps and their quantum descendants in Quantum Chromodynamics at high energies https://youtu.be/DJd-ZpJeT9w
16-09-2022	Prof. Ronnie Kosloff Institute of Chemistry, The Hebrew University, Jerusalem	Quantum thermal engines and quantum control https://youtu.be/AJqpS0Hf8Qc
20-09-2022	Prof. Jean-Marc Deshouillers University of Bordeaux	Results and Models: An Illustration through sum of cubes https://youtu.be/P-_Cevkp1zE

21-09-2022	Prof. V. Arvind Former Director and Professor (retd.), IMSc	The Graph Isomorphism Story https://youtu.be/z27-J-rsDzg
26-10-2022	Prof. Jayanta K Bhattacharjee School of Physical Sciences, IACS, Kolkata	Turbulence, Kolmogorov spectrum and its different variations https://youtu.be/AIqsH6Y7tec
14-11-2022	Prof. Dr. Antonio Acin ICFO-The Institute of Photonic Sciences, Barcelona	Certification of quantum technologies
16-11-2022	Prof. Andrew Forbes School of Physics, University of the Witwatersrand	Quantum mechanics with patterns of light
5-12-2022	Prof. Sudeshna Sinha Indian Institute of Science Education and Research Mohali	Chaos and Noise in the aid of Logic https://youtu.be/tbbXU0AEsaA
14-12-2022	Prof. Raman Parimala Arts and Sciences Distinguished Professor, Emory University	Quadratic forms over function fields https://youtu.be/uQ9nPcYHAHw
26-12-2022	Prof. M. Ram Murty Queen's Research Chair, Queen's University, Canada	Ramanujan and his legacy https://youtu.be/1LrTkqQJgWI
09-01-2023	Prof. Krishna Rajagopal William A. M. Burden Professor of Physics, MIT	Heavy Ion Collisions: What Next? https://youtu.be/YGN_0YZxJm0
16-01-2023	Prof. Subir Sachdev Herchel Smith Professor of Physics, Harvard University	Graphene flakes, strange metals, and black holes: insights from the SYK model
18-01-2023	Prof. Chandan Singh Dalawat Harish Chandra Research Institute, Prayagraj	The oldest problem

4.3.2 IMSc 60 Colloquium Series

Date	Speaker Affiliation	Title of the Talk
04-05-2022	Prof. Subhro Bhattacharjee International Center for Theoretical Sciences, TIFR, Bengaluru	Emergent Electromagnetism in Jammed Granular Solids https://youtu.be/ENf4w7OY8IQ
20-05-2022	Prof. Kabir Ramola Tata Institute of Fundamental Research, Hyderabad	Athermal Elasticity: From Crystalline to Amorphous Packings https://youtu.be/vWbfFeJI7DI
25-05-2022	Ayan Mukhopadhyay IIT Madras	Quantum channels and black holes https://youtu.be/fk555qJAjhY
18-07-2022	Prof. Hema Rajaram Head of Cyanobacterial Stress Biology and Biotechnology Section, Molecular Biology Division, BARC, Mumbai and Dean (Academic) Life Sciences, HBNI	Combating environmental stresses: Evolution from ancient cyanobacteria to modern day organisms https://youtu.be/yx24DC5U0z8
29-07-2022	Prof. Sumilan Banerjee Centre for Condensed Matter Theory, Department of Physics, Indian Institute of Science	Many-body chaos and dynamical transitions: Classical to quantum and back again https://youtu.be/DVVi0tRZhS0
03-08-2022	Prof. Basudeb Dasgupta Tata Institute of Fundamental Research	Fast Neutrino Oscillations: Beginning and End https://youtu.be/vPWMkYnwt08
05-08-2022	Prof. T. R. Govindarajan Retired Professor, IMSc	Geometry Beyond Riemann and Gravity Beyond Einstein https://youtu.be/PnyYP6zLhos
08-08-2022	Prof. Shamik Gupta Tata Institute of Fundamental Research Mumbai	From fireflies to power grids: The physics of spontaneous synchronization https://youtu.be/jI-PPIsjb-w

17-08-2022	Prof. Toru Kojo Tohoku University, Japan	Sound velocity peak as a signature of quark matter formation in neutron stars https://youtu.be/EdIxK8NEOlo
30-08-2022	Prof. Debasish Banerjee Theory Division, Saha Institute of Nuclear Physics	Exploring cousins of quantum electrodynamics using classical and quantum simulations https://youtu.be/OVBstMdSBIE
02-09-2022	Prof. Thomas Konrad University of KwaZulu-Natal, Durban, South Africa	Quantum Mechanics and Classical Optics: New ways to combine classical and quantum methods https://youtu.be/yDJaI-OeDtU
12-09-2022	Prof. Rajesh Singh Indian Institute of Technology Madras	Flow-induced bound states of active particles https://youtu.be/nhReD7QKMT8
23-09-2022	Prof. Rusa Mandal Indian Institute of Technology, Gandhinagar	What are the indirect hints of new physics telling us? https://youtu.be/05Vp6n-Edu4
26-09-2022	Prof. Sandhya Koushika Tata Institute of Fundamental Research Mumbai	Location and function of mitochondria in a neuronal process https://youtu.be/hW_pQCZ-m7g
07-10-2022	Prof. Rafal Demkowicz-Dobrzanski Faculty of Physics, University of Warsaw	Quantum Technologies A.D. 2022 https://youtu.be/73zO0gk0gIo
12-10-2022	Dr. Archishman Raju National Center For Biological Sciences, Bengaluru	Geometric models of cell fate specification https://youtu.be/D739OHdsEfI
18-11-2022	Prof. Narayan Rana Indian Institute of Technology Kanpur	Precision physics and perturbative calculation https://youtu.be/0xzbJsyVVVk
23-11-2022	Prof. Jan Steinhoff Max Planck Institute for Gravitational Physics, Potsdam	New perspectives on the relativistic binary problem
24-11-2022	Prof. Nicole Yunger Halpern NIST, QuICS and University of Maryland	Quantum steampunk: Quantum information meets thermodynamics

02-12-2022	Prof. Ranjan Laha CHEP, Indian Institute of Science	Dark matter and its indirect detection https://youtu.be/YYM6HRbxqso
07-12-2022	Prof. Diptarka Das Indian Institute of Technology Kanpur	Universal aspects of quenches in quantum theories https://youtu.be/UGDwzs5rnJU
08-12-2022	Prof. Shiv K. Sethi Raman Research Institute, Bengaluru	21cm cosmology: scope and prospects https://youtu.be/FjH4d_O8YnM
19-12-2022	Prof. Aparna Baskaran Physics Department, Brandeis University	From molecules to moduli: Data driven approaches to understanding active materials
20-12-2022	Prof. Fabio Finelli INAF OAS and INFN -Sezione di Bologna	The observational status of cosmic inflation and perspectives for future observations https://youtu.be/sp8UmWRw0ME
21-12-2022	Prof. Taushif Ahmed University of Regensburg, Germany	A tour to subatomic world through precision quantum chromodynamics
28-12-2022	Prof. Diptimoy Ghosh Indian Institute of Science Education and Research Pune	Boundaries of Quantum Field Theories https://youtu.be/gzjKQPpMYk
13-01-2022	Prof. Satyanarayan Mukhopadhyay Indian Association for the Cultivation of Science, Kolkata	Particle dark matter Thermal and non-thermal production mechanisms https://youtu.be/8nrxKpIuNks
24-01-2022	Prof. Sundar Srinivasan National Autonomous University of Mexico	The Nearby Evolved Stars Survey
25-01-2022	Prof. Sthitadhi Roy International Center for Theoretical Sciences, TIFR	Dynamical phases of quantum matter in measurement-unitary hybrid dynamics https://youtu.be/IEscBbzIVA

4.3.3 IMSc 60 Celebrations (Jan 2-5, 2023)

Date	Speaker and Affiliation	Title of the Talk
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02-01-2023	R. Chidambaram Former DAE chairman, Former PSA, GoI	Importance of Mathematics to other Sciences https://youtu.be/ag-CiAD22J4
02-01-2023	R. Balasubramanian Former Director, IMSc	Analytic Number theory in India https://youtu.be/no6jZHWQTVw
02-01-2023	P.D. Naik Officiating VC, Dean, HBNI	Homi Bhabha National Institute https://youtu.be/euIFdJvUIIU
02-01-2023	Rohini Godbole IISc Bengaluru	Light on light supersymmetric Dark Matter https://youtu.be/PxTl0ENk6aI
02-01-2023	T. Ramasami Former Director CSIR-CLRI, Former Secretary, DST	Changing Landscape of Indian science https://youtu.be/mRltGLoNNK0
02-01-2023	Sudeshna Sinha Deputy Director, IISER Mohali	Complex Systems: Surprises from the Interplay of Order and Disorder https://youtu.be/ZdPkQYf-2jE
02-01-2023	Gautam Bhattacharyya Director, SINP	A brief history of the Higgs boson https://youtu.be/Li.Ql1piT2A
02-01-2023	Vijay Kodyalam IMSc	Picture invariants and their applications https://youtu.be/-76nGVv2fb4
02-01-2023	Amritanshu Prasad IMSc	Kronecker Hecke Algebras https://youtu.be/QLcHEdzkqBM
02-01-2023	Manjari Bagchi IMSc	Studying gravitational physics using pulsars https://youtu.be/DntAKFCYehE
02-01-2023	Krishna Maddaly Ashoka University	Regularity of the Density of States https://youtu.be/wGsYqlGXJy0
02-01-2023	Debajyoti Choudhury University of Delhi	Evolution and Universe: Two wild thoughts https://youtu.be/hO_PqZQpsh4
02-01-2023	Manas Mandal IMSc	Cohomology of generalised Dold spaces https://youtu.be/eWINXr703_M

02-01-2023	Hitesh Garg IMSc	The conformational phase diagram of neutral polymers in attractive crowders https://youtu.be/3_TF55dYW7s
02-01-2023	Pavitra S IMSc	Clade Identification and Understanding the Evolutionary Trajectory of <i>Candida auris</i> through Genome Rearrangements https://youtu.be/Rk8lSYddorw
02-01-2023	Ajay Subbaroyan IMSc	Simple regulatory logic appears to drive complex cellular decisions https://youtu.be/wqqUC2nTy_8
02-01-2023	K. VijayRaghavan Former Director, NCBS Bengaluru, Former PSA, GoI	Cells and circuits in the making of the brain https://youtu.be/dGiTfYB8XtM
03-01-2023	V. Arvind Former Director, IMSc	Arithmetic complexity in the noncommutative world https://youtu.be/2WuQgpE1WW4
03-01-2023	Saket Saurabh IMSc	My kutti PC Story! https://youtu.be/OrLPK64rSsI
03-01-2023	V. Balaji CMI	Degenerations and deformations in algebraic geometry https://youtu.be/ggG0gn_Lmdw
03-01-2023	Asmita Mukherjee IIT Bombay	Nucleon Tomography in J/psi: Production at the Future Electron-ion Collider https://youtu.be/zymT9O2yd6w

03-01-2023 **Panel discussion on Chennai as a Science Hub**

Panelist : G.N. Hariharan, Executive Director, MSSRF.

Panelist : Rajeeva Karandikar Former Director, CMI.

Panelist : Madhavan Mukund Director, CMI.

Panelist : V. Ravindran Director, IMSc.

Panelist : Smita Srivastava Faculty-in-charge, IITM Biocubator.

Panelist : Soumya Swaminathan Former DG ICMR, Former Chief Scientist WHO.

Panelist : B. Venkatraman Director, IGCAR.

03-01-2023	Jayaram Chengalur Director, TIFR Mumbai	Evolution of gas in star forming galaxies https://youtu.be/zrOWmxbm-vQ
03-01-2023	Sitender Kashyap IMSc	How physicists can arrive at new mathematical identities - an example using string theory https://youtu.be/aigGMuU35jI
03-01-2023	Tanumoy Mandal IISER Thiruvananthapuram	Mind the gap: unconventional searches for vectorlike quarks https://youtu.be/IK-rc4hjNR8
03-01-2023	G. Natarajan Post Master General Chennai Circle	Release of Special Cover and My Stamp https://youtu.be/GvZEbltKDsM
03-01-2023	Pooja Singla IIT Kanpur	Group determinants and Representation theory of finite groups https://youtu.be/gprL-JBa0bE
03-01-2023	Kapil Paranjape IISER Mohali	Cycles in Chennai https://youtu.be/M2bPp2W3VIM
03-01-2023	Pratyusha Chattopadhyay BITS Hyderabad	Elementary linear groups, Suslin's normality theorem, and beyond https://youtu.be/QYLXASGUzmw
03-01-2023	Mithun Mitra IIT Bombay	A fine balance: Optimal behaviour in biological systems https://youtu.be/qq6fYgtwzmk
03-01-2023	Sudharma Vaithiyanathan	Cultural event: Bharathanatyam Dance Recital
04-01-2023	V. Srinivas TIFR Mumbai, Chair NBHM Board	What are the Bloch-Beilinson Conjectures?
04-01-2023	Sandhya Koushika TIFR Mumbai	Regulation of axonal transport: conversations between a biologist and a physicist
04-01-2023	Shiraz Minwalla TIFR Mumbai	Nontrivially Gapped QFTs
04-01-2023	Gautam Menon Ashoka University and IMSc	Infectious Diseases, Policy and the Social Determinants of Health
04-01-2023	Nitin Saxena IIT Kanpur	How to factor objects?

04-01-2023	Sudeshna Kolay IIT Kharagpur	Specialisations of Euclidean Steiner Tree and Generalizations of Rectilinear Steiner Tree
04-01-2023	Supratik Chakraborty IIT Bombay	On Computability and Synthesizability of Skolem Functions
04-01-2023	Arnab Pal IMSc	The benefits of reset or starting anew
04-01-2023	Anup Dixit IMSc	A classy invariant
04-01-2023	S. Viswanath IMSc	Refinements of Littlewood-Richardson coefficients and saturation
04-01-2023	Mythily Ramaswamy ICTS-TIFR Bengaluru	Differential Equations - a glimpse
04-01-2023	Umesh Waghmare JNCASR Bengaluru, President Indian Academy of Sciences	Metavalent Bonding Origins of Unusual Properties of Group IV Chalcogenides
04-01-2023	Namitha CH IMSc	Decomposable Product Systems-A brief glance
04-01-2023	Anannya Upasana IMSc	When approximation fails, try parameterized approximation
05-01-2023	T.R. Ramadas CMI, Chair NCM Apex committee	Symplectic Geometry of $SU(2)$ character varieties and lattice gauge theory
05-01-2023	Vikram Sharma IMSc	Automata and Transcendence
05-01-2023	Jaya Mukherjee BARC Mumbai, Member secretary NBHM	Salient Research and Development in Non-Nuclear Domain by BARC and BTDG
05-01-2023	Karteek Sreenivasaiah IIT Hyderabad	What is randomness?
05-01-2023	Shivam Gola IMSc	Dark matter from particle physics perspective
05-01-2023	Suprabh Prakash IMSc	Sterile neutrino searches with a deuterated liquid scintillator
05-01-2023	Apurba Biswas IMSc	Anomalous relaxation in non-equilibrium systems

05-01-2023	Vinod Mamale IMSc	Effect of Fluctuations on Symmetry and Fields
05-01-2023	Sunil Naik IMSc	Ramanujan tau function and its prime factors
05-01-2023	Nirmalya Kajuri IIT Mandi	Black hole information loss: modern developments
05-01-2023	Release of special volume of the Tamil Nadu Science Forum (TNSF) science outreach magazine Jantar Mantar featuring the contributions of IMSc members over the years	
05-01-2023	Naveen Garg IIT Delhi	Locating Charging Stations
05-01-2023	Rukmini Dey ICTS-TIFR Bengaluru	Minimal surfaces
05-01-2023	Sushmita Venugopalan IMSc	Counting curves tropically
05-01-2023	Biswajyoti Saha IIT Delhi	Multiple zeta functions, analytic and arithmetic theory
05-01-2023	Anirban Mukhopadhyay IMSc	Beyond uniform distribution
05-01-2023	Jaya N Iyer IMSc	Invariants in Algebraic Geometry
05-01-2023	Debabrata Adak IMSc	First 10^{-32} seconds of our Universe
05-01-2023	Himanshu Badhani IMSc	Non-Hermitian PT-symmetric Quantum walks
05-01-2023	Yogesh Dahiya IMSc	Time and Space complexity of Query Algorithms
05-01-2023	Debabrata Deb IMSc	Study the effects of anisotropy on the highly magnetized white dwarfs
05-01-2023	Aman Abhishek IMSc	Understanding QCD thermodynamics from nuclear models
05-01-2023	Arkaprabha Ghoshal IMSc	Local Identification of Subsets of Quantum states: A Stronger Quantum Nonlocality

4.4 Azadi Ka Amrit Mahotsav (AKAM)

The Institute of Mathematical Sciences (IMSc), Chennai, is celebrating the 75th anniversary of India's independence with a year-long calendar of popular scientific talks, a line-up of distinguished lectures, public outreach programmes, exhibitions and educational initiatives.

The following are some of the programs organized during 2022-2023 :

4.4.1 DAE Iconic Week (22-28 August 2022)

As part of Azadi Ka Amrit Mahotsav, the Ministry of Culture, Government of India, has allotted the week of 22-28 August 2022 as an Iconic Week for the Department of Atomic Energy (DAE) to showcase the achievements of the department. IMSc is an autonomous institution funded by DAE and we are proud to celebrate the DAE Iconic Week with the following activities organised by the Institute, during 22-28 August 2022.

Date	Speaker and Affiliation	Title of the Talk
22-08-2022	Ramakrishna Mission Vivekananda College, Mylapore, Chennai	Interdisciplinary research opportunities at IMSc and invitation to DAE Iconic week celebrations
22-08-2022	VKK Ammani Ammal Matriculation School, Pammal, Chennai.	Information session for school students titled: (Ningal Ariyadha Ariviyal Paadhai)



Figure 4.13: Information session for school students titled: (Ningal Ariyadha Ariviyal Paadhai)

23-08-2022	Ramakrishna Mission Vivekananda College, Mylapore, Chennai.	Interdisciplinary research opportunities at IMSc and invitation to DAE Iconic week celebrations
23-08-2022	Prof. G. Amarendra Raja Ramanna Fellow, Nuclear Fuel Complex, Hyderabad and Homi Bhabha National Institute	A legend lives on - The story of Homi Jehangir Bhabha https://youtu.be/fMmujsBIvm4
24-08-2022	Dr. Kuber Bhainsa Scientific Officer G, Nuclear Agriculture and Biotechnology Division, Bhabha Atomic Research Centre, Mumbai	Development of BARC-Hydrogel: Improving Water Economy in Plantation and Agriculture https://youtu.be/1bG2mUQZcGY
24-08-2022	Prof. V. Kamakoti Director, Indian Institute of Technology Madras, Chennai	Research and Education in Emerging and Disruptive Technologies https://youtu.be/DDSsLiTrASK



Figure 4.14: Prof. V. Kamakoti, Director, Indian Institute of Technology Madras

25-08-2022	Prof. R. Parthasarathy Retired Professor, IMSc, Chennai	Alladi Ramakrishnan - Theoretical Physicist https://youtu.be/BUBR9Ogpgu0
26-08-2022	Savitri Ammal Oriental Higher Secondary School, Mylapore, Chennai.	Information session for high school students titled: (Ningal Ariyadha Ariviyal Paadhai)
26-08-2022	Prof. Sreerup Raychaudhuri Tata Institute of Fundamental Research, Mumbai	Evolution of Modern Science in India https://youtu.be/wU0exoOk1Ns



Figure 4.15: Prof. Sreerup Raychaudhuri, Tata Institute of Fundamental Research, Mumbai

27-08-2022 Ramanujan Auditorium,
IMSc Chennai.

Stimulating high school students
towards a future in basic sciences
<https://youtu.be/AHJeQLojQQA>



Figure 4.16: Stimulating high school students towards a future in basic sciences

28-08-2022 Prof. S.G. Dani
UM-DAE Centre for Excellence
in Basic Sciences,
Mumbai

Glimpses of India's Mathematical
Heritage
https://youtu.be/Ndt_pI-nlaY

4.4.2 AKAM - Distinguished Lectures

Date	Speaker and Affiliation	Title of the Talk
06-05-2022	Prof. R. Balasubramanian The Institute of Mathematical Sciences (IMSc), Chennai, India	Number theory in India after Ramanujan https://youtu.be/LfR1Sf1xFhM
02-08-2022	Prof. Vivek M. Datar The Institute of Mathematical Sciences (IMSc), Chennai, India	A journey in nuclear physics and its intersections with high energy physics https://youtu.be/mYJif7itF4
24-08-2022	Prof. V. Kamakoti Director, Indian Institute of Technology Madras, Chennai	Research and Education in Emerging and Disruptive Technologies https://youtu.be/DDSsLiTrASk
25-08-2022	Prof. R. Parthasarathy The Institute of Mathematical Sciences (IMSc), Chennai, India	Alladi Ramakrishnan - Theoretical Physicist https://youtu.be/BUBR9Ogpgu0
25-08-2022	Prof. Vinay Nandicoori Director, CSIR - Centre for Cellular and Molecular Biology, Hyderabad	Delineating survival strategies employed by Mycobacterium tuberculosis https://youtu.be/bmbbmNIy-xc

4.4.3 AKAM - Heritage Lectures

Date	Speaker and Affiliation	Title of the Talk
23-08-2022	Prof. G. Amarendra Raja Ramanna Fellow, Nuclear Fuel Complex, Hyderabad and Homi Bhabha National Institute	A legend lives on - The story of Homi Jehangir Bhabha https://youtu.be/fMmujsBIvm4

26-08-2022	Prof. Sreerup Raychaudhuri Department of Theoretical Physics, Tata Institute of Fundamental Research, Mumbai	Evolution of Modern Science in India https://youtu.be/wU0exoOk1Ns
28-08-2022	Prof. S. G. Dani UM-DAE Centre for Excellence in Basic Sciences (CBS), Mumbai	Glimpses of India's Mathematical Heritage https://youtu.be/Ndt_pI-nlaY
04-11-2022	Prof. L. Sriramkumar Department of Physics, Indian Institute of Technology Madras, Chennai	Forces of nature: Padmanabhan and gravitation https://youtu.be/vIqTLF7hd6o

4.4.4 AKAM - Popular Lectures

Date	Speaker and Affiliation	Title of the Talk
13-04-2022	Prof. Manjari Bagchi The Institute of Mathematical Sciences (IMSc), Chennai, India	Using undead stars as natural laboratories to understand theories of physics https://youtu.be/JCz9woGr1ho
17-06-2022	Prof. Venkatesh Raman The Institute of Mathematical Sciences (IMSc), Chennai, India	Succinct representations https://youtu.be/ESJVQT6RIAc
21-06-2022	Prof. R. Ganesh Brock University, Canada	Emergence and indecision – the physics of quantum magnets https://youtu.be/nwjFLx52pi4
15-11-2022	Prof. Smita Srivastava Department of Biotechnology, Indian Institute of Technology Madras, Chennai	Microbial and plant bio-factories for sustainable production of high-value low-volume Phytochemicals: Need for a rational and integrated approach https://youtu.be/WMx4K1DjjUk
21-06-2022	Mr. Krish Ashok Global Head, Digital Workspace for Tata Consultancy Services	Masala Lab – the science of Indian cooking

4.5 Outreach Activities

IMSc Ganakam program:

IMSc students have been running a weekend program for children of Kanagam village to help them with school work etc. The general plan is to help children with whatever they want to learn! Currently, IMSc volunteers help children with languages (English, Hindi), Maths/Science HW/doubts, basic programming (with use of computer lab) as well as some fun activity/experiment sessions. The program runs every Saturday (4:30-6:00pm) and Sunday (3:30-6:00pm) and has been regularly attended by 20 students from 5th-12th std.

Organizers: IMSc students

Zero Shadow Day: (24 April, 2022)

Zero Shadow Day is a phenomenon which occurs twice a year when the sun is directly overhead at each latitude in the tropics. IMSc organized a public event on Elliot's Beach, Besant Nagar on 24 April (ZSD in Chennai) for the public to understand and observe the phenomena.

The poster for ZSD: https://www.imsc.res.in/outreach/resources/ZSD_poster.pdf The event was also covered by the NDTV: <https://youtu.be/LZatszRn3wA>

Organizers: Manikandan Sambavasivan and Varuni P

Foldscope workshop (Madurai): (05-06 May, 2022)

A Foldscope (<https://foldscope.com/>) is an optical microscope that can be assembled from simple components: a sheet of paper and a lens (magnification 140X). Foldscopes are distributed by Foldscope Instruments. which aims to make science accessible to all. We conducted a two day Foldscope training workshop for teachers (32) and middle school students (85+) from Government schools in and around Madurai. Over the course of the workshop, participants assembled and used Foldscopes to observe, document and study microscopic objects around them. This workshop highlighted observation and documentation of plant related materials including pollen, stomata, other stem & leaf structures.

Organizers: Manikandan Sambavasivan, Mo. Pandiarajan (Thulir Science Centre) and Varuni P.

Vigyan Pratibha Teachers Workshop (Tamil): (16-20 August, 2022)

IMSc organized a 3-day local teachers workshop for the Vigyan Pratibha program, a Government of India program to nurture talent in Science and Mathematics among VIII - X students. The workshop was attended by 31 teachers from mainly from Tamil Nadu government schools in and around Chennai. The program also included the release of the bilingual (English and Tamil) version of the Vigyan Pratibha Class 8 Teachers booklet.



Figure 4.17: Vigyan Pratibha Teachers Workshop (Tamil): (16-20 August, 2022)

Organizers: K. N. Raghavan, Manikandan Sambavasivan, Varuni P, S. Viswanath
 Speakers: Arun Kumar (IITM), I. K. Lenin Tamilkovan (Periyar Science and Technology Centre), R. Ramanujam (rtd IMSc, Azim Premji University), Manikandan Sambasivam, Subashri V, K. Subramaniam (HBCSE), Uthra Dorairajan (D G Vaishnav College), Varuni P, Gummdigampatti Youvaraj (Ramanujan Institute for Advanced Study in Mathematics)
 Details: <https://www.imsc.res.in/outreach/vpchennai/TWChTam2022.html>

Vigyan Pratibha Teachers Workshop (English): (21-23 August, 2022)

IMSc organized a 5-day regional teachers workshop for the Vigyan Pratibha program, a Government of India program to nurture talent in Science and Mathematics among VIII - X students. The workshop was attended by 39 teachers from central government schools (KVs and JNVs) from the southern region. The program included a trip to the Periyar Science and Technology Centre, Chennai

Organizers: K. N. Raghavan, Manikandan Sambavasivan, Varuni P, S. Viswanath
 Speakers: Aaloka Kanhere (educationalist), Adithi Muralidhar (HBCSE), Anand Vaidya (TIFR-H), Arun Kumar (IITM), Vadnala Rakesh Netha, R. Ramanujam (rtd IMSc, Azim Premji University), T. Rukmani (KVS), Manikandan Sambasivam, Subashri V, Sulochana R (HBCSE), Sushma Rawool (Educational Initiatives), Uthra Dorairajan (D G Vaishnav College), Varuni P.
 Details: <https://www.imsc.res.in/outreach/vpchennai/TWChEng2022.html>

Vigyan Pratibha KV school visits : August 2022 onwards

The Vigyan Pratibha program is a Government of India program to nurture talent in Science

and Mathematics among VIII - X students. The program is carried out mainly in the form of " Learning Units" (LUs) prepared by science and mathematics educators in partnership with scientists from various institutions which expose students to the processes of observation, analysis, critical thinking and collective learning. These LUs consist of student worksheets and teacher notes which teachers can use as a resource to plan and conduct sessions in their classrooms. To facilitate this, we have been visiting various KVs to help teachers conduct sessions with their students.

Details: <https://www.imsc.res.in/outreach/vpchennai/schoolvisits.html>

Vigyan Pratibha Teachers Workshop @University of Calicut: (21-23 September, 2022)

IMSc co-organized a 3-day regional teachers workshop for the Vigyan Pratibha program, a Government of India program to nurture talent in Science and Mathematics among VIII - X students. The workshop was co-organized and hosted by the Department of Mathematics, University of Calicut, Mallapuram, Kerala. The workshop was attended by 41 teachers from KVs (Ernakulam region) and local government schools. The program included a trip to the Botanical garden in the University of Calicut.

Organizers: K. N. Raghavan, Manikandan Sambavasivan, Prasad T (UoC), Anil Kumar (UoC), Varuni P, S. Viswanath

Speakers: Anand Vaidya (TIFR-H), Jayasree S (HBCSE), Manikandan Sambasivam, Manish Jaiswal (TIFR-H), Sarath Sasi (IIT Palakkad), Varuni P.

Details: <https://www.imsc.res.in/outreach/vpchennai/TWKer2022.html>

Foundations Program for MSc students: (11-29 September, 2022)

A research foundations program for MSc students in Mathematics was conducted. The goal of the program was to strengthen foundations and provide research exposure to the participants. It was attended by 52 students (47 University of Madras, 5 Patrician College of Arts and Science). The program consisted of lectures and tutorial sessions.

Organizers: Velmurugan S, K. N. Raghavan

Speakers: Amri, Anirban, Aryan, Abhirup, Arun Kumar (IIT Madras faculty), Dhananjaya, Jayakumar, Manav, Manikandan, Mithun, Praveen (IISER Mohali), Soumyadip, Sathish, Selvakumar, Srin, Subhankar, Sushant

Facets 2022: (29 & 30 September, 2022)

Facets is the Institutes's outreach program for advanced undergraduate and postgraduate students of mathematics. This 2 day program is intended for mathematics students to interact with professional mathematicians working in research. Topics of lectures ranged from mathematical applications to linguistics to cartography. This year, over 120 students attended this program.

Organizer: Sushmita V, Varuni P.

Speakers: C. Aiswarya (CMI), Anup Dixit, Kripa Gowrishankar (Azim Premji University), Pinaki Chaudhuri, K. N. Raghavan, Srikumar K. Subramanian (Krea University), Vijay Ravikumar.

Details: <https://www.imsc.res.in/outreach/facets2022/>

Vigyan Pratibha Regional Workshop (KVS & JNV): (10–13 January, 2023)

IMSc organized a 4-day follow up workshop for teachers in the Vigyan Pratibha program, a Government of India program to nurture of talent in Science and Mathematics among VIII - X students. The workshop was attended by 35 teachers from central government schools (KVs and JNVs) from the southern region.

Organizers: K. N. Raghavan, Manikandan Sambavasivan, Varuni P, S. Viswanath

Details/photos: <https://www.imsc.res.in/outreach/vpchennai/TWChEng2023.html>

Teacher’s Enrichment Workshop: (23–28 January, 2023)

Workshop for mathematics teachers of Engineering colleges focusing on Linear algebra and discrete mathematics.

Organizers: Amritanshu Prasad, K. Srinivas

Darwin Day: (12 February, 2023)

To mark Darwin Day, the birth anniversary of Charles Darwin, IMSc and TNSF volunteers organised a with public event at Elliots Beach (Chennai) to raise awareness among students, teachers and the general public about the topic of Evolution and Natural Selection.

Details/photos: <https://www.imsc.res.in/outreach/DD2023/>

Science at the Sabha (19 February, 2023)

Science at the Sabha 2023” was conducted on Sunday, 19 February, 4:00-7:30 pm at The Music Academy (TTK Auditorium). ”Science at the Sabha” is a set of four public talks on different aspects of science and is part of the Institute of Mathematical Sciences, ongoing program of outreach to the general public. This was the 6th edition of this flagship event conducted in February of each year at this venue. The event was attended by 500-700 people. The talks were aimed at anyone with an interest in science, irrespective of age or background. This year the talks were:

- **Black holes through different windows** by **Parameswaran Ajith**, International Centre for Theoretical Sciences, Bengaluru.
- **Ayurveda and modern medicine: the beginning of a molecular conversation** by **Mitali Mukerji**, Indian Institute of Technology Jodhpur.
- **The Quest for Automating Mathematics** by **Siddhartha Gadgil**, Indian Institute of Science, Bangalore.

- **Carnatic Music Processing: A Culture Specific Approach** by **Hema A Murthy**, Indian Institute of Technology Madras.

There was also a poster series exhibited in the foyer describing research work from various IMSc members.

<https://www.imsc.res.in/triveni/2023/>



Figure 4.18: Speakers : Science at the Sabha, 19 February, 2023

Vanavil Mandram IMSc visit: (21 March 2023)

150 students (Class 6 to 8) from various parts of Tamil Nadu visited IMSc as part of Vaanavil Mandram, an initiative by the TN School Education Department.

Speakers: Disha Kuzhively, G Arun Kumar (IITM) and IMSc volunteers

Organizers: Amritanshu Prasad, Disha Kuzhively, Manikandan Sambasivam, Varuni P.

Detailsphotos: <https://www.imsc.res.in/outreach/VM2023/>

4.6 Seminars

Date	Speaker Affiliation	Title
1-4-2022	Andrzej Hryczuk National Centre for Nuclear Research, Warsaw	Developments in dark matter relic abundance calculations
1-4-2022	Naveen Prabhakar ICTS-TIFR	A Hilbert space for large N Chern-Simons matter theories
4-4-2022	Loic Merel Institut de Mathematiques de Jussieu-Paris Rive Gauche, Universite de Paris	Eisenstein cycles and Manin-Drinfeld properties
5-4-2022	Pratik Tarafdar IMSc	3.5 years of Indian Pulsar Timing Array: data release for the international effort to detect nanoHz gravitational waves and other sciences
6-4-2022	Loic Merel Institut de Mathematiques de Jussieu-Paris Rive Gauche, Universite de Paris	Eisenstein cycles and Manin-Drinfeld properties
6-4-2022	Ranjani Seshadri Department of Physics, Ben-Gurion University of the Negev, Beer-Sheva, Israel	Josephson Junction of Nodal Superconductors
7-4-2022	Sayan Chakraborty ISI Kolkata	Classification of crossed product C*-algebras of noncommutative tori by cyclic groups
11-4-2022	Nihar Ranjan Sahoo Shandong University	Studying inner-working of Quark-Gluon Plasma by photon+jet measurement at RHIC
13-4-2022	Manjari Bagchi IMSc, Chennai	Using undead stars as natural laboratories to understand theories of physics
18-4-2022	Loic Merel Institut de Mathematiques de Jussieu-Paris Rive Gauche, Universite Paris Cite	The elusive prediction of L-values

22-4-2022	Rohitashwa Chattopadhyay IMSc Chennai	Modelling inter-group competitions via minority games
22-4-2022	Biswajit Karmakar University of Silesia in Katowice, Poland	Neutrinos and flavor symmetries
26-4-2022	Ramit Das IMSc	A Logical Study of Improvement Graphs formed from Games
28-4-2022	Vinay Kumaraswamy TIFR	Quantitative Diophantine approximation for generic ternary diagonal forms
28-4-2022	Hugh Thomas Universite du Quebec a Montreal	The Robinson–Schensted–Knuth correspondence via quiver representations
4-5-2022	Subhro Bhattacharjee ICTS-TIFR Bengaluru	Emergent electromagnetism in Jammed granular solids
5-5-2022	Ashutosh Dubey IIT Delhi	Probability distribution functions of relevant first passage Brownian functionals: Few case studies for classical systems and extension for a quantum case
5-5-2022	Shraddha Srivastava Uppsala University	Diagram categories and reduced Kronecker coefficients
6-5-2022	R Balasubramanian IMSc, Chennai	Number theory in India after Ramanujan
6-5-2022	Dr. Pinaki Swain McGill University	Modeling biological polymers: size of the bacterial chromosome, and phase separation of proteins
6-5-2022	IMSc Chennai	CSR Interaction with Prof. Rajeeva Karandikar
9-5-2022	N. D. Hari Dass Retd. Senior Professor, IMSc	Lectures on Non-Perturbative Quantum Field Theories
10-5-2022	N. D. Hari Dass Retd. Senior Professor, IMSc	Lectures on Non-Perturbative Quantum Field Theories
11-5-2022	N. D. Hari Dass Retd. Senior Professor, IMSc	Dispersion Relations: From Classical Optics to String Theory
11-5-2022	Prof. Shankar Mukherji Washington University	Building the cell from unreliable parts: the case of stochastic organelle biogenesis

11-5-2022	Abhranil Chatterjee IIT, Bombay	New Algorithmic Results using Noncommutative Algebraic Complexity
12-5-2022	N. D. Hari Dass Retd. Senior Professor, ISc	Lectures on Non-Perturbative Quantum Field Theories
12-5-2022	Edward Witten Institute for Advanced Study, Princeton	Algebras and Entropies for Black Holes and De Sitter Space
13-5-2022	Frithjof Karsch Bielefeld University	Supercomputing the properties of strong interaction matter
13-5-2022	Pinaki Swain McGill University	Modeling biological polymers: size of the bacterial chromosome, and phase separation of proteins
13-5-2022	Jean Marc Deshouillers	SPARC Lecture Series (Three Basic tools in Number Theory)
18-5-2022	Krishna Jalan ISc	Algebras and Emergent times
18-5-2022	Rob Pisarski Brookhaven National Laboratory	A Golden Age in High Energy Nuclear Physics
19-5-2022	Moumita Naskar Presidency University, Kolkata	Statistical studies of metastable lifetimes in magnetic model systems
20-5-2022	N. Abdul Majith INRIA Rennes, France	Automated verification and synthesis of distributed systems
20-5-2022	Kabir Ramola TIFR Hyderabad	Athermal Elasticity: From Crystalline to Amorphous Packings
20-5-2022	Apoorva Khare Indian Institute of Science	Higher order Verma modules, and a positive formula for all highest weight modules
23-5-2022	Rahul Mallikarjun	Brownian bridges
25-5-2022	Ayan Mukhopadhyay IIT Madras	Quantum channels and black holes
26-5-2022	Amaldev Manuel IIT Goa	Algebraically characterising subclasses of regular languages and functions
26-5-2022	Nicolas Libedinsky Universidad Chile	An introsurvey of representation theory

30-5-2022	Sagar Zephania C F IIITDM Kancheepuram	Study of nonlinear systems using improved homotopy perturbation methods
1-6-2022	Gert Aarts ECT* Trento and Swansea University	Machine learning for lattice field theory and back
2-6-2022	Apoorva Khare Indian Institute of Science	Higher order Verma modules, and a positive formula for all highest weight modules - 2
2-6-2022	Suvam Mukherjee	Fractal analysis of Tagore's music
6-6-2022	M Sivakumar University of Hyderabad	How effective, field theory is?
7-6-2022	Yash Deshmukh Columbia University	Homotopically extending actions of moduli spaces of Riemann surfaces
8-6-2022	Thomas Schaefer North Carolina State University	The QCD critical point
9-6-2022	Koduri Siddharth Choudary IMSc	On the Decidability and Complexity of the Theory of Presburger Arithmetic
10-6-2022	Projesh Roy IMSc	Glassy dynamics of semi-stiff ring polymers under pressure
13-6-2022	Surabhi Tiwari IMSc, Chennai	Next-to-Soft Virtual resummed corrections to processes at the LHC
14-6-2022	M. Balamurugan Department of Theoretical Physics, Madras University	Generalized spin kitten states in a strongly coupled spin-oscillator system
15-6-2022	Gerald Dunne University of Connecticut	Decoding the Path Integral: Resurgence and Nonperturbative Physics
16-6-2022	Rikki Garner Harvard University	Vast heterogeneity in cytoplasmic diffusion rates revealed by nanorheology and Doppelganger simulations
17-6-2022	Venkatesh Raman IMSc, Chennai	Succinct Representations
20-6-2022	P Rakesh Kumar Dora IMSc	Nature of the anomalous $4/13$ fractional quantum Hall effect in graphene

21-6-2022	A. P. Balachandran Syracuse University	Spin 1/2 from Color and a Little More
21-6-2022	C L Sriram	Poisson-Lognormal distribution
21-6-2022	R. Ganesh Brock University, Canada	Emergence and indecision – the physics of quantum magnets
22-6-2022	R Janani IMSc, Chennai	Exposome and health: Characterization and network-based exploration of diverse environmental chemical spaces
22-6-2022	Gaurav Sood IMSc	A study of QBF Merge Resolution and MaxSAT Resolution
23-6-2022	Subhrajit Modak IISER – Mohali	Bounding quantum advantages in Postselected Metrology
24-6-2022	Ranjani Seshadri Ben Gurion University of Negev	Engineering Floquet topological phases using periodic driving
24-6-2022	Pavan	Critical $O(N)$ theory in 6-eps dimensions
27-6-2022	Nitin Saurabh IIT Hyderabad	Rabbits approximate, cows compute exactly!
29-6-2022	Sujoy Bhore IISER Bhopal	Geometry and Graphs: A Tale of Two Worlds
29-6-2022	Guy Moore TU Darmstadt	Topology at High Temperature from the Lattice
4-7-2022	Neelam Kandhil IMSC	Around non-vanishing, linear independence and transcendence of L values at rational and integer points
8-7-2022	Dr. Sourav Mitra Surentranath College, Kolkata	Modeling reionization history of the Universe
11-7-2022	Andri Sharma IISER Mohali	Polymer translocation through conical channels
12-7-2022	Pushkar Joglekar Vishwakarma Institute of Technology, Pune	On Efficient Noncommutative Polynomial Factorization via Higman Linearization
14-7-2022	Venkat Venkatasubramanian Columbia University, New York City, NY	A unified theory of emergent equilibrium phenomena in active and passive matter

14-7-2022	Arijit Mondal IISER Tirupati	The Structure, thermodynamics, and dynamics of supercooled liquid
14-7-2022	Amrutha P IISER Thiruvananthapuram	Induced representations of dihedral groups from their subgroups and to symmetric groups
15-7-2022	Ranjan Modak IIT-Tirupati	Uncertainty relation in PT invariant non-Hermitian system
15-7-2022	Sougato Bose Department of Physics and Astronomy, University College London	Quantum Coherent Nature of Gravity through a Table-Top Experiment
18-7-2022	S. Aravinda IIT-Tirupati	Spacetime dual-unitary quantum circuits : From quantum many-body systems to quantum combinatorial designs
18-7-2022	Hema Rajaram BARC Mumbai	Combating environmental stresses: Evolution from ancient cyanobacteria to modern day organisms
19-7-2022	Abhranil Chatterjee IIT Bombay	Black-box Identity Testing of Noncommutative Rational Formulas of Inversion Height Two in Deterministic Quasipolynomial-time
19-7-2022	Vinod Variyam University of Nebraska, Lincoln, USA	Reproducibility Meets Computational Complexity
21-7-2022	Deeptak Biswas IMSc	Chiral condensate in the Hadron Resonance Gas model
22-7-2022	Dr. Brato Chakrabarti Flatiron Institute, Simons Foundation	The waves within us: from single cilium to the formation of metachronal waves
25-7-2022	Disha Bhatia IMSc	Exploring consequences of the self interactions of dark matter
25-7-2022	Aneesh P B IMSc	Towards flat space holography
26-7-2022	Mohammad Shabbir IMSc	Lie algebraic decomposition of black hole partition functions
27-7-2022	Barry Sanders University of Calgary	Observing a changing Hilbert-space inner product

28-7-2022	Praveen Chhikara IMSc	A Talk on Mathematical Writing
28-7-2022	Kadambari Patil Centre for Predictive Human Model Systems, Atal Incubation Centre - CCMB Hyderabad	Informational Session on India — EMBO Lecture Course: Microphysiological Systems
28-7-2022	Vishaka Gopalan National Cancer Institute, NIH, Bethesda, MD, USA	Non-genetic contributions to pancreatic cancer initiation
29-7-2022	Mohan Swaminathan Princeton University	Extending Taubes' Gromov invariant to Calabi-Yau 3-folds
29-7-2022	Soling Zimik IMSc Chennai	Mechanics enhances synchronization in heterogeneous excitable media
29-7-2022	Sumilan Banerjee Indian Institute of Science	Many-body chaos and dynamical transitions: Classical to quantum and back again
2-8-2022	Marc Bourdon Universite de Lille	L^p -cohomology for semi-simple and solvable Lie groups
2-8-2022	Vivek Datar IMSc, Chennai	A journey in nuclear physics and its intersections with high energy physics
3-8-2022	Bruno Kahn CNRS	Philosophy and practice of motives
3-8-2022	Gautami Bhowmik University of Lille	Goldbach and Riemann : some links
3-8-2022	Basudeb Dasgupta Tata Institute of Fundamental Research	Fast Neutrino Oscillations: Beginning and End
4-8-2022	Rahul Gupta University of Regensburg	Ramified class field theory
5-8-2022	Semanti Dutta IMSc	Exact Renormalization Group and $O(N)$ model
5-8-2022	T. R. Govindarajan Retd. Professor, IMSc	Geometry Beyond Riemann and Gravity Beyond Einstein
8-8-2022	Vishwajeet Kumar IMSc Chennai	NLD End-term presentation: Anomalous diffusion in random dynamical systems

8-8-2022	Shamik Gupta Tata Institute of Fundamental Research	From fireflies to power grids: The physics of spontaneous synchronization
10-8-2022	Ashwin Jacob Ben-Gurion University, Israel	New Directions in Parameterized Deletion Problems
10-8-2022	Krishnendu Sengupta IACS Kolkata	Emulating strong correlation using ultracold atoms
10-8-2022	Amit Suthar	Scattering amplitudes for all masses and spins
11-8-2022	Bruno Kahn CNRS	Philosophy and practice of motives
11-8-2022	Akashdeep Dey Princeton University	A comparison of the Almgren-Pitts and the Allen-Cahn min-max theory
11-8-2022	Abhijeet Alase University of Sydney, Australia	Operational Foundations of PT-Symmetric and Quasi-Hermitian Quantum Theory
12-8-2022	Shraddha Bandekar Vellore Institute of Technology, Chennai	Mathematical Modeling of COVID-19
12-8-2022	Shailesh Chandrasekharan Duke University	Building our Universe with Qubits
16-8-2022	Ananth Shankar University of Wisconsin-Madison	Arithmetic families of elliptic curves, abelian surfaces and K3 surfaces
16-8-2022	K. Sravan Kumar Tokyo Institute of Technology	Generalized non-local R^2 -like inflation, quantum gravity, and future CMB
17-8-2022	Bruno Kahn CNRS	Philosophy and practice of motives
17-8-2022	Bishal Deb University College London	Continued fractions and combinatorial sequences: factorials, Genocchi and median Genocchi numbers
17-8-2022	Toru Kojo Tohoku University	Sound velocity peak as a signature of quark matter formation in neutron stars
18-8-2022	Mrinal Kanti Pal Department of Applied Mathematics, Calcutta University	The shaping role of non-local interactions in formation of spatio-temporal patterns

19-8-2022	Ananth Shankar University of Wisconsin-Madison	Arithmetic families of elliptic curves, abelian surfaces and K3 surfaces
19-8-2022	Prof. Ueli Grossniklaus Department of Plant & Microbial Biology, University of Zurich	Signaling Processes during Plant Reproduction
19-8-2022	Soumya Sur IMSc	Investigations into Quantum Compass Models in Two Dimensions
20-8-2022	Bruno Kahn CNRS	Philosophy and practice of motives
22-8-2022	Sivasurender Chandran IIT Kanpur	Nonequilibrium Properties of Polymer Films
23-8-2022	Anupam Ray Tata Institute of Fundamental Research	Unravelling the Mystery of Dark Matter with Black Holes
23-8-2022	Prof. G. Amarendra Nuclear Fuel Complex Hyderabad & HBNI	A legend lives on - The story of Homi Jehangir Bhabha
24-8-2022	Ananth Shankar University of Wisconsin-Madison	Arithmetic families of elliptic curves, abelian surfaces and K3 surfaces
24-8-2022	Mrinal Kumar Indian Institute of Technology Bombay	Fast multivariate multipoint evaluation over finite fields
24-8-2022	Prof. V. Kamakoti Director, IIT Madras, Chennai	Research and Education in Emerging and Disruptive Technologies
24-8-2022	Dr. Kuber Bhainsa Nuclear Agriculture and Biotechnology Division, BARC, Mumbai	Development of BARC-Hydrogel: Improving Water Economy in Plantation and Agriculture
25-8-2022	Prof. R. Parthasarathy Retired Professor, IMSc Chennai	Alladi Ramakrishnan - Theoretical Physicist
26-8-2022	Ananth Shankar University of Wisconsin-Madison	Arithmetic families of elliptic curves, abelian surfaces and K3 surfaces
26-8-2022	Prof. Sreerup Raychaudhuri TIFR Mumbai	Evolution of Modern Science in India
28-8-2022	Prof. S.G. Dani CBS Mumbai	Glimpses of India's Mathematical Heritage
29-8-2022	Arkaprabha Ghosal Bose Institute, Kolkata	Fidelity Fluctuations in Quantum Teleportation

29-8-2022	Debanjana Kundu UBC	Studying Hilbert's 10th problem via explicit elliptic curves
29-8-2022	Yajnaseni Dutta Mathematisches Institut der Universtat Bonn	Maximal variation of families of curves
30-8-2022	Bernard Chenevier CNRS, France & Okayama University, Japan	Promoting and Initiating / Implementing MSCA-Staff-Exchange projects (HORIZON EUROPE) including Japanese and Indian teams
30-8-2022	Debasish Banerjee Saha Institute of Nuclear Physics	Exploring cousins of quantum electrodynamics using classical and quantum simulations
30-8-2022	Sayan Kumar Pal S. N. Bose National Centre for Basic Sciences, Kolkata	Entanglement entropy in generalized Landau system and squeezing in the three-wave mixing process
1-9-2022	Po-Wen Chang Ohio State University	Towards Powerful Probes of Neutrino Self-Interactions in Supernovae
1-9-2022	Ramu Kumar Yadav IISER Mohali	Study of Unzipping Transitions of an Adsorbed Polymer and Block Copolymer DNA by a Periodic Force
2-9-2022	Samim Akhtar	Classical black hole scattering from a worldline quantum field theory
2-9-2022	Thomas Konrad University of KwaZulu-Natal	Quantum Mechanics and Classical Optics: New ways to combine classical and quantum methods
5-9-2022	Arkajyoti Manna IISc Bangalore	Scattering amplitudes from Generalized Recursion
5-9-2022	Ankit Agrawal University of Wurzburg, Germany	The mechanistic view of spatial biology
7-9-2022	Dr. Nirmal Raj TRIUMF, Canada	The Reverse Rutherford Era ​ of Dark Matter
7-9-2022	Antonio Gonzalez-Arroyo IFT-UA Madrid	The challenges of Yang-Mills theory
8-9-2022	Asmita Kumari HRI	Sharing preparation contextuality for both parties by arbitrary number of sequential observers

12-9-2022	Ravi Kunjwal Centre for Quantum Information and Communication (QuIC), Universite libre de Bruxelles (ULB), Brussels, Belgium	Trading causal order for locality
12-9-2022	Rajesh Singh IIT Madras	Flow-induced bound states of active particles
13-9-2022	HEPF IMSc	Discussions on HEPF applications
14-9-2022	Aneesh PB	Diffeomorphism symmetry in 2D and celestial holography
14-9-2022	Raju Venugopalan Brookhaven National Laboratory	Classical lumps and their quantum descendants in Quantum Chromodynamics at high energies
15-9-2022	Brij Mohan HRI	Quantum Speed Limits
16-9-2022	Md Abhishek HRI	Scattering amplitudes and BCFW in $N = 2^*$ Theory
16-9-2022	Ronnie Kosloff Institute of Chemistry, The Hebrew University, Jerusalem	Quantum thermal engines and quantum control
19-9-2022	Jean-Marc Deshouillers University of Bordeaux	Discussion on open problems
20-9-2022	Jean-Marc Deshouillers University of Bordeaux	Results and Models : An Illustration through sum of cubes
21-9-2022	Ria Ghosh IMSc Chennai	Emergent patterns of activity in disordered biological systems: Role of heterogeneities in organizing the collective dynamics of excitable cell-assemblies and tissues
21-9-2022	V. Arvind IMSc	The Graph Isomorphism Story
22-9-2022	Antareep Mandal IIT Madras	Uniform sup-norm bounds for Siegel cusp forms
22-9-2022	Manish Shrimali Central University of Rajasthan, Bandar Sindri	Effect of intermittent interactions and noise
23-9-2022	Rusa Mandal IIT Gandhinagar	What are the indirect hints of new physics telling us?

24-9-2022	Various Organized by DAAD Chennai	ReDiscover Germany with Focus on PhD in Germany
26-9-2022	Sandhya Koushika Tata Institute of Fundamental Research Mumbai	Location & function of mitochondria in a neuronal process
28-9-2022	Singanporia Kushal Piyushkumar	Matrix Rigidity - A Brief Survey
28-9-2022	Adarsh Sudhakar	Parallels between Quantum Error Correction and Holography
29-9-2022	Jayanth Guhan Emory University	Local-global principle for hermitian spaces over semi-global fields
4-10-2022	Murali K Srinivasan IIT Bombay	A weighted adjacency matrix associated with the projective geometry $B(q,n)$
6-10-2022	Akhil Antony IMSc, Chennai	A primordial solution to the tensions in cosmology
7-10-2022	Rafal Demkowicz-Dobrzanski University of Warsaw	Quantum Technologies A.D. 2022
11-10-2022	Tanay Nag Department of Physics and Astronomy, Materials Theory, Uppsala University, Sweden	Dynamical construction of Quadrupolar and Octupolar topological superconductors
12-10-2022	Archishman Raju NCBS Bengaluru	Geometric models of cell fate specification
13-10-2022	Amritanshu Prasad IMSc	Orthogonal polynomials
17-10-2022	Rituparno Mandal Georg-August-Universitat Gottingen	Dynamics and Rheology of Glassy Active Matter
20-10-2022	Vijay Kodiyalam IMSc	2-unitaries
21-10-2022	Subramanya Hedge	Geometric soft theorems
26-10-2022	Jayanta Kumar Bhattacharjee IACS Kolkata	Turbulence, Kolmogorov Spectrum and its different variations
27-10-2022	Jayanta Kumar Bhattacharjee IACS Kolkata	Introductory lecture on Turbulence

28-10-2022	Vinay Vaibhav IMSc	Thermo-mechanical response of glassy systems
28-10-2022	Subramanya H	Geometric soft theorems (continued)
31-10-2022	Algebraic Combinatorics Group	Algebraic Combinatorics
4-11-2022	Swapan Chattopadhyay Distinguished Scientist Emeritus, Fermilab, Infosys Chair Visiting Professor, IISc, Bengaluru, etc	Probing the early and dark Universe with atomic interferometry
4-11-2022	L Sriramkumar IIT Madras	Forces of nature: Padmanabhan and gravitation
4-11-2022	Sitabhra Sinha IMSc Chennai	Complex Systems course (PHY/ECS 439/739 IISER-Tirupati)
14-11-2022	Antonio Acin ICFO-The Institute of Photonic Sciences, Barcelona	Certification of quantum technologies
15-11-2022	Mintu Nandi Department of Chemistry, University of Calcutta, Kolkata, India	Information restriction in model gene regulatory networks
15-11-2022	Smita Srivastava IIT Madras	Microbial and plant bio-factories for sustainable production of high-value low-volume Phytochemicals: Need for a rational and integrated approach
16-11-2022	Subramanya Hedge	Geometric Soft Theorems
16-11-2022	Andrew Forbes The University of the Witwatersrand	Quantum mechanics with patterns of light
17-11-2022	Vaishnavi Sundararajan University of California Santa Cruz	Formal verification for security protocols
17-11-2022	Neelam Kandhil IMSc	Around non-vanishing, transcendence and linear independence of L values at rational and integer points
18-11-2022	Narayan Rana IIT Kanpur	Precision physics and perturbative calculation
21-11-2022	Joseph Samuel Raman Research Institute and ICTS-TIFR	The finite part of infinity

22-11-2022	Vivek Ananth RP IMSc Chennai	Compilation, curation and exploration of natural product spaces to enable traditional knowledge based drug discovery
22-11-2022	Sridhar P Narayanan IIT Bombay	The weighted perfect matching association scheme
22-11-2022	R Thiru Senthil IMSc	Invertor for Matrices: Parallel mode
23-11-2022	Sabyasachi Maulik Saha Institute of Nuclear Physics	Pseudo-complexity of purification in free scalar field theories
23-11-2022	Jan Steinhoff MPI Potsdam	New perspectives on the relativistic binary problem
24-11-2022	Nicole Yunger Halpern NIST and JQIC, University of Maryland	Quantum steampunk: Quantum information meets thermodynamics
25-11-2022	Prof. Sibasish Ghosh IMSc	Testing violation of local-realism (on Nobel Prize in Physics, 2022)
25-11-2022	Pulak Banerjee IIT Guwahati	NNLO QED corrections in McMule
30-11-2022	Debodirna	SYK Model
1-12-2022	Malavika Mukundan University of Michigan	An Introduction to Holomorphic Dynamics
2-12-2022	Debmalya Chakraborty Department of Physics and Astronomy, Uppsala University, Sweden	Three way interplay of strong correlations, topology, and disorder in high temperature superconductors
2-12-2022	Ranjan Laha CHEP, Indian Institute of Science	Dark matter and its indirect detection
2-12-2022	Subramanya Hegde IMSc	Lectures on scattering amplitudes
2-12-2022	Rohit Kumar Shukla IIT-BHU	Out-of-time-order correlators of nonlocal block-spin and random observables in integrable and nonintegrable spin chains
5-12-2022	Prof. Sitabhra Sinha	"Patterns, Dynamics, Computation"

5-12-2022	Sudeshna Sinha IISER Mohali	Chaos and Noise in the aid of Logic
5-12-2022	Arnab Priya Saha IISER Bhopal	Higher spin amplitudes in supersymmetric theories
5-12-2022	Sushovan	Discussing neutron stars
7-12-2022	Debodirna Ghosh	SYK Model
7-12-2022	Diptarka Das IIT Kanpur	Universal aspects of quenches in quantum theories
8-12-2022	Shiv K. Sethi Raman Research Institute	21cm cosmology: scope and prospects
9-12-2022	Sunil L Naik IMSc	Prime divisors of non-zero Fourier coefficients of Hecke eigenforms (Pre-Synopsis talk)
9-12-2022	Prudhvi Bhattiprolu University of Michigan	Statistical significances and projections for proton decay experiments
9-12-2022	Manoj Yadav Harish Chandra Research Institute, Allahabad	Construction of skew braces
12-12-2022	Soumyadip Banerjee IMSc Chennai	Trade-off between response sensitivity and information flow in an intracellular signaling pathway
12-12-2022	Anshu Bhardwaj CSIR-Institute of Microbial Technology, Chandigarh, India	Understanding and addressing Genotype-Phenotype Correlations in Complex Diseases
13-12-2022	Dr. Nirmal Raj TRIUMPH, Canada	Dark Neutrons: Cosmology, Astrophysics & Laboratory
14-12-2022	Gunjan Kumar National University of Singapore	Support size estimation - Power of conditioning
14-12-2022	R. Parimala Emory University	Quadratic forms over function fields
14-12-2022	Shriya M University of Hyderabad	Vector Partitions
19-12-2022	Aparna Baskaran Brandeis University	From molecules to moduli : data driven approaches to understanding active materials

20-12-2022	Fabio Finelli INAF OAS and INFN - Sezione di Bologna	The observational status of cosmic inflation and perspectives for future observations
21-12-2022	Satish Khurana IISER Thiruvananthapuram	Molecular and spatial regulation of hematopoiesis: The journey so far and the way forward
21-12-2022	Taushif Ahmed University of Regensburg	A tour to subatomic world through precision quantum chromodynamics
21-12-2022	Soumi Nandi ISI Kolkata	COLORFUL HELLY THEOREM FOR PIERCING BOXES WITH TWO POINTS
22-12-2022	Venkatesan Guruswami University of California, Berkeley	A near-cubic lower bound for 3-query locally decodable codes
22-12-2022	Anupa Sunny IRIF, Paris, France	Certificate Games
22-12-2022	Ronak Soni Cambridge University	Microstates of the 2d Non-Supersymmetric Black Hole
22-12-2022	Chandrima Kayal ISI Kolkata	Separations between Combinatorial Measures for Transitive Functions
23-12-2022	Sutapa Saha ISI-Kolkata	The non-classicality of two information processing tasks in convex operational theories
26-12-2022	M. Ram Murty Queen's University, Canada	Ramanujan and his legacy
27-12-2022	Ram Murty Queen's University	An "all-purpose" Erdos-Kac theorem
28-12-2022	Diptimoy Ghosh IISER Pune	Boundaries of Quantum Field Theories
29-12-2022	I. Iyyappan IMSc	Studies of Brownian particle using stochastic thermodynamics
29-12-2022	Sudhir Pujahari NISER	Sato-Tate conjecture in arithmetic progressions for certain families of elliptic curves
6-1-2023	Anshuman Swain Harvard University	Microbial spatial dynamics over eco-evolutionary timescales
6-1-2023	Biswaranjan Behera University of Florida	Probing Beyond Standard Model Physics in the ICARUS Detector at Fermilab

10-1-2023	Rahul Kashyap Pennsylvania State University	Stellar Graveyards: Signals from the merging deads
11-1-2023	Prateek Chawla Institute of Mathematical Sciences	Quantum walks on networks - a paradigm for quantum simulation and computation
11-1-2023	Priyanshu Chakraborty IMSc	Irreducible modules for loop Witt algebra
11-1-2023	Soham Chanda Rutgers University	Invariance of Floer cohomology under higher mutation via neck-stretching
11-1-2023	Amlan Chakraborty The State University of New York, Buffalo	The three loop four parton scattering in QCD
11-1-2023	Roji Pius IMSc	General Relativity
11-1-2023	Dr. Sayantan Sharma IMSc	Statistical Field Theory
11-1-2023	Chandrasekaran, Karthik UIUC	Partitioning over Submodular Structures
13-1-2023	Satyanarayan Mukhopadhyay IACS Kolkata	Particle dark matter – thermal and non-thermal production mechanisms
13-1-2023	Dr. Sayantan Sharma IMSc	Statistical Field Theory
13-1-2023	Venkatesh Raman	Parameterized Complexity
16-1-2023	Souvik Priyam Adhya IFJ-PAN Krakow, Poland	Exploring jet quenching in heavy ion collisions through expanding medium induced cascades
16-1-2023	Sourav Chakraborty The talk will be based on joint works with Kuldeep Meel, Yash Pote, Priyanka Golia and Mate Soos (AAAI19, NeurIPS20, FMCAD21, CP22) and previous paper with Eldar Fischer, Arie Matsliah and Yonatan Goldhrish (SICOMP 16)	On the power of conditional sampling: a special case of property testing
16-1-2023	Subir Sachdev Harvard University	Graphene flakes, strange metals, and black holes: insights from the SYK model

18-1-2023	Chandan Singh Dalawat HRI	The oldest problem
18-1-2023	Manish IMSc	Solvable Quantum Gravity in 2D
19-1-2023	Anannya Upasana IMSc	Parameterized Approximation Scheme for Biclique-free Max k-Weight SAT and Max Coverage
19-1-2023	Mritunjay Verma University of Southampton	Scale Invariant Effective Field Theories in AdS/CFT
20-1-2023	Gaurav Rattan RWTH, Germany	Classifying Graphs by Counting Homomorphisms
20-1-2023	Chandan Singh Dalawat Harish chandra Institute	Primitive p-extensions of p-fields
23-1-2023	Sankalp Nambiar Nordita, Stockholm, Sweden	Enhanced velocity fluctuations in suspensions of interacting micro-swimmers
23-1-2023	Some Sankar Bhattacharya International Centre for Theory of Quantum Technologies, University of Gdansk, Poland	New Notions of Non-classicality in Communication Networks
23-1-2023	Tanmay Mitra Department of Systems Immunology, Helmholtz Centre for Infection Research, Braunschweig, Germany	Diversity of B cells in germinal centres amid affinity maturation
24-1-2023	Reshmi Roy Calcutta University	Dynamical Phenomena in Reaction Diffusion and Spin Systems
24-1-2023	Avijit Misra Weizmann Institute, Israel	Work extraction from thermal noise by measurements and nonlinear interactions in quantum optical setups
24-1-2023	Sundar Srinivasan National Autonomous University of Mexico	The Nearby Evolved Stars Survey
25-1-2023	Priyo Sankar Pal KIAS, Seoul	First passage time in stochastic resetting process with finite time return
25-1-2023	Badri Vishal Pandey University of Virginia	Inversion formulas for the j-function around elliptic points

25-1-2023	Sthitadhi Roy ICTS-TIFR	Dynamical phases of quantum matter in measurement-unitary hybrid dynamics
25-1-2023	Manish	Solvable Quantum Gravity in 2D
27-1-2023	Chandan Datta Centre of New Technologies, University of Warsaw	Entanglement catalysis for quantum states and noisy channels
27-1-2023	Prashanth Raman IISc, Bengaluru	Celestial insights into the S-matrix bootstrap
28-1-2023	Saket Saurabh IMSc	Approximation Algorithms
1-2-2023	Subham Dutta Chowdhury University of Chicago	Constraining tree-level gravitational scattering
1-2-2023	Dishant IMSC	Topology course
2-2-2023	Mani Shankar Pandey Institute of Mathematical Sciences	On Multiplicative Lie Algebras
3-2-2023	Pavan D	Hilbert space of QFT in de Sitter spacetime
4-2-2023	Maura McLaughlin West Virginia University	Astrophysics for School Kids
6-2-2023	Bhal Chandra Joshi NCRA-TIFR, Pune (formerly)	Indian Pulsar Timing Array through the last decade
6-2-2023	Jyotijwal Debnath IMSc	Light Bending
7-2-2023	A. Gopakumar Tata Institute of Fundamental Research, Mumbai	The promise of persistent multi-messenger GW astronomy with sources like Blazar OJ287
7-2-2023	Meera Sitharam University of Florida	A Radical Geometric Alternative Complementary to MonteCarlo(MC) and Molecular Dynamics(MD) for Pair-Potential driven soft-matter Assembly Modeling
8-2-2023	Keitaro Takahashi Kumamoto University	Probing First Stars and Epoch of Reionization with 21cm line

8-2-2023	Reshma Maiya IMSc	Spatial and temporal modulation of cargo transport in axons (Pre-synopsis talk)
8-2-2023	Indian Pulsar Timing Array InPTA	Noise Analysis InPTA and InPTA+EPTA
14-2-2023	Saket Saurabh IMSc	Approximation Algorithms
15-2-2023	Soumyakanti Bose Dept. of Physics & Astronomy, Seoul National University, Korea	Quantum teleportation of optical qubits using Gaussian resources
15-2-2023	Christian Schmidt Bielefeld University	Analyzing phase transitions with multi-point Pade analyses: from the Ising model to lattice QCD
16-2-2023	K. Krishnarjun HRI	On the symmetries of base n expansion of $1/m$: The class number connection
16-2-2023	Sayan Goswami IMSc, Chennai	PRODUCT OF DIFFERENCE SET OF SET OF PRIMES
16-2-2023	Alok Laddha	Feynman Integral Calculus
17-2-2023	Archana Radhakrishnan TIFR	Hadron Spectroscopy using Lattice QCD
20-2-2023	Umang Dattani IMSc	Cavitation instabilities in amorphous solids: an athermal study
22-2-2023	Spyros Sypsas CU, Bangkok	Statistics of cosmic random fields
22-2-2023	P. K.Manoharan University of Central Florida	Solar physics in radio wavelengths
23-2-2023	Murugappan Muthukumar University of Massachusetts Amherst	Dipole-driven Self-assembly of Charged Macromolecules
23-2-2023	Anirban Chakraborti BML Munjal University & Jawaharlal Nehru University	Complex Systems Approach to Sustainability Development
28-2-2023	Apurba Biswas The Institute of Mathematical Sciences	Mpemba effect in granular and Langevin systems (Synopsis talk)

28-2-2023	Viji Thomas IISER Thiruvananthapuram	On Schur's conjecture and Berkovich's problem
1-3-2023	Shivam Gola IMSc	A phenomenological study of WIMP models
2-3-2023	Abhinandan University of Tokyo	Crystalline representations and Wach modules in the relative case
2-3-2023	Alok Laddha CMI	Feynman Integral Calculus
4-3-2023	Saket + Sounak	Flow Augmentation
6-3-2023	Malay Banerjee Department of Mathematics and Statistics, IIT Kanpur	Epidemic model with time varying parameter and Immuno-epidemiological model
6-3-2023	Saket	Flow Augmentation
6-3-2023	Sreedhar Bhamidi Harish chandra Institute	Riemann Roch theorem for algebraic stacks
7-3-2023	Gaurav Sood IMSc - _i Technion	A study of QBF Merge Resolution and MaxSAT Resolution
7-3-2023	Shankar Prasad Das JNU, New Delhi	Coarse-grained description for the time evolution of a many-particle system
7-3-2023	Prahladh Harsha TIFR	Criticality of AC0-formulae
9-3-2023	Kumar Murty University of Toronto	Tate's conjecture and poles of L-functions
9-3-2023	Archan Mukhopadhyay School of Computer Science, University of Birmingham, Edgbaston, Birmingham	Nonconvergent outcomes in the evolutionary game theory: A case study of replicator dynamics
13-3-2023	Rajendra Kumar Weizmann Institute, Israel	Foundations of Lattice-based Cryptography
13-3-2023	Shovan Dutta Raman Research Institute	Long-range multipartite entanglement from a local drive
14-3-2023	Elanchearan IIT Madras	Getting started with Notion
15-3-2023	Shibananda Das University of Massachusetts Amherst	Self-organization of biomolecular condensates

15-3-2023	Sinnou David Sorbonne University (Paris 6)	Galois Groups of lacunary polynomials are large
18-3-2023	Krish Ashok Tata Consultancy Services	Masala Lab – the science of Indian cooking
23-3-2023	Sruthi Sekar UC Berkeley	Robustness in Cryptography
23-3-2023	Sumandeep Kaur Panjab University	On discriminant, integral basis and common index divisors of certain quintic number fields
24-3-2023	Ms. Ashwini Bhide	Achieving ease of travel through Mega Infrastructure Projects in Mumbai
27-3-2023	Vinay Nandicoori Director, CSIR Centre for Cellular and Molecular Biology (CCMB), Hyderabad	Delineating survival strategies employed by Mycobacterium tuberculosis
28-3-2023	Ankush Kumar Garg IISER Thiruvananthapuram	Average Sampling and Reconstruction Problems over Shift-Invariant Spaces
28-3-2023	Dr. Varsha Sreenivasan IISc Bengaluru	Structural connectivity correlates of human cognition explored with diffusion MRI and tractography
29-3-2023	Susobhan Mandal IISER-Kolkata	Equations of state in the curved space-time of compact degenerate stars
30-3-2023	Navdeep Singh Dhindsa IISER Mohali	Large Matrices on Lattice and Holography
30-3-2023	Avishek Mukherjee Department of Mathematical Sciences, University of Delaware, Newark DE, USA	Role of cross section geometry in intimal growth induced by hemodynamical shear stresses
31-3-2023	Arindam Mitra IMSc	Aspects of compatibility of quantum devices and quantum communication using quantum switch
31-3-2023	Prosenjit Roy IIT Kanpur	Regularity theory for elliptic PDE

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 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 für Radioastronomie Bonn Germany, etc.

5.1.2 Chemical kinetics and stochastic thermodynamics

Ongoing collaboration with Prof. Saar Rahav, Technion, Israel

5.1.3 DST SERB Start-up Research Grant

Project title:

First passage of intermittent random walk searchers applications to statistical physics, biological and chemical processes

5.1.4 Dynamics of strongly-entangled topological quantum matter

Royal Society Exchange grant with Zlatko Papić, University of Leeds IES
R2

202052 - International Exchanges 2020 Round 2 Award Value: GBP 11,990.00 The initial award was for two years but owing to COVID we got a year's extension.

5.1.5 Extreme events in dynamical and stochastic systems

This is an ongoing collaboration with a PhD student Suvam Pal (who is my joint PhD student) and Prof. Dibakar Ghosh, ISI Kolkata

5.1.6 First passage processes of many body systems

This is an ongoing collaboration with Dr. Ohad Shpielberg, University of Haifa, Israel.

5.1.7 Hardness in QBF Proof Complexity

This is an Indo-German joint collaborative project funded by the DST in India and the DAAD in Germany. The PIs are Meena Mahajan (IMSc) and Olaf Beyersdorff (Friedrich-Schiller University, Jena). The project aims to understand QBF proof systems better through developing new lower bound techniques, characterising hardness in known systems, and advancing the scope of known techniques. The project runs for 2 years.

5.1.8 Harnessing stochastic motion using automated robots

This is a theory-experiment collaboration with Dr Nitin Kumar, IIT Mumbai. We study Active dynamics of a self-propelled programmable robot.

5.1.9 Home-range search processes

Ongoing collaboration with Prof. Shlomi Reuveni, Tel Aviv University, Israel

5.1.10 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 upgraded Giant Metrewave Radio Telescope (uGMRT). Observations and data analysis is going on. The preliminary results were presented in various national and international meetings and some papers have been published. This collaboration has become a full member of the International Pulsar Timing Array consortium in February 2021.

InPTA experiment is a joint venture among various Indian institutes (IMSc, TIFR, NCRA-TIFR, IIT-Hyderabad, RRI, etc) as well as Kumamoto University of Japan. Four IMSc members (one faculty, one postdoc, one research associate, and one student) are part of this experiment.

5.1.11 Max Planck Partner Group in Mathematical Biology

This partner group was funded by Max Planck Society for 5 years with effect from April 2017. In collaboration with Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany, the mandate of this partner group is to develop geometry-inspired measures for the analysis of complex networks.

5.1.12 Modelling of amorphous solids for large scale simulations

DST/NSM/R&D HPC Applications/2021/29, in collaboration with Smarajit Karmakar, Physics (Tata Institute of Fundamental Research, Hyderabad), Shiladitya Sengupta (Indian Institute of Technology, Roorkee), Vishwas V, (Indian Institute of Technology, Palakkad). The project proposes to develop a computational modeling methodology and tools that will enable faithful modeling of a diverse range of amorphous solids and allow such solids to be simulated for a variety of mechanical deformation protocols, on large length scales that are not possible with atomistic simulation methods.

5.1.13 Mpemba effect in non-equilibrium systems

Inhouse collaboration with Prof. R Rajesh, IMSc

5.1.14 SPARC

We have been organising seminars jointly with University of Bordeaux and IIT Madras under this project. We have completed three visits by French PI and co-PI. We have also organized an online workshop on Schinzel- Zassenhaus conjecture.

We already have a first version of a monograph and one accepted paper. We have three more research articles submitted. A number of research collaborations are in progress in tune with the theme of the proposal.

5.1.15 Stochastic resetting and ergodic theory

Ongoing collaborations with Prof. Trifce Sandev (Macedonia Academy), Prof. Ljupco Kocarev (Macedonia Academy), Prof. Ralf Metzler (University of Potsdam, Germany), and Dr. Viktor Stojkoski (Macedonia Academy)

5.1.16 Stochastic resetting experiments using optical traps

Ongoing theory-experiment collaboration with Prof. Basudev Roy, IIT Chennai

5.1.17 Stochastic thermodynamics in viscoelastic systems

This is a theory-experiment collaborative project with Prof. Ayan Banerjee, IISER Kolkata

5.2 Conference Participation and Visits to Other Institutions

Ashok, Sujay K.

Visited Department of Physics, INFN, Torino during Apr 21 – Jul 18, 2022. Collaboration on string amplitudes and AdS/CFT

Chaudhuri, Pinaki P.

Participated in *XVI Complex Fluids Symposium* held at IIT Kharagpur Research Park, Kolkata during Dec 19 – Dec 21, 2022. talk on cavitation

Participated in *8th Indian Statistical Physics Community Meeting* held at ICTS, TIFR, Bangalore during Feb 1 – Feb 3, 2023. talk

Coimbatore Balram, Ajit

Visited University of Leeds during Jun 1 – Jun 10, 2022. invited talk at a conference and discussions with a collaborator

Participated in *24th Symposium on the interplay between Quantum Matter and Gravity* held at Weetwood Hall, Conference Centre & Hotel in Leeds during Jun 6 – Jun 8, 2022. invited talk

Visited Pennsylvania State University during Jul 6 – Jul 28, 2022. Collaborations with Jainendra K. Jain. Delivered a Condensed Matter, Atomic and Molecular Physics (CAMP) Seminar.

Visited Florida State University (FSU) and the National High Magnetic Field Laboratory (NHMFL/MagLab) on Jul 15, 2022. Delivered a "Hot Topics" seminar.

Participated in *School on "Correlations in Topological Quantum Matter"* held at Lammi Biological Station, Finland during Sep 6 – Sep 10, 2022. invited tutorial at the school

Participated in *QMat2022* held at IIT Kanpur <https://www.iitk.ac.in/cce/courses/22-23/qmat2022/> during Sep 18 – Sep 22, 2022. invited talk

Participated in *Advances in Quantum Transport in Low Dimensional Systems* held at Institute of Physics 37 Caledonian Road London during Sep 26 – Sep 27, 2022. invited talk

Participated in *Young Investigator's Meet on Quantum Condensed Matter Theory - 2022* held at NISER, Bhubaneswar during Oct 29 – Nov 1, 2022. invited talk

Participated in *88th Annual Meeting of the Indian Academy of Sciences* held at SRM University, AP during Nov 4 – Nov 6, 2022. <https://am2022.ias.ac.in/>

Visited Nanyang Technological University (NTU), Singapore during Jan 3 – Jan 9, 2023. invited seminar

Participated in *Quantum Geometric Advantage Workshop* held at Nanyang Technological University, Singapore during Jan 3 – Jan 6, 2023. <https://www.ntu.edu.sg/spms/research/ceqm/news-events/quantum-geometric-advantage-workshop>

Participated in *PRL conference on Condensed Matter Physics (PRL CCMP 2023)* held at PRL, Ahmedabad during Feb 6 – Feb 8, 2023. invited talk

Visited IIT Gandhinagar during Feb 8 – Feb 9, 2023. invited seminar

Visited IIT Guwahati during Feb 20 – Feb 21, 2023. invited seminar

Participated in *APS March meeting 2023* held at Las Vegas Convention center (satellite online meeting: 20-22 March, 2023) during Mar 6 – Mar 10, 2023. focus talk

Participated in *Physics of Strongly Correlated Electron Systems (PSCES) 2023* held at IISER Pune during Mar 15 – Mar 17, 2023. invited talk

Dixit, Anup B.

Participated in *AFS-1 (Annual Foundation School) by NCM* held at Pondicherry University during May 13 – May 25, 2022. Delivered 8 lectures and 8 tutorials on algebra

Participated in *Leuca 2022: Celebrating birthdays of Claude Levesque, Damien Roy and Michel Waldschmidt* held at San Gregorio, Patu, Italy during May 15 – May 21, 2022. Gave a talk titled "Generalized Diophantine m-tuples".

Participated in *La grandezza dei punti piccoli: Celebrating Francesco Amoroso's 60th birthday* held at University of Pisa, Italy during May 23 – May 25, 2022. Attended talks by experts in Diophantine geometry

Participated in *International Conference on Class Groups of Number Fields and Related Topics* held at Kerala School of Mathematics during Nov 21 – Nov 24, 2022. Invited speaker

Participated in *RMS meet (Number theory Symposium)* held at SSN College of Engineering during Dec 6 – Dec 8, 2022. Invited speaker

Participated in *Chennai Tirupati Number theory conference* held at Chennai Mathematical Institute during Feb 11 – Feb 12, 2023. Invited speaker

Ghosh, Sibasish

Visited Indian Statistical Institute, Kolkata during Dec 5 – Dec 16, 2022. Gave a series of lectures on Quantum Information Theory for continuous variable systems together with two research seminars (on 8th Dec., 2022 and 14th Dec., 2022)

Visited S. N. Bose National Centre for Basic Sciences during Dec 12 – Dec 13, 2022. Gave a series of lectures on Quantum Information Theory for continuous variable systems, and also delivered a colloquium on 13th Dec., 2022

Participated in *Progress in Quantum Science and Technology (2023)* held at IIT-Madras during Jan 23 – Jan 27, 2023. Was an invited speaker in the Conference, and delivered a seminar there.

Gun, S.

Participated in *IISER TVM Frontier Symposium-Mathematics 2022* held at IISER TVM during Apr 8 – Apr 10, 2022. Invited Speaker

Visited Pondicherry University during Jun 6 – Jun 11, 2022. Teaching in AFS I school

Participated in *17th International conference of Korean Women in Mathematical Sciences* held at Online mode during Jun 23 – Jun 24, 2022. Plenary Speaker

Visited Universite Paris Cite, France during Oct 4 – Nov 5, 2022. Invited Professor

Visited Université of Bordeaux, France during Oct 12 – Oct 15, 2022. Invited speaker in number theory seminar

Visited Oberwolfach, Germany during Nov 6 – Nov 12, 2022. Invited Speaker

Participated in *Analytic Number Theory* held at Oberwolfach, Germany during Nov 6 – Nov 12, 2022. Invited speaker

Visited Sorbonne University, France during Nov 12 – Nov 15, 2022. Invited speaker in Paris number theory seminar

Participated in *International Conference on Class groups of Number fields and related topics* held at KSOM, Kerala during Nov 21 – Nov 24, 2022. Invited Speaker

Participated in *Collaborative Research Group in L-functions and Analytic Number Theory Seminar* held at Online mode on Nov 24, 2022. Invited speaker

Participated in *37th Annual Conference of Ramanujan Mathematical Society* held at Sri Sivasubramaniya Nadar College of Engineering, Chennai during Dec 6 – Dec 8, 2022. Invited

speaker in the Number Theory Symposium

HAZRA, Dhiraj Kumar

Participated in *First IAGRG School on Gravitation and Cosmology* held at Indian Association for General Relativity and Gravitation during May 16 – May 28, 2022. Taught Cosmological Perturbations (<https://sites.google.com/iitgn.ac.in/iagrgschool2022>)

Kodiyalam, Vijay

Participated in *CMI-NASI Winter Training Programme in Mathematics* held at Ramanujan Institute for advanced study in Mathematics, Chennai during Dec 7 – Dec 17, 2022. Gave 3 lectures on group theory

Participated in *IMSc 60* held at IMSc, Chennai during Jan 2 – Jan 5, 2023. Gave a lecture on "Picture invariants and their applications"

Visited Presidency College, Chennai on Feb 23, 2023. Delivered the P. Subramaniam Endowment lecture on "Unitary invariants and their applications"

Visited RIASM, Chennai on Mar 6, 2023. Delivered the V. K. Balachandran endowment lecture on "Infinitely many quantum solutions to Euler's 36 officers problem"

Mahajan, Meena B.

Participated in *Women in Math: Progresses and Challenges* held at online, organised by IIT Jodhpur during May 7 – May 8, 2022. Gave a talk titled "The Complexity of Formal Proofs"

Participated in *Satisfiability: Theory, Practice, and Beyond Reunion* held at Simons Institute for the Theory of Computing, Berkeley, USA during Jun 14 – Jun 17, 2022. Gave a talk titled "MaxSat Resolution and SubCube Sums".

Participated in *Mathematical Approaches to Lower Bounds: Complexity of Proofs and Computation* held at International Centre for Mathematical Sciences, The Bayes Centre, Edinburgh, UK during Jul 4 – Jul 8, 2022. Gave a talk titled "Merge Resolution: QBF proofs with inbuilt strategies"

Participated in *Vigyan Vidushi Program of STCS, TIFR* held at TIFR, Mumbai during Jul 4 – Jul 14, 2022. Gave a plenary talk on 13 July 2022.

Participated in *Algebraic and Analytic Methods in Computational Complexity* held at Schloss Dagstuhl, Leibniz Zentrum for Informatics during Sep 11 – Sep 16, 2022. Gave a talk titled "Decision Tree Rank for Boolean Functions"

Visited Friedrich-Schiller University, Jena, Germany during Sep 17 – Oct 8, 2022. Research Collaboration.

Also, participated in the group’s Interactive Inference retreat at Siegmundsburg during 26-30 Sep, in which gave part of a tutorial on ”Solving and Proof Complexity”.

Participated in *Theory and Practice of SAT and Combinatorial Solving* held at Schloss Dagstuhl, Leibniz Zentrum for Informatics during Oct 9 – Oct 14, 2022. Gave a talk titled ”Quantified Boolean Formulas: (Solving and) Proof Complexity”.

Participated in *88th Annual Meeting of the Indian Academy of Sciences* held at SRM AP, Amaravati. during Nov 4 – Nov 6, 2022. Gave a talk titled ”What is hard to prove, and why”.

Participated in *IARCS Winter School on SAT+SMT* held at IIT Madras during Dec 15 – Dec 17, 2022. Gave an invited talk on Proof Complexity for QBFs

Participated in *42nd International FSTTCS Conference* held at IIT Madras during Dec 18 – Dec 20, 2022.

Visited IISER Tirupati during Jan 18 – Jan 19, 2023. Gave an Institute Colloquium titled ”What is hard to prove, and why?”.

Participated in *ACM-W India Decade Celebrations, and ACM India Annual Event 2023* held at OIST, Bhopal during Feb 10 – Feb 11, 2023. Panelist in the ACM-W event in a panel discussion on the theme ”Diversity, Equity and Inclusion: The journey till now and way forward”

Participated in *Dagstuhl Seminar 23111: Computational Complexity of Discrete Problems* held at Schloss Dagstuhl, Leibniz Zentrum for Informatics during Mar 12 – Mar 17, 2023. One of the four scientific co-organisers of the research seminar.

Participated in *North American Annual Meeting of the Association of Symbolic Logic* held at University of California at Irvine, USA during Mar 25 – Mar 26, 2023. In the special session on “Proof Complexity Beyond Propositional Logic”, gave an invited talk on “Quantified Boolean formulas: solving and proof complexity.”

Mukhopadhyay, Anirban

Visited University of Lille, France during Nov 7 – Dec 6, 2022. Collaborative research

Participated in *Conference on Analytic Number Theory* held at Indian Statistical Institute, Kolkata during Feb 6 – Feb 9, 2023. gave a talk on ”Poissonian pair correlations”.

Mukhopadhyay, Partha

Visited Department of Physics & Astronomy, University of Kentucky during Apr 1 – Nov 15, 2022. Virtually participated as a Visiting Scientist.

Pal, Arnab

Visited IIT Kharagpur during Jul 17 – Jul 21, 2022. Conference+school

Participated in *Discussion Meeting On Statistical Physics and Complex Systems* held at IIT Kharagpur during Jul 18 – Jul 20, 2022. Invited speaker

Prasad, Amritanshu

Participated in *National Symposium on Mathematics and Applications* held at IIT Madras on Dec 22, 2022. Invited Lecture

Raghavan, K. N.

Visited Indian Academy of Sciences during Jan 9, 2022 – Jan 9, 2023. Chair of the Mathematics Selection Committee of Summer Research Fellowships

Visited IISER Mohali during Feb 10, 2022 – Feb 10, 2023. NBHM Board Meeting

Participated in *Service Programme for College Teachers* held at Ramanujan Institute for Advanced Study in Mathematics on Apr 19, 2022. Gave a talk as resource person

Visited Vijay Vidyalaya College of Arts and Sciences on Apr 23, 2022. Lectured to Undergraduate Students in an Outreach Programme sponsored by RMS (Ramanujan Mathematical Society)

Visited HBCSE Mumbai on May 6, 2022. NBHM Board Meeting

Visited NEHU Shillong on May 27, 2022. Colloquium Talk

Participated in *Advanced Instructional School on Representation Theory* held at Chennai Mathematical Institute during Jun 20 – Jun 25, 2022. Gave six lectures and conducted associated tutorials as a resource person during the first week of the event

Visited General Assembly of International Mathematical Union at Helsinki during Jul 2 – Jul 6, 2022. Also attended the award ceremony of ICM 2022

Visited Indian Statistical Institute Bangalore on Jul 7, 2022. Editorial Board Meeting of IJPAM

Visited Indian Institute of Science during Jul 18 – Jul 22, 2022. Attended FPSAC (as a

member of its organising committee)

Visited Kerala School of Mathematics on Aug 26, 2022. Meeting of the Research Council

Participated in *Refresher Course in Mathematics* held at UGC HRDC University of Hyderabad (Online) during Sep 12 – Sep 24, 2022. Gave four online lectures

Visited Insitute of Mathematics and Applications, Bhubaneswar during Sep 18 – Sep 20, 2022. Part of NBHM's Review Committee

Visited IISER Thiruvananthapuram on Dec 11, 2022. Lectured at an outreach event for teachers, sponsored by the India Mathematics Consortium

Participated in *International Seminar on Algebra and Discrete Mathematics* held at St. Berchmans College, Chengannassery, Kerala during Dec 12 – Dec 14, 2022. Invited Speaker

Visited Vellore Institute of Technology, Vellore on Dec 22, 2022. Gave a lecture on the occasion of National Mathematics Day

Participated in *Conference on Commutative Algebra and Algebraic Geometry* held at IIT Hyderabad during Feb 8 – Feb 9, 2023.

Participated in *Group Theory and Related Topics* held at NISER, Bhubaneswar on Mar 4, 2023. Gave an invited talk

Visited University of Hyderabad during Mar 6 – Mar 7, 2023. School Board Meeting, Colloquium Talk

Participated in *13th Refresher Course in Mathematical Science* held at University of Calicut (Online) during Mar 10 – Mar 18, 2023. Gave two online talks

Visited Secretariat of the International Mathematical Union, Berlin during Mar 11 – Mar 14, 2023. Meeting of the IMU Commission for Developing Countries

Visited Harish-Chandra Research Institute during Mar 20 – Mar 21, 2023. NBHM Library Committee Meeting, Colloquium Talk

Ravindran, V.

Given a set of lectures on "QCD" at Asia-Europe-Pacific School of High-Energy Physics (AEPSHEP 2022), Pyeongchang, South Korea from 5-18 October 2022.

Visited DESY, Hamburg, from 1 to 27 November 2022 under Indo-German Joint project

Invited talk at international conference on "QCD at LHC" 28th November to 2 December

2022 at Laboratoire de Physique des 2 Infinis Irene Joliot-Curie (IJCLab) CNRS / Paris-Saclay U., Paris

Visited Laboratoire de Physique des 2 Infinis Irene Joliot-Curie (IJCLab) CNRS / Paris-Saclay U., Paris and LAPTH, Jussieu, Paris from 26th November to 9th December 2022.

Joint seminar at LAPTH, Jussieu, Paris, 6th December 2022.

Invited Talk at IMHEP, IOP, Bhubaneswar, 16-24 February 2023

Invited Talk at Frontiers in particle physics, CHEP, Bangalore, 10-12 March 2023

Srinivas, K.

Participated in *Summer Training Programme in Mathematics* held at Pie Mathematics Association, Chennai on May 27, 2022. Delivered a talk.

Participated in *ICMSA-2022* held at SRTM University, Nanded, Maharashtra during Jul 28 – Jul 30, 2022. Participated virtually and delivered a talk.

Visited NIT Rourkela during Jan 4 – Jan 13, 2023. Delivered couple of talks in the department of mathematics.

Participated in *Workshop on Number Theory* held at NISER Bhubaneswar during Feb 21 – Feb 24, 2023. Delivered a talk.

Visited IMA Bhubaneswar during Feb 27 – Feb 28, 2023. Delivered two talks.

Subramanian, C. R.

Participated in *9th International Conference on Algorithms and Discrete Applied Mathematics (CALDAM-2023)* held at Dhirubhai Ambani Institute of Information and Communication Technology during Feb 9 – Feb 11, 2023.

Viswanath, Sankaran

Participated in *Advanced Instructional School on Representation Theory* held at Chennai Mathematical Institute during Jun 20 – Jul 9, 2022. Gave 5 lectures

Visited IIT Kanpur on Jun 29, 2022. Participant at the convocation of the Department of Mathematics, IIT Kanpur

5.3 Visitors from Other Institutions

Faculty Visitors

Nihar Ranjan Sahoo	09.04.22 - 13.04.22	Shandong Univ. China
R. Venkatesh	19.04.22 - 22.04.22	IISc, Bengaluru
Jean Marc Deshovillers	08.05.22	Univ. Of Berdeaux, France
N.D. Hari Dass	10.04.22 - 14.05.22	IMSc Retired Faculty
Subhro Bhattacharjee	03.05.22 - 05.05.22	ICTS, TIFR, Bengaluru
R. Venkatesh	02.05.22 - 06.05.22	IISc, Bengaluru
Kabir Ramola	18.05.22 - 28.05.22	TIFR, Hyderabad
Rahul Srivastava	24.05.22 - 31.05.22	IISER Bhopal
Suvam Mukherjee	30.05.22 - 05.06.22	Girls College Kolkata
A.P. Balachandran	08.06.22 - 05.09.22	Syracuse Univ. Newyork
Rahul Srivastava	11.06.22 - 14.06.22	IISER Bhopal
Sivakumar	06.06.22 - 15.06.22	Univ. Of Hyderabad
Sudhansu Sekhar Rout	14.06.22 - 24.06.22	IMA, Odisha
Sourav Mitra	07.06.22 - 09.07.22	Surendranath Collge, Kolkata
Nitin Saourabh	01.06.22 - 08.07.22	IIT, Hyderabad
Sujoy Kumar Bhore	29.06.22 - 30.06.22	IISER Bhopal
Ashutosh Rai	21.06.22 - 06.07.22	IIT, Delhi
Vishwas V	29.06.22 - 02.07.22	IIT, Palakkad
Sreejith A.V	22.06.22 - 03.07.22	IIT, Goa
Aravinda S	14.07.22 - 18.07.22	IIT, Tirupathi
Ranjan Krishna	14.07.22 - 17.07.22	IIT, Tirupathi
Bruno Kahn	01.08.22 - 22.08.22	CNES
Marc Bourdon	30.07.22 - 05.08.22	France
Gowtami Bhowmik	30.07.22 - 05.08.22	France
Travis Scmmshaw	24.07.22 - 28.07.22	Sage Days Conference
Martin Rubey	24.07.22 - 28.07.22	Sage Days Conference
Eric Marberg	24.07.22 - 31.07.22	Sage Days Conference
Srinivas Raghavendran	01.08.22 - 03.08.22	National Univ. Ireland
K. Ragavendran	20.03.22 - 17.10.22	Kalasalingam University
Roy Joshua	02.08.22 - 03.08.22	OHIO State Univ. USA
Anuja Jakhar	15.07.22 - 28.07.22	IIT, Bhilai
Sumilan Banerjee	27.07.22 - 30.07.22	IISc, Bengaluru
Mohan Swaminathan	24.07.22 - 30.07.22	Stanbridge Univ. USA
Shailesh Chandra Sekharan	11.08.22 - 13.08.22	Duke Univ. USA
K.V.S. Shiv Chaitanya	16.08.22 - 20.08.22	BITS Pilani
Shamik Gupta	05.08.22 - 09.08.22	TIFR, Mumbai
R. Venkatesh	01.08.22 - 06.08.22	IISc, Bengaluru
Krishnendu Sengupta	10.08.22 - 12.08.22	JACS, Kolkata
Deshevillers Jean Marc	28.08.22 - 03.10.22	France
Biswajyoti Saha	11.08.22 - 21.08.22	IIT, Delhi
Ekaka Saha	11.08.22 - 21.08.22	IIT, Delhi
Antonio Gonzalez	04.09.22 - 08.09.22	Arroyo
Kuber Bhainsa	24.08.22 - 24.08.22	BARC

Shanta Laishram	13.09.22 - 18.09.22	ISI, New Delhi
Manish Dev Shriondi	21.09.22 - 22.09.22	Central Univ. Rajasthan
Swarup Floria	01.10.22 - 10.10.22	Univ. Of Calcutta
Asweel Ahmed A Jaleel	04.10.22 - 05.10.22	Sadakathullah College, Tirunelveli
Debasish Banerjee	29.08.22 - 31.08.22	SINP Kolkata
Raju Venugopalan	12.09.22 - 15.09.22	Brookaven National Cab USA
N. Sukumar	19.09.22 - 31.10.22	Shiv Nadar Univ.
Rusa Mandal	23.09.22 - 25.09.22	IIT, Gandhinagar
Lawqueen Kanesh	01.10.22 - 11.10.22	IIT, Jodhpur
Archinshman Raju	12.10.22 - 13.10.22	NCBS, TIFR
Abhinav Saket	29.10.22 - 31.10.22	Samastipur College, Bihar
Jayanta Kumar Bhattacharjee	25.10.22 - 29.10.22	
A. Sankaranarayanan	16.11.22 - 19.11.22	Univ. Of Hyderabad
Oliveire Ramare	04.12.22 - 10.12.22	Behrampur
Rahul Srivastava	13.11.22 - 28.11.22	IISER Bhopal
Fabio Finelli	11.12.22 - 24.12.22	Italy
Olaf Beyersdorff	11.12.22 - 23.12.22	F.S. University Jena, Germany
Parimala Raman	01.11.22 - 31.12.22	Emory University
Deileep Jatkar	08.11.22 - 30.11.22	HRI, Allahabad
Prasad V.V	14.11.22 - 02.12.22	Cochin University
M. Sivakumar	21.11.22 - 04.12.22	Univ. Of Hyderabad
Ranjan Laha	01.12.22 - 03.12.22	IISc, Bengaluru
Asweel Ahmed A Jaleel	07.12.22 - 09.12.22	Sadakathullah College, Tirunelveli
Manoj kumar yadav	08.12.22 - 11.12.22	HRI
Siddhartha Sarkar	12.12.22 - 19.12.22	IISc, Bengaluru
Ashutosh Rai	15.12.22 - 21.12.22	IIT, Delhi
Urjjarani Patel	20.12.22 - 31.12.22	BITS Pilani
Sudhir Kumar Pujahari	23.12.22 - 31.12.22	NISER
Diptimoy Ghosh	27.12.22 - 29.12.22	IISER Pune
Goutam Bhattacharya	28.12.22 - 03.01.23	SIMP
Subir Sachdev	15.01.23 - 16.01.23	Harvard Univ.
A.P. Balachandran	01.01.23 - 30.04.23	Syracuse University
Chanda Singh Dalawat	15.01.23 - 22.01.23	HRI
Narayan Rana	11.11.22 - 19.11.22	IIT, Kanpur
Ditarka Das	06.12.22 - 09.12.22	IIT, Kanpur
Stayanarayanan	10.01.23 - 14.01.23	
Mukhopadhyay		
Nirmalya Kajuri	03.01.23 - 15.01.23	IIT, Mandi
Lawqueen Kanesh	13.12.22 - 11.01.23	IIT, Jodhpur
Biswaranjan Behera	05.01.23 - 09.01.23	Univ. Of Florida
Sthitadhi Royh	24.01.23 - 25.01.23	ICTS, TIFR, Bengaluru
Vishwas V	06.01.23 - 10.01.23	IIT, Palakkad
Jean Marc Deshovillers	10.02.23 - 14.02.23	Univ. of Bordeaux
David Sinnou	01.02.23 - 30.04.23	Sorbonne University
Spyridon Sypsas	20.02.23 - 26.02.23	Chulalongkom Univ. Thailand
Christian Schmidt	11.02.23 - 17.02.23	Bielefeld Univ. Germany
Gautam I Menon	15.03.23 - 16.03.23	Ashoka University

K.V.S. Shiv Chaitanya	27.02.23 - 03.03.23	BITS Pilani, Hyderabad
Shreedhar Bhomidi Sai So- man	06.03.23 - 06.03.23	HRI, Prayagraj
Fahad Panolan	19.02.23 - 22.02.23	IIT, Hyderabad
Murugappan Muthukumar	23.02.23 - 23.02.23	Univ. Of Massachusetts
Venkatesh Rajendran	18.02.23 - 23.02.23	IISc, Bengaluru
Viji Thomas	27.02.23 - 01.03.23	IISER Thiruvananthapuram
Ariane Mezard	02.03.23 - 10.03.23	Sorbonne University
Malay Banerjee	05.03.23 - 07.03.23	IIT, Kanpur
Sankar Prasad Das	06.3.23 - 08.03.23	SPS, JN University, New Delhi
Shovan Dutta	12.03.23 - 14.03.23	RRI
Rajendra Kumar	12.03.23 - 14.03.23	Weizmann Institute
v. Kumar Murty	08.03.23 - 10.03.23	Univ. Of Toronto

Post Doctoral Visitors

Sayan Chakraborty	03.04.22 - 10.04.22	ISI Kolkatta
Biswajit Karmakar	19.04.22 - 27.04.22	Univ. Of Sileria, Poland
Akshaya Devi	IGCAR	
Ashutosh Dubey	25.04.22 - 03.05.22	IIT Delhi
Abdul Majith N	11.05.22 - 15.05.22	Univ. Of Rennes, France
Maguni Mahakhud	09.05.22	HEP
Saudamini Nayak	18.05.22	IMA, Bhubaneswar
Samapan Sikdar	01.06.22 - 01.09.22	IMSc
C.G. Karthick Babu	20.05.22 - 15.06.22	IISER Berhampur
Ranjani Seshadri	23.06.22 - 25.06.22	Bengurion Univ.
Suman Dutta	13.06.22 - 21.06.22	ICTS TIFR
Dipanjan Mandal	16.06.22 - 22.06.22	Univ. Of Warwick
Mrigendra Singh Kushwala	12.06.22 - 26.06.22	IISc Bengaluru
Arkaprabha Ghosal	15.07.22 - 14.10.22	Bose Institute
Samapan Sikdar	01.06.22 - 01.09.22	IMSc PDF
Vivek Ananth RP	01.08.22 - 31.12.22	Post-Doc, IMSc
Abhranil Chatterjee	17.07.22 - 20.07.22	Post-Doc
Debanjana Kundu	28.08.22 - 30.08.22	Canada
Yajnaseni Dutta	27.08.22 - 30.08.22	Hausdorff Centre for Maths
Amrutha P	08.08.22 - 31.08.22	IISER, TVM
Rakesh Netha Vadnala	01.08.22 - 16.08.22	IMSc
Mrinal Kanti Pal	17.08.22 - 20.08.22	DPM. Univ. Of Calcutta
Sabiar Shaikh	05.09.22 - 04.12.22	IMSc
Roja Nadarajan	01.09.22 - 30.11.22	Univ. Of Madras
Mrigendra Singh Kushwala	07.08.22 - 15.09.22	IISc Bengaluru
Arkajyoti Manna	03.09.22 - 09.09.22	IISc Bengaluru
Ravi Kunjwal	05.09.22 - 13.09.22	Univ. De budellos Belgium
Aaloka Kanhere	18.08.22 - 26.08.22	Freelance Researcher
Aparna Sankar	01.08.22 - 31.08.22	IMSc

Vinay Vaibhav	01.08.22 - 31.10.22	IMSc
Semanti Dutta	01.08.22 - 29.09.22	IMSc
Susmita Ghosh	01.07.22 - 30.09.22	IMSc
Minlu Nandi	15.11.22 - 16.11.22	Univ. Of Calcutta
Sabyasachi Maulik	21.11.22 - 24.11.22	SINP
Sridhar P. Narayanan	21.11.22 - 28.11.22	IIT Bombay
Arnab Priya Saha	03.12.22 - 13.12.22	IISER Bhopal
Mohammed Shabbir	07.12.22 - 06.03.22	IMSc
K. Balamurugan	01.2.22 - 28.02.22	IMSc
Debmalya Chakraborty	02.12.22 - 02.12.22	Uppsala University
Gourav Rattan	02.12.22 - 31.01.23	Scientific Researcher RWTH, Germany
Sankalp Radhakrishnan	22.01.23 - 24.01.23	Nordita, Sweden
Nambial		
Mritunjay Verma	18.01.23 - 20.01.23	Univ. Of Southampton
Tanay Nag	22.01.23 - 24.01.23	Uppsala University, Sweden
Amlan chakraborty	08.01.23 - 12.01.23	State Univ. Of New york
Biswajit Chakraborty	Ramakrishna Mission	
Pulak Banerjee	20.11.22 - 26.11.22	IIT Guwahati
Prashanth Ramar	20.01.23 - 27.01.23	IISc, Bengaluru
Some Sarkar Bhattacharya	23.01.23 - 27.01.23	CT QT, Poland
Arijit Misra	23.01.23 - 27.01.23	Weizmann Israel
Disha Bhatia	18.01.23 - 21.01.23	Institute of Fisica, Brasil
Chandar Datta	27.01.23 - 31.01.23	Univ. Of Warsaw, Poland
Badri Vishal Panday	23.01.23 - 25.01.23	Univ. Of Cologne
Souvik Priyam Adhya	14.01.23 - 17.01.23	PDF, IFJ, Rev, Poland
Tanmay Mitra	16.01.23 - 24.01.23	Helmholtz centre, Germany
Soumyakanti Bose	13.02.23 - 17.02.23	Seoul National Univ. Korea
Archana Radhakrishnan	05.02.23 - 18.02.23	TIFR
Suman Dutta	23.01.23 - 27.01.23	ICTS TIFR
Abhinandan	01.03.23 - 04.03.23	Univ. Of Tokyo
Archan mukhopadhyay	07.03.23 - 11.03.23	Univ. Of Birmingham
Gaurav Sood	05.03.23 - 09.03.23	Technion, Israel

Doctoral Visitors

Yash Uday Deshmukh	05.06.22 - 08.06.22	Columbia Univ, USA
Soumen Mandal	01.06.22 - 30.06.22	IIT, Delhi
Susobhan Bandopadhyay	17.06.22 - 31.07.22	NISER, Bhubaneswar
Devichandrika	19.06.22 - 19.07.22	Univ. Of Hyderabad
Sreenanda S.B	19.06.22 - 19.07.22	Univ. Of Hyderabad
Prince Mathew	01.06.22 - 30.06.22	IIT, Goa
Aditi Krishnan	03.06.22 - 03.07.22	IISER, Bhopal
Dilip Kumar Saho	01.07.22 - 28.07.22	IISER, Berhampur
Shraddha Ramdas Bndekar	12.08.22 - 12.08.22	VIT
MD Irfan Habib	02.08.22 - 07.08.22	IISc, Bengaluru
Ion Santra	04.08.22 - 06.08.22	RRI
Anupam Ray	22.08.22 - 23.08.22	TIFR

Bishal Deb	16.08.22 - 21.08.22	Univ. Colloge London
Divya Aggarwal	09.07.22 - 16.07.23	IIT, Delhi
Amrutha A.S	10.10.22 - 16.10.22	JNCASR, Bengaluru
Nidhi Purohit	01.11.22 - 30.04.23	Univ. Of Bergen
Sushant Yadav	14.11.22 - 28.11.22	IISER, Bhopal
Aditya Batra	14.11.22 - 28.11.22	IISER, Bhopal
Sachin Gnover	08.11.22 - 20.11.22	HRI, Allahabad
Marlene Grundel Friendrich	11.12.22 - 23.12.22	Schiller Univ, Jena Germany
Biswajit Das	23.01.23 - 22.02.23	IOP, Bhubaneswar
Priya Chakraborty	13.12.22 - 14.12.22	NIT, WestBengal
Susobhan Bandopadhyay	15.12.22 - 21.12.22	NISER
Soni Dayashankar Prajapati	16.01.23 - 21.01.23	IIT, Hyderabad
Suvam Pal	16.01.23 - 19.01.23	ISI Kolkata
Reshmi Roy	21.01.23 - 24.01.23	Dept of Physics, Univ of Kolkata
Sumandeep kaur	30.01.23 - 31.03.23	Punjab Univ. Chandigarh
Krishnarjun K	01.02.23 - 28.02.23	HRI, Allahabad
Madhumita Kundu	10.12.22 - 06.05.23	Univ. Of Bergen, Norway

Non-Doctoral Student Visitors

Gaurav Viramgami	09.05.22	IIT, Gandhinagar
Yash More	09.05.22	IIT, Gandhinagar
Akshaya L	06.06.22 - 30.11.22	PSG College, Coimbatore
Subhasri Manigandan	06.06.22 - 30.11.22	PSG College, Coimbatore
Sudharsan Vijayaraghavan	01.07.22 - 31.12.22	PSG College, Coimbatore
Jishnu R	08.07.22 - 26.05.23	IISER, Tirupati
Kundanathan R	09.07.22 - 31.07.22	NIT, Rourkela
Kishan Kumar	15.07.22 - 31.12.22	Central University
Sushree S. Behera	15.07.22 - 14.10.22	IISER, Tirupati
Mousumi Kundu	02.07.22 - 02.11.22	IISER, Berhampur
Shriya M	25.07.22 - 31.12.22	BITS Pilani
Smurit Dixit	28.07.22 - 28.10.22	IISER, Bhopal
Kadambari Patil	28.07.22 - 29.07.22	CCMB, Hyderabad
Harry Rickman	24.07.22 - 30.07.22	
Lukasz Maslanka	24.07.22 - 28.07.22	
Mikday Marginiah	23.07.22 - 30.07.22	
Shobhit Singh	01.08.22 - 31.12.22	Azim Premjit Univ.
Atul Bhargav Balaji	24.07.22 - 31.01.23	PSG College, Coimbatore
S. Dheeraj Kumar	16.08.22 - 15.10.22	IISER, Tirupati
Prem Agarwal	11.07.22 - 05.07.22	IISER, Pune
Ria Ghosh	21.09.22 - 22.09.22	IMSc
N. Krishna		
Soham Chanda	08.01.23 - 09.01.23	Rutgers Univ. USA
Prem Agarwal	05.01.23 - 04.02.23	IISER, Pune
Sathish Kumar G	12.12.22 - 30.06.23	Anna Universtiy
R. Kundanathan	06.12.22 - 06.01.23	NIT, Rourkela

Lakshmi Priya
Sudharsan V

06.01.23 - 30.06.23
20.02.23 - 30.09.23

SASTRA
PSG College, Coimbatore

Chapter 6

Infrastructure

6.1 Computer Facilities

Enhancement of Computer Facility during 2022-23

- The Laptops/ipad s were issued to newly joined faculty and those faculty requested for replacement of laptops which are older than 4 years. About 10 nos of different model laptops are purchased and issued to faculty, staff, system service and media team use.
- Network connection refurbished in the hostel building. Network switches in all the lecture meeting halls are checked and replaced.
- New Panasonic PT-MZ780 model is installed in the Ramanujam Auditorium
- Zoom Academic license is renewed for one more year.
- The internet bandwidth speed is upgraded to 67 Mbps 1:1 fiberloop connection.
- TP Link WiFi routers are purchased and installed in the Pallavaram hostel facility to improve the internet speed.
- Old obsoleted media server replaced with new Dell Poweredge R540 servers.
- 8 TB hard disks qty 5 nos are changed in the Nanda Devi cluster.
- Kyocera printer M2040dn qty 11 nos are purchased and installed in the office, civil, electrical, reception etc as a replacement of old printers.

Activities :

E-Procurement and GeM online purchase activities are maintained.

Mr Unguturu Naga Malleswara Rao has joined as Scientific Officer C Systems.

Continuous system support has been provided to the Institute members for the remote work.

Apart from the regular online classes and talks, Media System team have supported the activities involved in the ISc 60 events, AZADI KA AMRIT MAHOTSAV events and the Science at Sabha event etc.

Media team has supported and fulfilled the requirements for all the virtual classes, official meetings, conference and webinars. In the year 2022-23 about 483 hours of video contents are recorded by the media team.

New media room setup and New HPC installation process started.

6.2 The Library

The Institute Library holds a total collection of 76681 books and bound periodicals as on March 31, 2023 inclusive of current year's addition.

The NBHM has recognized this Institute library as the Regional Library in the areas of Mathematics and Allied subject disciplines - in order to share our information resources to all bonafide members of other academic and research institutions.

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. Also, remote access during work from home situations to the subscribed online resources was facilitated by institutes' VPN (Virtual Private Network) service.

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.

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.

In addition, library also assists in annual report preparation that includes compilation of publications and other editorial processes.

Acknowledgment:

The Library gratefully acknowledges the donation of valuable books, journals and other reading materials received during the current year from the persons and organizations mentioned below:

R. Balasubramanian, IMSc
Srinivasa Rao, K., IMSc
Ghanashyam Date, IMSc
G. Subramoniam, IMSc
Director's office

V. Ravindran, IMSc
Rajasekaran G, IMSc
Rajesh Singh, IMSc
S. Kesavan, IMSc
NBHM