Chennai Mathematical Institute

Annual Report

April 2021–March 2022

H1, SIPCOT IT Park, Siruseri
Kelambakkam Post
Chennai 603 103
India.

Tel.: +91-44-7196 1000,
+91-44-2747 0226/0227/0228/0229
Fax: +91-44-2747 0225
WWW: http://www.cmi.ac.in

1 Preface

Chennai Mathematical Institute (CMI) has been a centre of excellence for research and teaching in the mathematical sciences for over 30 years. During this period, CMI has contributed to the growth of mathematics and allied subjects in the country by providing a conducive environment for academic activities at all levels, ranging from school outreach and undergraduate and postgraduate teaching to advanced research.

CMI faculty are all active researchers, comparable to the best in their fields. CMI faculty publish in leading international venues. They are acknowledged internationally as experts in their subject areas and are invited to deliver lectures at major seminars and conferences. Several faculty members are members of national and international academic societies and policy-making bodies.

CMI's teaching programme has also won national and international recognition. Over the past two decades, CMI has attracted the best students wishing to pursue mathematics, computer science and physics to its high-quality undergraduate and postgraduate programmes. The teaching programmes offered in CMI are BSc Honours in Mathematics and Computer Science, BSc Honours in Mathematics and Physics, MSc in Mathematics, MSc in Computer Science and MSc in Data Science. In addition, CMI offers PhD programmes in Mathematics, Computer Science and Physics.

The BSc and MSc programmes in CMI have traditionally had a strong research focus. An overwhelming majority of CMI students go on to join graduate programmes at the best institutions across the world, such as Caltech, Carnegie-Mellon, Harvard, MIT, Princeton and Stanford in USA, Oxford in UK, ENS Paris in France, the Max Planck Institutes and Humboldt University in Germany, as well as IISERs, IMSc, ISI, IISc, IITs and TIFR in India, not to mention CMI itself. The newer MSc Data Science programme has a more applied focus and the response from industry has been highly positive. Even though the programme is still very young, the placement record is outstanding.

CMI has made significant contributions to India's scientific manpower. The number of CMI graduates who are faculty members at institutions such as IISc, ISI, IITs, IISERs, IIMs, TIFR, IMSc and CMI grows steadily each year. In addition, CMI alumni are also researchers in organizations such as Microsoft Research India.

With data-driven decision making becoming ubiquitous across all sectors, CMI students are much sought after for industry placement, thanks to their strong background in mathematics, statistics and computing. Graduates from CMI have joined companies in areas ranging from finance and insurance to manufacturing and retail, as well as startups offering technology solutions that exploit the power of machine learning.

The past year saw a leadership transition at CMI. Prof. Rajeeva Karandikar stepped down as Director after completing two terms. Prof. Karandikar became Director in 2011, taking over from Prof. C.S. Seshadri, who founded the Institute. It is always a challenge to follow such an influential figure, but Prof. Karandikar was more than equal to this task.

Under his leadership, CMI consolidated its existing strengths in academic research with new linkages. An important new dimension of applied research was added, leading to the creation of Algolabs, a society to promote interaction between CMI and the industry. The teaching programme also prospered. In keeping with the new focus on applied research, a new MSc programme in Applications of Mathematics was launched, which eventually evolved into the highly successful MSc programme in Data Science. On behalf of the Institute, I take this opportunity to thank Prof. Karandikar for his invaluable contributions to the growth of CMI, and look forward to his continued involvement in its development.

In 2020, CMI had established a Centre of Excellence named after Dr. F.C. Kohli, the pioneer of the Indian IT industry. In connection with the projected activities of this Centre, the Institute had requested additional land within the IT park where CMI is located. In March 2022, the state government sanctioned this additional land, which is within walking distance of the present campus. The development of the new campus will be taken up in 2022–2023.

During 2021–2022, CMI also began to engage with the state government, which has embarked on an ambitious programme to consolidate and analyse the data collected by its different departments for more effective design and implementation of policies and programmes. In January 2022, CMI signed an MoU with the Tamil Nadu e-Governance Agency (TNeGA) to formalize this engagement.

Another very positive development during the year was the addition of four new faculty members, three in Computer Science and one in Mathematics. We look forward to welcoming several more talented young researchers to CMI in the coming years.

Despite the challenges posed by the pandemic, CMI continued to maintain an active research presence though online seminars and conferences. The annual conference Statistical Methods in Finance was organized in June 2021 and a school and conference on geometric complexity theory was held in January 2022. During January–February 2022, a series of talks called Perspectives on Mathematical Sciences was organized to inaugurate the academic activities of the F.C. Kohli Centre. This series had survey talks by both established, award-winning researchers and rising stars across a diverse range of contemporary topics in computing, mathematics and physics.

The Institute also maintained its focus on outreach. CMI's students organized their annual nationwide Scholastic Test of Excellence in Mathematical Sciences (STEMS), accompanied by a vibrant set of online talks on diverse topics by leading researchers from across the world. CMI also continued its partnership with Raising A Mathematician Foundation's Training Programme (RAM TP) during the summer of 2021. In collaboration with the National Academy of Sciences, Allahabad (NASI), CMI continued its outreach lectures for schools online.

This year finally saw a steady return to regular academic activity on the campus. Most faculty, postdoctoral fellows and research scholars resumed in-person interactions from the start of 2022. Though teaching remained online, students were gradually allowed to come

back to CMI on a voluntary basis. By March 2022, the hostel was close to full capacity.

We are optimistic that the impact of the pandemic on daily life will continue to wane and academic activity will return to normal during the next academic year. In addition to in-person classes, CMI hopes to return to hosting instructional schools, research workshops and scientific conferences on campus, as well as other activities such as endowment lectures and cultural programmes.

To conclude, we are happy to acknowledge the agencies and organizations that support CMI's activities and sustain its growth. Over the years, CMI has received steady support from the Government, primarily through the Department of Atomic Energy. CMI has also received funding from the UGC and DST. CMI is fortunate to be the beneficiary of generous support from private sources, including CSR funding from both small and large organizations, notably the Shriram Group Companies, Cognizant Foundation and Trumpf Metamation.

Madhavan Mukund
Director

2 Board of Trustees

1. Mr. N. Lakshmi Narayanan, Managing Trustee
   Emeritus Vice Chairman, Cognizant Technology Solutions, Chennai

2. Dr. A.C. Muthiah, Founder Trustee
   Chairman Emeritus, SPIC Ltd., Chennai

3. Prof. Vijay Chandru, Trustee
   INAE Distinguished Technologist, BioSystems Science and Engineering,
   Indian Institute of Science, Bangalore

4. Mr. Arun Duggal, Trustee
   Chairman, ICRA, New Delhi

5. Dr. Anil Kakodkar, Trustee
   Former Chairman, Atomic Energy Commission
   INAE Satish Dhawan Chair of Engineering Eminence,
   Bhabha Atomic Research Centre, Mumbai

6. Mr. P. Venketrama Raja, Trustee
   Chairman, Ramco Group and Ramco Systems, Chennai

7. Dr. M.R. Srinivasan, Trustee
   Former Chairman, Atomic Energy Commission

8. Ms. Sudha G, Trustee
   Regional Head - Facilities, Infosys Limited, Bangalore

9. Mr. Jawahar Vadivelu, Trustee
   Chairman, Navia Corporate Services Ltd., Chennai

3 Governing Council

1. Prof. R. Balasubramanian (Chairman)
   National Centre for Mathematics, Mumbai

2. Prof. Manindra Agrawal
   Indian Institute of Technology Kanpur

3. Prof. V. Balaji
   Chennai Mathematical Institute, Chennai

4. Dr. Ravi Kannan
   Microsoft Research, Bangalore

5. Prof. Rajeeva L. Karandikar
   Chennai Mathematical Institute, Chennai

6. Prof. Madhavan Mukund
   Director, Chennai Mathematical Institute, Chennai

7. Prof. V. Kumar Murty
   University of Toronto
   Director, Fields Institute

8. Prof. Nitin Nitsure
   Tata Institute of Fundamental Research, Mumbai (retired)

9. Prof. Bimal Roy
   Indian Statistical Institute, Kolkata

10. Prof. V. Srinivas
    Tata Institute of Fundamental Research, Mumbai
    Chair, National Board for Higher Mathematics

11. Prof. K.V. Subrahmanyam
    Dean of Studies, Chennai Mathematical Institute, Chennai

12. Prof. P.S. Thiagarajan
    National University of Singapore (retired)

4 Academic Council

1. Madhavan Mukund (Chairman),
   Director, Chennai Mathematical Institute, Chennai

2. K.V. Subrahmanyam, (Convenor),
   Dean of Studies, Chennai Mathematical Institute, Chennai

3. M.S. Ananth,
   Professor, Indian Institute of Technology Madras

4. V. Balaji,
   Professor, Chennai Mathematical Institute, Chennai

5. R. Balasubramanian,
   Professor, National Centre for Mathematics, Mumbai

6. S.G. Dani,
   Professor, Centre for Excellence in Basic Sciences (CBS), Mumbai
   Tata Institute of Fundamental Research, Mumbai (retired)

7. R.L. Karandikar
   Professor Emeritus, Chennai Mathematical Institute, Chennai

8. S. Kesavan,
   Professor, The Institute of Mathematical Sciences, Chennai (retired)

9. Gadadhar Misra,
   Professor, Indian Institute of Science, Bangalore

10. N. Mukunda,
    Professor, Indian Institute of Science, Bangalore

11. Rajaram Nityananda,
    Professor, Azim Premji University, Bangalore

12. G. Rajasekaran,
    Professor, Chennai Mathematical Institute, Chennai

13. T.R. Ramadas
    Professor, Chennai Mathematical Institute, Chennai

14. Jugal Verma
    Professor, Indian Institute of Technology Bombay, Mumbai

5 Boards of Studies

Mathematics

1. Parameswaran Sankaran (CMI), Chair
2. V. Balaji (CMI)
3. Clare D'Cruz (CMI)
4. Rajeeva L. Karandikar (CMI)
5. Vijay Kodiyalam (IMSc)
6. D.S. Nagaraj (IISER Tirupati)
7. M. Thamban Nair (IIT, Madras)
8. Pramathanath Sastry (CMI)
9. K.V. Subrahmanyam (CMI, Chair, Board of Studies in Computer Science)

Computer Science

1. K.V. Subrahmanyam (CMI), Chair
2. Manindra Agrawal (IIT, Kanpur)
3. V. Arvind (IMSc)
4. Madhavan Mukund (CMI)
5. K. Narayan Kumar (CMI)
6. V. Vinay (LimberLink, Bangalore)
7. Parameswaran Sankaran (CMI, Chair, Board of Studies in Mathematics)

Physics

1. V.V. Sreedhar (CMI), Chair
2. K.G. Arun (CMI)
3. H.S. Mani (CMI)
4. K. Narayan (CMI)
5. R. Rajesh (IMSc)
6. J. Samuel (RRI)

Data Science

1. Sourish Das (CMI), Chair
2. Tathagata Bandyopadhyay (IIM Ahmedabad)
3. Shibasish Dasgupta (Pfizer)
4. Rajeeva L. Karandikar (CMI)
5. Madhavan Mukund (CMI)
6. B. Ravindran (IIT Madras)
7. Ramaseshan Ramachandran (Cognizant, retired)
8. Ganesh Sankaralingam (Latentview)
9. K.V. Subrahmanyam (CMI)

Undergraduate Studies

1. Pramathanath Sastry (CMI), Chair
2. K. Narayan Kumar (CMI)
3. Parameswaran Sankaran (CMI)
4. V.V. Sreedhar (CMI)
5. K.V. Subrahmanyam (CMI)

6 Institute Members

Director	
	Madhavan Mukund
Dean of Studies	
	K.V. Subrahmanyam
Professor Emeritus	
	Rajeeva L. Karandikar
Distinguished Professors	
	V. Balaji
Professors	
	K.G. Arun
	Clare D'Cruz
	Govind S. Krishnaswami
	Samir Datta
	K. Narayan
	K. Narayan Kumar
	Partha Mukhopadhyay
	Purusottam Rath
	T.R. Ramadas
	P. Sankaran
	Pramathanath Sastry
	S. Senthamarai Kannan
	V.V. Sreedhar
	R. Srinivasan
Associate Professors	
	Aiswarya Cyriac
	Sourish Das
	Krishna Hanumanthu
	Upendra Kulkarni
	Manoj Kummini
	Alok Laddha
	Sukhendu Mehrotra
	Prajakta Nimbhorkar
	Geevarghese Philip
	M. Praveen
	B. Srivathsan
	M. Sundari
	S.P. Suresh
	Amitabh Virmani
Assistant Professors	
	Priyavrat C Deshpande
	Pranabendu Misra

Siddhi Pathak
C. Ramya
Nithin Varma

Visiting Faculty

Karthikeyan Bhargavan
Keshab Chandra Bakshi
Kamalakshya Mahatab
S. Selvaraja
Raja Sridharan
Kavita Sutar
V. Swaminathan
Venkatesh Vinayakarao (until September 2021)
Pascal Weil

Post-doctoral Fellows

Chaitanya Ambi
Sajat Ahmad Bhat
Ritabrata Bhattacharya
Suprajo Das
Soumya Dey
Jyotirmoy Ganguly
Murugeswari Issakkimuthu
Abhijeet Ghanwat (until August 2021)
Pratik Ghosal
Suchita Goyal (until January 2022)
Varun Gupta
Rupam Karmakar (until February 2022)
Tanya Kaushal (until August 2021)
Arvind Kumar
Sushma Kumari
Animesh Lahiri
Jayakrishnan Madathil
Nirupama Mallick
Snehajit Misra
Sayanta Mandal (until January 2022)
Oorna Mitra
Arghya Mondal
Mandira Mondal
Arpita Nayak
Partha Paul
Nabanita Ray
Mallika Roy
Sudeshna Roy
Anurag Singh (until September 2021)

Chiranjeeb Sinha (until April 2021)
Shivdutt Sharma (Until August 2021)
Vimal Raj Sharma
Amith Shastri K
Amit Kumar Singh
Jyothsnaa Sivaraman
Sruthymurali
Shibi Vasudevan (until June 2021)

Adjunct Professors

Manindra Agrawal
Shibasish Dasgupta
Ghanshyam Date
Ramesh Hariharan
S. Kesavan
V. Lakshmibai
Ashok Kumar Kapoor (until June 2021)
Usha Mahadevan
H. S. Mani
Neeraj Kayal
Raghav Kulkarni
T. Parthasarathy
Mythily Ramaswamy
S. Ramanan
R.V. Ramamoorthi
B.V. Rao
Sharad S. Sane
Nitin Saxena
R. Sridharan
K. Srilata
Mandayam Srivas
G. Rajasekaran
Sundareswaran Ramasubramanian
A. Thyagaraja
V. Vinay

Research Scholars

Aashish Satyajith
Aditya N K Subramaniam (until July 2021)
Adwitee Roy
Aneesh P B (until July 2021)
Ankit Yadav
Archit Chauhan
Arkadev Ghosh
Asif Khan

Athira P V (until November 2021)
Chellapillai D (until August 2021)
Ashwin Bhaskar
Akshay Chandrakant Kharade
Cyril J Jacob
Debodirna Ghosh
Dharm Veer
Gautham Shenoy R
Govind R (until June 2021)
Harish Chandramouleeswaran
Hitesh Saini
Jagadish Pine
Kaberi Goswami
Krishna Menon
Keerthan Ravi
Mohammed Rizwan Rawani
Malay Mandal
A Manu (until November 2021)
Muthuvelmurugan I
Navnath Daundkar
Nirmal Kotal
Pankaj Saini
Parthapratim Mahapatra
Plawan Das (Until December 2021)
Pranjal Dutta
Preeti
Pritthijit Biswas
Pritish Sinha
Rajit Datta (until July 2021)
Ramadas N
Sadhanandh Vishwanath B
Sahil Kulshrestha (until January 2022)
Sahil Mhaskar
Samit Ghosh (until November 2021)
Sayan Mukherjee (until January 2022)
Sanchari Sil
Sayantani Datta
Mangala Pandi P
Shanmugapriya P
Sheikh Shakil Akhtar
Somnath Sudam Dake
Soumodev Mal

Sourav Roychowdhury
Srinidhi N
Sridharan Sankaran
Suhita Hazra
Tejas Shekhar Bhojraj
Utsab Ghosal
Varun Rajan
Vishnu T R (until July 2021)
Vishwa Prakash H V

Administrative Staff

S. Sripathy
V. Vijayalakshmi
Rajeshwari Nair
Ranjini Girish
Nisha John
B. Godwin
A. Sankaranarayanan
Daniel Lawrence
T. Jothi

7 Faculty Profiles

Rajeeva L. Karandikar

Rajeeva L. Karandikar received his B.Sc. from Indore University, Indore (1976), M.Stat. form Indian Statistical Institute, Kolkata (1978) and Ph.D. from Indian Statistical Institute, Kolkata (1981).

He has been an Associate Professor at the Indian Statistical Institute, Delhi (1984-89), a Professor at the Indian Statistical Institute, Delhi (1989-2006), a Professsor-in-Charge at the Indian Statistical Institute, Delhi (2000-2002), Head, Delhi Center at the Indian Statistical Institute, Delhi (2000) and (2004-2006) and an Executive Vice-President at Cranes Software International Limited.

He received the Shanti Swarup Bhatnagar Award in 1999. He has been awarded the P C Mahalanobis Gold medal by the Prime Minister at the Indian National Science Congress in February 2014. He is a fellow of the Indian Academcy of Sciences and the Indian National Science Academy.

His research interests are: Probability theory and Stochatic Processes, Applications of Statistics and Cryptography.

Madhavan Mukund

Madhavan Mukund received his B.Tech. (Computer Science and Engineering) from the Indian Institute of Technology, Bombay (1986) and his Ph.D. (Computer Science) from Aarhus University, Aarhus, Denmark (1992).

He is a member of the Executive Council and President of the Indian Association for Research in Computing Science (IARCS), as well as a member of the ACM India Council.

His research interests include models for concurrent and distributed systems, formal verification and distributed algorithms.

C.S. Seshadri

C.S. Seshadri received his B.A. Hons. (Mathematics) degree from Madras University (1953) and his Ph.D. from TIFR/Bombay University (1958).

He was at the School of Mathematics, Tata Institute of Fundamental Research, Bombay from 1953 to 1984 starting as a Research Scholar and rising to a Senior Professor. He was then a Senior Professor at the Institute of Mathematical Sciences, Madras (1984–89).

He has been a Visiting Professor at the University of Paris, France; Harvard University, Cambridge, U.S.A.; Institute for Advanced Study, Princeton, U.S.A.; University of California at Los Angeles, Los Angeles, U.S.A.; Brandeis University, U.S.A.; University of Bonn, Bonn,

Germany; Kyoto University, Kyoto, Japan.

He has given invited talks at many international conferences including the International Congress of Mathematicians, Nice, France, 1970.

He has received the Shanti Swarup Bhatnagar Award (1972) and the Srinivasa Ramanujan Medal of Indian National Science Academy (INSA). He was awarded the D.Sc. Degree (Honoris Causa) of Banaras Hindu University, Varanasi (1985). He has been awarded the Shanti Swarup Bhatnagar Medal (1995) of INSA and Srinivasa Ramanujan Birth Centenary Award (1995-96) of Indian Science Congress Association (ISCA). He has received G.M. Modi Science Award (1995), The Trieste Science Prize of the Academy of Sciences for the Developing World in (2006) and H.K. Firodia Award for Excellence in Science & Technology, Pune (2008).
He has also been awarded Padma Bhushan by the President of India (2009).

He is a Fellow of the Indian Academy of Sciences, Indian National Science Academy and a Fellow of the Royal Society. He has been appointed National Research Professor of the Ministry of Human Resource Development Government of India in 2006.

His research interests are: Algebraic Geometry and Algebraic Groups.

K.G. Arun

K.G. Arun received his B.Sc. (Physics) from Calicut University, Calicut (1998), M.Sc. (Physics) from Cochin University of Science and Technology (2001) and Ph.D. (Physics) from Raman Research Institute, Bangalore.

He has been a Postdoctoral Research Associate, Washington University in St Louis and VESF Fellow, LAL Orsay & IAP, Paris (2009-2010).

His research interests are Gravitational Wave Astrophysics, Modelling compact binaries, High energy Astrophysics and Cosmology, Tests of General Relativity and Alternative theories of gravity.

V. Balaji

V. Balaji received his B.A. Hons. (Mathematics) from University of Delhi (1982), his M.A. (Mathematics) from University of Delhi (1984), his Ph.D. from University of Madras (1991).

He has been an NBHM Post-doctoral Fellow at the Chennai Mathematical Institute (1989–92).

He received the Shanti Swarup Bhatnagar Award in 2006 and is a Fellow of the Indian Academy of Sciences.

His research interest is Algebraic Geometry.

Clare D' Cruz

Clare D' Cruz received her M.Sc. (Mathematics) from the Indian Institute of Technology, Bombay (1991) and her Ph.D. (Mathematics) from the Indian Institute of Technology, Bombay (1996).

She has been a Post-Doctoral Fellow at the Tata Institute of Fundamental Research, Mumbai (1996–98) and a Visiting Scholar at the Northeastern University, Boston, U.S.A. (1997–98).

Her research interest is Commutative algebra.

Govind S. Krishnaswami

Govind S. Krishnaswami received his B.Sc. (Physics), B.A. (Mathematics) from University of Rochester,U.S.A. (1999), M.A. (Physics), from University of Rochester, U.S.A. (2001) and Ph.D. (Physics) from University of Rochester, U.S.A. (2004).

He has been a Marie Curie Fellow, Spinoza Institute & Institute for Theoretical Physics, Utrecht University, The Netherlands.

His research interests are Quantum Field Theory, Hydrodynamics and Mathematical Physics

Samir Datta

Samir Datta received his B.Tech. (Computer Science and Engineering) from the Indian Institute of Technology, Kanpur (1995), M.S. from Rutgers University (1997) and Ph.D. from Rutgers University (2004).

He has been a Network Architect at Tellium Inc. (2000-03) and a Post Doctoral Fellow at WINLAB, Rutgers University (2004-05).

His research interests are Complexity Theory, Wireless and High Speed Networking.

K. Narayan

K. Narayan received his B.Tech. (Engineering Physics) from the Indian Institute of Technology Bombay, Mumbai (1997), M.S. (Physics) from the Cornell University, U.S.A. (1999) and Ph.D. (Physics) from the Cornell University, U.S.A. (2002).

He has been a Research Assistant at the Cornell University, U.S.A. (1998-2001), a Research Assistant at the Cornell University, U.S.A. (2001-02), a Postdoctoral Research Fellow at the Duke University, U.S.A. (2002-04) and a Postdoctoral Research (Visiting) Fellow at the Tata Institute of Fundamental Research, Mumbai (2004-07).

His research interests are String theory and cosmology, Stringy geometry and D-brane gauge theories.

K. Narayan Kumar

K. Narayan Kumar received his M.Sc. (Tech.) in Computer Science from Birla Institute of Technology and Science, Pilani (1990). He received his Ph.D. from the TIFR/University of Bombay (1997).

His research interests include Logic, Automata theory and Concurrency.

Partha Mukhopadhyay

Partha Mukhopadhyay received his B.E. (Electronics & Telecommunication Engineering) from Jadavpur University, Kolkata (2000), M.Tech. (Computer Science) from the Indian Statistical Institute, Kolkata (2002) and Ph.D. from the Institute of Mathematical Sciences, Chennai (2009).

He has been a Software Engineer at Motorola India Electronics Ltd., Bangalore (2002-2003), a Research Associate at the Indian Statistical Institute, Kolkata (2003-2004) and a Postdoctoral Fellow at Technion, Israel (2009-2010).

His research interests are Complexity Theory and Additive Combinatorics.

Purusottam Rath

Purusottam Rath received his Ph.D. (Mathematics) from Harish Chandra Research Institute, Allahabad (2006).

He has been a Visiting Fellow at the Institute of Mathematical Sciences, Chennai (2006–2007) and a Coleman Research Fellow at Queen's University, Canada (2007–2008).

His research interests are Combinatorial Number Theory, Diophantine Approximation and Transcendental nature of special values of L-functions.

T.R. Ramadas

T.R. Ramadas received his M.Sc. in Physics from the Indian Institute of Technology, Kanpur (1977) and Ph.D. in Mathematics from TIFR/University of Bombay (1982).

He has been a Professor at the School of Mathematics, TIFR till June 2002, a Professor at the University of Montpellier, France (2000-03), a Research Scientist at ICTP (2003-10) and Head, Mathematics Group, ICTP (2010-13).

He has received the Shanti Swarup Bhatnagar Award for Mathematical Sciences (1998). He is a Fellow of the Indian Academy of Sciences.

His research interests are: Differential and Algebraic Geometry.

Parameswaran Sankaran

P. Sankaran received his B.Sc. (Mathematics) degree from the University of Madras (1979), his M.Sc. (Mathematics) degree from I.I.T. Madras (1981) and his Ph.D. from the University of Calgary, Calgary, Canada (1985).

He held Post-Doctoral Fellowships at the University of Calgary (1985-87), and at The Institute of Mathematical Sciences (1987-89). He was as faculty member at CMI since its inception in 1989 till 2000. Since 2000 till 2019, he was at The Institute of Mathematical Sciences, Chennai. He rejoined CMI as Professor in July 2019.

His research interests include: Topology, group theory, Lie groups and representation theory.

Pramathanath Sastry

Pramathanath Sastry received his B.Sc. (Hons) in Mathematics from University of Delhi, New Delhi (1982), M.Stat. from the Indian Statistical Institute, New Delhi (1984) and Ph.D. (Mathematics) from Purdue University, U.S.A. (1990).

He has been a Teaching Assistant, a Research Assistant at Purdue University, U.S.A. (1984-1990), a Visiting Assistant Professor at University of Missouri, U.S.A. (1990-1991), a Visiting Fellow at the Tata Institute of Fundamental Research, Mumbai (1991-1992), a Fellow at SPIC Science Foundation (1992-1995), a Reader at SPIC Science Foundation (1995-1996), a Reader at Harish-Chandra Research Institute, Allahabad (1996-1999), a Reader F at Harish-Chandra Research Institute, Allahabad (1999-2001), a Visiting Assistant Professor at Purdue University, U.S.A. (1999-2001), an Asst. Assoc. Professor (Term) at the University of Toronto, Canada (2001-2006), CLA at McMaster University, Canada (2006) and an Assistant Professor at East Carolina University, U.S.A. (2007-2009).

His research interest is Algebraic Geometry.

S. Senthamarai Kannan

S. Senthamarai Kannan received his B.Sc. from HKRH College, Uthama Palayam (1985–88), M.Sc. from the Madurai Kamaraj University (1988–90) and Ph.D. from the Chennai Mathematical Institute, (1992–98). He has been a Post-doctoral Fellow at the International Centre for Theoretical Physics (1999–2000).

His research interests are Representation Theory and Algebraic Geometry.

V.V. Sreedhar

V.V. Sreedhar received his B.Sc. from Andhra University, Visakhapatnam, M.Sc. (Physics) from the Indian Institute of Technology, Madras and received his Ph.D. (Physics) from Saha Institute of Nuclear Physics, Jadavpur University, Calcutta.

He has been an Assistant Professor in the Department of Physics at the Indian Institute of Technology, Kanpur, a Post-doctoral researcher at the School of Theoretical Physics, Dublin Institute of Advanced Studies, Dublin, Ireland and a Post-doctoral researcher at the Institute for Theoretical Physics, Uppsala University, Uppsala, Sweden.

His visiting positions include stints at the S. N. Bose National Centre for Basic Sciences, Kolkata, Raman Research Institute, Bangalore, Universities of Rochester, New York and Cincinnati, Ohio, U.S.A. and the High Energy Research Organization (KEK), Tsukuba, Japan.

His research interests are Quantum Entanglement, Classical and Quantum Field Theory and Fluid Dynamics.

K.V. Subrahmanyam

K.V. Subrahmanyam received his B.Tech. (Computer Science and Engineering) degree from the Indian Institute of Technology, Bombay (1986) and M.S. from Vanderbilt University, U.S.A. in 1987. He received his Ph.D. from the TIFR/University of Bombay in December, 1995.

His research interests are Circuit Complexity, Algebraic methods in Complexity theory.

Aiswarya Cyriac

Aiswarya Cyriac received her B.Tech. in Computer Science and Engineering from National Institute of Technology (2008), First year of Masters from Institute of Mathematical Sciences, Chennai (2009), Second year of Masters from Master Parisien de Recherche en Informatique (MPRI), Ecole Normale Superieure de Cachan, France (2010) and Ph.D. in Computer Science from Laboratoire Spécification et Vérification, Ecole Normale Superieure de Cachan, France (2014).

She has been a Teaching Assistant at ENS, Cachan (2010-13), a Lecturer and a Postdoctoral Researcher at Uppsala University (2014-15).

Her research interests are: Lossy channel systems with data, Gossip beyond channel bounds and Under-approximate analysis of data-centric data-base systems.

Sourish Das

Sourish Das received his B.Sc. (Statistics) from St. Xavier's College, Calcutta (2001), M.Sc. (Statistics) from Calcutta University, Calcutta (2003) and Ph.D. (Statistics) from the University of Connecticut, U.S.A. (2008).

He has been a Postdoctoral Fellow at the Statistical and Applied Mathematical Science Institute (aka SAMSI) (2008-10), A Postdoctoral Associate at Duke University (2008-10) and a Scientist - Analytics at SAS Research & Development, India (2010-13).

His research interests are: Biostatistics, Financial Statistics, Functional Data Analysis and Bayesian Statistics.

Krishna Hanumanthu

Krishna Hanumanthu received his B.Sc. (Mathematics) from the Chennai Mathematical Institute (2001), M.Sc. (Mathematics) from the Chennai Mathematical Institute (2003) and Ph.D. (Mathematics) from the University of Missouri (2008).

His research interests are Algebraic Geometry and Commutative Algebra.

Upendra Kulkarni

Upendra Kulkarni received his B.Tech. (Computer Science and Engineering) from the Indian Institute of Technology Bombay, Mumbai (1992) and Ph.D. (Mathematics) from Brandeis University, U.S.A. (1998).

He has been a Visiting Assistant Professor at the University of Massachusetts Amherst (1998-2000), an Assistant Professor at the Truman State University (2000-05), An Associate Professor at the Truman State University (2005), a Visiting Scientist at the Indian Statistical Institute, Bangalore (2005-06) and a Visiting Fellow at the Tata Institute of Fundamental Research, Bangalore (2006-07).

His research interests are Representations of algebraic groups over the integers and in characteristic p, Algebraic aspects of Lie representation theory including Lie algebras, quantum groups and related combinatorics and in solving elementary challenging problems.

Manoj Kummini

Manoj Kummini has received his B.Tech. (Electronics and Communication Engineering) from the University of Calicut (1999), M.E. (Telecommunication Engineering) from the Indian Institute of Science, Bangalore (2002), M.A. (Mathematics) from the University of Kansas, Lawrence (2005) and Ph.D. from University of Kansas, Lawrence (2008).

He has been a Software Engineer at Sasken Communication Technologies, Bangalore (1999–2000), a Senior Design Engineer (2003) & Design Engineer (2002-2003) at Texas Instruments India, Bangalore, Graduate Teaching Assistant, University of Kansas, Lawrence, KS, U.S.A. (2003-2008), Research Assistant Professor, Purdue University, West Lafayette, IN, U.S.A. (2008-2011) and a Post-doctoral Fellow at Mathematical Sciences Research Institute, Berkeley, CA, U.S.A. (2012).

His research interest is commutative algebra.

Alok Laddha

Alok Laddha received his B.Sc. in Physics from University of Mumbai (1998), M.Sc. in Physics from Indian Institute of Technology (2000) and Ph.D. in Theoretical Physics from Institute of Mathematical Sciences (2008).

He has been a Teaching Assistant at University of Utah, USA (200-03), a Research Fellow at Institute of Mathematical Sciences , Chennai (2004-08), a Postdoctoral Fellow at Raman Research Institute, Bangaloru (2008-10), a Postdoctoral Fellow at Institute of Gravitation and Cosmos, Pensylvania State University (2010-12), and a Ramanujan Fellow at the Chennai Mathematical Institute, Chennai (2012-14).

His research interest is: Loop Quantum Gravity.

Sukhendu Mehrotra

Sukhendu Mehrotra received his B.Sc. (Hons) in Mathematics from Delhi University (1998), M.S. in Mathematics from the University of Delaware (2000) and Ph.D. in Mathematics from the University of Pennsylvania (2005).

He has been a Visiting Assistant Professor at the University of Massachusetts Amherst (2005–2009) and Van Vleck Visiting Assistant Professor at the University of Wisconsin Madison (2009–2012).

His research interests are algebraic geometry and homological algebra—more specifically, derived categories, Bridgeland stability conditions and moduli problems, and string theory.

Prajakta Nimbhorkar

Prajakta Nimbhorkar received her B.E. (Computer Science and Engineering) from Government College of Engineering, Aurangabad (2003), M.Tech. (Information Technology) from Indian Institute of Technology, Bombay (2005) and Ph.D. from The Institute of Mathematical Sciences, Chennai (2010).

Her research interests are Complexity and Algorithms.

Geevarghese Philip

Geevarghese Philip received his B.Sc. in Physics from St. Berchmans' College, Chenganassery, Kerala (1998), MCA from Regional Engineering College, Kozhikode, Kerala (2001), M.Sc. in Theoretical Computer Science from Institute of Mathematical Sciences, Chennai (2008) and Ph.D. in Theoretical Computer Science from Institute of Mathematical Sciences, Chennai (2011).

He has been Senior Application Developer - Oracle Apps at Oracle India Pvt. Ltd., Bangalore, (2002-06), and a Postdoctoral researcher at Max Planck Institute for Informatics, Saarbruecken, Germany (2011-2015).

His research interest is: Parametrized Algorithms and Complexity.

M. Praveen

M. Praveen received his B.E. in Electronics and Communication Engineering from R.V. College of Engineering, Bangalore University, Bangalore (2001), M.Sc. in Theoretical Computer Science from the Institute of Mathematical Sciences, Homi Bhabha National Institute, Chennai (2008) and Ph.D. in Theoretical Computer Science from the Institute of Mathematical Sciences, Homi Bhabha National Institute, Chennai (2011).

He has been a Software Engineer at Mindtree Consulting Pvt. Ltd., Bangalore (2002-06), a Research Intern at Microsoft Research, Bangalroe (2011), ERCIM Postdoctoral Researcher at Inria Saclay - Ile de France (2012) and a Postdoctoral Researcher at Laboratoire Bordelais de Recherche en Informatique, France (2013-14).

His research interests are: Computational complexity of modelling and verifying concurrent infinite state systems, logic and parameterized complexity.

R. Srinivasan

R. Srinivasan received his Ph.D. degree in Mathematics from the Indian Statistical Institute and the Institute of Mathematical Sciences (1998).

He has been a Visiting Fellow at the Harish-Chandra Research Institute, Allahabad (1998-2000), a Post Doctoral Fellow at the Indian Statistical Institute (2000-01), a Post Doctoral Fellow at Universite d'Orleans, France (2001-02), a Visiting Scientist at the Indian Statistical Institute (2002-03), a Visiting Fellow at ICTP, Trieste, Italy (2003) and a JSPS Post Doctoral Fellow at University of Tokyo, Japan (2003-2005).

His research interests are Operator Algebras and Operator Theory.

B. Srivathsan

B. Srivathsan received his B.Tech. and M.Tech. (Dual Degree Programme) in Computer Science and Engineering from the Indian Institute of Technology (2009) and Ph.D. in Computer Science from LaBRI, Université Bordeaux 1 (2012).

He has been a Postdoctoral Researcher at RWTH-Aachen (2012-13).

His research interests are: Theoretical foundations of formal verification and Formal langualge theory.

M. Sundari

M. Sundari received her M.Sc. (Mathematics) from the University of Hyderabad, Hyderabad (1988), M.Phil. (Mathematics) from the University of Hyderabad, Hyderabad (1990) and Ph.D. (Mathematics) from the Indian Statistical Institute, Bangalore (1996).

She has been a Visiting Mathematician at the International Center for Theoretical Physics,

Trieste, Italy (1996), a Research Associate at the University of New South Wales, Sydney, Australia (1996-97), an Assistant Professor in the Effat College, Jeddah, Saudi Arabia (2000-01), a Faculty member at the ICFAI Institute of Science and Technology, Hyderabad (2003-04) and an Assistant Professor at the Indian Institute of Technology Roorkee, Roorkee (2004-06).

Her research interests are Representation theory of Lie groups, Uncertainty Principles in Harmonic Analysis, Wiener-Tauberian theorems.

S.P. Suresh

S.P. Suresh received his M.C.A. from R.E.C. Trichy (1996), his M.Sc. (by Research) from Anna University (1999), and his Ph.D. from the Institute of Mathematical Sciences (2003).

His research interests are Logic in Computer Science, Reasoning about Security protocols and Classical Indian Epistemology.

Amitabh Virmani

Amitabh Virmani received his M.Sc. degree in Physics from Indian Institute of Technology, Kanpur (2003) and Ph.D. in Physics from University of California, USA (2008).

He has been a Postdoctoral Researcher at Université Libre de Bruxelles and International Solvay Institutes, Belgium (2008-2011), Junior Scientist at Max-Planck-Institut Für Gravitationsphysik, Germany (2011-12), Assistant Professor at Institute of Physics, Bhubaneshwar (2012-2014) and Reader-F at Institute of Physics, Bhubaneshwar (2014-2017).

His research interests are general relativity and gravitational aspects of string theory & classical and quantum aspects of black holes.

Priyavrat Deshpande

Priyavrat Deshpande received his B.Sc. in Mathematics from Pune University, Pune (2000), M.Sc. in Mathematics from Pune University, Pune (2002), M.Sc. in Mathematiacs from the University of Western Ontario (2007) and Ph.D. in Mathematics from the University of Western Ontario, Canada (2011).

Priyavrat Deshpande has been a Junior Research Fellow at Computational Mathematics Lab, Pune (2002-04), a Visiting Lecturer at Institute of Management and Career Courses, Pune (2005), a Lecturer at S.P. College, Pune (2004-06), a Graduate Teaching Assistant at University of Western Ontario, Canada (2006-11), a Lecturer in Mathematics at University of Western Ontario, Canada (2011), a Visiting Research Scholar at Northeastern University, Boston, USA (2011-12) and a Visiting Fellow at the CMI (2012-15).

His research interest are: Topology, Combinatorics and Algebra.

Pranabendu Misra

Pranabendu Misra received his B.Sc. (Honors) in Mathematics and Computer Science in 2010, and M.Sc. in Computer Science in 2012 from the Chennai Mathematical Institute, India. He received his PhD in Computer Science from the Institute of Mathematical Sciences, HBNI, India in 2017.

He was a Researcher at the Department of Informatics, University of Bergen, Norway from 2016 to 2019. He was a Postdoctoral Fellow at the Max-Planck Institute for Informatics, Saarbrucken, Germany from 2019 to 2021. Since 2021, he is an Assistant Professor in Computer Science at the Chennai Mathematical Institute, India.

His research interests are: Algorithms, Graph Theory and Machine Learning.

C. Ramya

C. Ramya received her B.E., in Computer Science and Engineering from Madras Institute of Technology (2013), M.S., Ph.D., in Computer Science and Engineering from the Indian Institute of Technology Madras (IIT Madras), INDIA (2019).

Ramya was a postdoctoral research fellow in the School of Technology and Computer Science at the Tata Institute of Fundamental Research (TIFR), Mumbai (2019-2021). She is also a recipient of the INSPIRE Faculty Fellowship awarded by the Department of Science and Technology (DST) for the period 2021-2026.

Her research interests include Computational Complexity Theory and algorithmic aspects of Algebra.

Siddhi Pathak

Siddhi Pathak completed BSc in Mathematics and Computer Science (Hons.) from Chennai Mathematical Institute, Chennai (2014), MSc in Mathematics from Queen's University, Canada (2015) and Ph.D. in Mathematics from Queen's University, Canada (2019).

Siddhi Pathak was a S. Chowla Assistant Research Professor at Pennsylvania State University, USA (2019-2021) and an INSPIRE faculty fellow at Chennai Mathematical Institute (August 2021-Dec 2021).

Her research interest is: Number Theory

Nithin Varma

Nithin Varma received his B.Tech. in Computer Science and Engineering from National Institute of Technology Calicut (2011), M.Sc. in Computer Science from Tata Institute of Fundamental Research Mumbai (2014), and his PhD in Computer Science from Boston

University, USA (2019).

He was a postdoctoral fellow at the Department of Computer Science, University of Haifa, Israel from 2019 to 2021.

His research interests are: Sublinear algorithms, randomized algorithms and approximation algorithms.

8 Achievements

- Sandesh Kamath, Amit Deshpande, K V Subrahmanyam, and Vineeth Balasubramanian win best paper award at CODS-COMAD 2022.
- Saket Saurabh awarded Shanti Swarup Bhatnagar Prize for the year 2021.
- Textbook by G Venkatesh and Madhavan Mukund 'Computational Thinking: A Primer for Programmers and Data Scientists' published in 2021.

9 Research Activities

Mathematics

In Mathematics research was carried out in several areas including Number Theory, Commutative Algebra and Algebraic Geometry, Algebraic Groups and Representation Theory, Graph Theory and Algebraic Topology, Functional Analysis, and Data Science.

In Number Theory, work was done extending existing theorems on Euclidean ideal classes to the case when the Hilbert class field is not abelian over $\mathbb{Q}$, on on Koblitz's conjecture in the case of non-CM elliptic curves over $\mathbb{Q}$, a generalisation of Linnik's theorem on the least prime in a residue class to the setup of ray class groups and an analogue of the work of Ghosh and Sarnak on Markoff's equation. Also studied was the vanishing of certain classes of L-functions at $s = 1/2$, as well as rational linear relations between special values of class group L-functions associated to different imaginary quadratic fields,

In Commutative Algebra, properties of Hilbert-Kunz density function were investigated in various contexts, in particular for a standard graded domain over a perfect field of characteristic $p > 0$, with respect to an ideal of finite co-length and for varieties with toric degeneration. Work was done on the Shank-Wehlau conjecture for the action of transvection p-groups on vector space of low dimension over a field of characteristic p. A question of Mel Hochster, regarding the finiteness of associated primes of local cohomology modules under faithfully flat extension and asymptotic behaviour of local cohomology modules, was addressed. The property N_p, $p \geq 2$ for Hibi rings was studied, as well as the problem of classification of complete intersection Hibi rings. Other topics studied were: test ideals and rational singularity of the Rees algebra in prime characteristic, regularity of small symbolic powers of edge ideals, Koszulness of combinatorial algebras, regularity of powers of path ideals, symbolic multi-Rees algebras, symbolic powers, multiplicity formulae, bi-graded Hilbert coefficients, D-module structure of local cohomology modules over Stanley-Reisner rings supported on monomial ideals, representation theory of Hecke algebras and q-rook monoids, Charney-Davis-Stanley conjecture for simple thin polyominos, the Betti table of binomial edge ideals, and problems related to direct summand property and ramification in Modular Invariant Theory.

In Algebraic Geometry, a project of generalising Bruhat-Tits theory over bases of higher dimensions is under way. The study of Seshadri constants – of *Quot* schemes, products of projective spaces and other Fano varieties, BSDH varieties, rational surfaces – continued to be a focus. Work was done on generalizing the Bondal-Orlov criterion for derived equivalences of tame DM stacks, good reduction of K3 surfaces in characteristic 2, and lifting automorphisms/derived auto-equivalences of Hilbert scheme of points on a surface. Other objects of study were parabolic bundles, unexpected hypersurfaces, set-theoretic complete intersections, regularity of coherent sheaves, hyperholomorphic sheaves on holomorphic symplectic varieties, categorical SL_2 actions in the context of holomorphic symplectic manifolds, H-Stability of vector bundles on algebraic surfaces, Jacobians of singular curves, Picard

groups of certain non-projective varieties, and a problem on toric degeneration.

In Algebraic Groups and Representation Theory, twisted conjugacy in algebraic groups continued to be investigated – in S-arithmetic subgroups of SL_n over rational function field over finite fields, in Chevelley groups of classical type over certain ring of positive characteristic, and in the Baumslag-Solitar group. Work was also done on Stiefel-Whitney Classes for real representations of general linear groups over finite fields, torus quotients of Richardson varieties, a characterisation co-minuscule fundamental weights, automorphism groups of large Schubert varieties, and the anti-canonical bundle of Bott-Samelson varieties.

In Graph Theory, work was done on grid graphs, line graphs, matching complexes, higher independence complex, chordal graphs, shellable complexes, vertex decomposable complexes, hypergraphs, and the Stanley-Reisner ideal. Also pursued were the relation between the homotopy type of homomorphism complexes of directed graphs and combinatorial properties of directed graphs, pattern avoidance in circular permutations, Vietoris-Rips complexes of hypercube graphs, and the computation of the collapsibility number of nonmatching complexes of graphs.

In Algebraic Topology, work was done on the K-theory of real Grassmann manifolds, deformations of Coxeter arrangements, automorphisms of Bestvina-Brady groups, building planar polygon spaces from projective braid arrangement and the Coxeter complex, and the topological complexity of archnoid mechanisms, planar polygon spaces and the higher dimensional Klein bottle.

In Functional Analysis, work was done subfactors, the KMS problem on groupoid C* algebras, finite-depth subfactor planar algebras and its subalgebras. Fermionic Gaussian states were studied

In Data Science work was done on dimensionality reduction methods for learning algorithms, implementation of random projection on high-dimensional data, projection of high-dimensional data to low-dimensional space while approximately retaining data structure, and applying k-nearest neighbour rule to enhance performance. Theoretical properties of random projection-based k-nearest-neighbour rule were investigated. Work continued on implementing k-NN and neural networks on high-dimensional datasets in R, further incorporating random projection and PCA, comparing the performances, and investigating the consistency of these learning rules. The application of computer vision in plant phenotyping, corn tassel detection and counting in UAV images was studied. Applications of Topological Data Analysis to groups, and persistent homology for clustering, were studied.

Computer Science

Research in Computer Science was carried out in a variety of areas including: Algorithms, Complexity Theory, Formal Verification: including logic and automata theory and Machine Learning.

In algorithms the work done includes: dynamic algorithm and complexity of planar em-

bedding, algorithms for even paths in single crossing and single crossing minor free graphs, dynamic algorithms for single source shortest paths, network design problems, streaming algorithms, parallel complexity of depth first search problem in directed planar graphs, algorithm for counting number of depth first search trees, extending results on even path problem and disjoint path problem from planar graphs to more general graph classes like near planar graphs and single crossing minor free graphs, popular edge problem under privileges, group fairness with lower bounds, disjoint stable matchings in roommates case, many-to-many popular matchings with lower quotas, the disjoint rank-maximal matching problem, disjoint stable roommate problem, tradeoffs in glycan manufacture in cells and upper and lower bounds for finding Morse matchings in graphs of bounded treewidth, faster parameterized algorithms for vertex cover, incentive compatible rationing of vaccination, polytope of disjoint stable matching problem, even-path in near planar and constant genus graphs, catalytic computation, tree evaluation problem, developing stable algorithms for solving constraint satisfaction problems, hospital-residents problem with two-sided lower quotas, matchings under group fairness constraints, solving fair division problems in the house allocation setting, matchings with individual fairness and group fairness constraints, many-to-many popular matchings with 2-sided lower quotas, modelling vaccine allocation as a special case of weighted b-matching instance, planar vertex deletion approximation and kernel, social choice theory such as opinion diffusion and house allocation, sublinear-time algorithms for detecting patterns in sequential numerical datasets, stable algorithms for combinatorial problems solvable by semi-definite programs, sublinear-time algorithms for local properties, problem of finding small weights that result in non-zero circulations in graphs classes like apex minor-free graphs, fair healthcare rationing, dynamic cayley group membership problem, sensitivity analysis of semi-streaming algorithms to perturbations in the input stream, sensitivity analysis of Cholesky decomposition of matrices, improving state of the art sublinear-time algorithms for testing permutation freeness in arrays.

In formal verification work was done on the bug reports dataset for identifying mathematical expressions, defect deduplication, distributed representations for code changes, verification of systems with thread creation under modern memory models, verification of file systems, formal semantics and learning for expressive decision tables, satisfiability of string constraint systems, formal verification of distributed consensus protocols, on the verification of the reachability in acyclic lossy channel pushdown systems, verification of programs under weak memory models and persistency, developing a unit testing framework with a DSL, checking regular invariance under tightly controlled string modifications, reliability for constraint LTL, formal verification of verilog designs and on the Gabbay-style separation of temporal logic for nested words.

Work on timed systems includes timed negotiations, communication-safe realizability, extending negotiations with clocks, extension of event clock automata with pattern clocks, simulation relation for the local-time semantics for networks of timed automata, reachability problem for extensions of timed automata, on synthesis of asynchronous automata by projecting the specifications to components, zone simulations for event-clock automata, zone based algorithms for inclusion between timed automata and synthesis for parametric timed

automata.

Work on the theory of database systems includes distributed systems testing, introducing faults and observing the system to find bugs, GANs and interpretability, reachability problem in distributed datalog programs, solving and measuring complexity of reachability and invariance problems for first-order database-like structures.

Work was also done on decidability issues in security protocols, decidability of leakiness and other properties for protocols with unboundedly many nonces and active intruder problem for protocols with list membership assertions. Other work done includes algorithms for solving bridge bidding games, efficient algorithms for imperfect recall games, verification of distributed consensus protocols, realizability games for constraint linear temporal logic, timed games, testing distributed consensus implementations, partial order reduction in negotiations, on the edit distance between transducers, invariant checking problem for string modifiers and symbolic regular expressions to define windows on streaming data.

Work on geometric complexity theory includes closures of orbits of stable points, projective normality of torus quotients of Gr(3,7), understanding the projective orbit closures of stable points and obstructions from Lie algebra cohomology, geometry of torus quotients of all flag varieties in a five dimensional vector space over complex numbers,torus action on grassmannian, the GIT quotient of the binomial form, the Reimannian geometry of the local model to study projective limits of stable points, projective normality of grassmannian variety and Hilbert basis algorithm.

In complexity theory work includes PIT and lower bound in restricted models, group property in DynFO, dynamic complexity of group problems, monotone bounded genus circuit value problem, rational identity testing, communication complexity, lower bounds on algebraic circuits in border, even-path problem in near planar graphs and showing reachability in the apex-minor free graphs in UL, applications of depth 2 polynomial factoring to depth three reconstruction and parameterized complexity of quasigroup homomorphism.

In machine learning work was done on explainability via counterfactuals and fairness in machine learning models, mathematical model for text editors, regularity of string constraints with subword ordering, analysing complexity of invariance problems under certain transformations, modelling real world problems using action transformations, automated evaluation metrics for machine translation, detecting mathematical expressions in text, active learning for expressive decision tables, invariant checking for text processors, solving the relationship between commuting matrices and multivariate multiplicity, controller synthesis for robotics motion planning, AI alignment and permutation invariance of Deep Neural Networks with ReLUs

Physics

In Physics, research was carried out in gravitational waves, string theory and related areas, quantum field theory, nonlinear dynamical systems, and open quantum systems.

In Gravitational Waves, research was focussed on various tests of general relativity (GR) using gravitational-wave observations by LIGO-Virgo as well as third-generation gravitational wave detectors. Parameterized tests in multiband astronomy were developed by combining information on the source binary system from ground-based and space-based detectors to measure deformations on multiple post-Newtonian (PN) coefficients simultaneously. Work is also ongoing on obtaining an optimum linear combination of deformation on PN coefficients that can test the overall structure of the PN phasing in GR and measuring the deformation on the binary components due to their spin-induced quadrupole moments to constrain possible black hole mimicker parameter spaces. Other research work related to direct measurement of gravitational recoil with future gravitational wave detectors, and gravitational recoil from compact binaries in quasi-elliptical orbits is also being conducted. Related research on the detection problem of stellar mass (binary) black holes in the LISA band, parameter estimation of binary black holes in the LISA band, multi-messenger observations of neutron star–black hole mergers and their implications, estimation of kick speeds of binary black holes and implications for growth of black holes, premerger localisation of intermediate mass binary black holes in the LISA band, and multibanding of eccentric stellar mass binary black holes in the LISA band is being carried out. Systematic biases due to the neglect of orbital eccentricity and its effect on parameterised test of general relativity, and constraining boson star models using gravitational waves are amongst the other problems being explored.

In String Theory, various aspects of black hole physics were studied including positivity of discrete information for CHL black holes, flat space limit of small BPS AdS6 black holes, phase transition in black holes, black hole hair removal, and near BPS AdS6 black holes. Related cosmological problems include fluxes across cosmological horizon, renormalisation group approach to mini-superspace cosmology, and cosmologies with singularities and quantum extremal surfaces. Quantum gravity related work explored the relation between BMS and spi group, the relation between the supertranslation charges from the null infinity to the horizon via timelike infinity, symmetries of quantum gravity S-matrix, soft theorems, analysing the classical limit of scattering amplitudes and positive geometries of S-matrix in quantum field theories, asymptotic flatness at timelike infinity, and soft radiation from spinning particles. Other investigations involved exploring the plane wave geometries in non-Abelian T-dual backgrounds, the deformation of string backgrounds, the Kerr de-Sitter metric in Bondi coordinates, generic 2-dim dilaton gravity, holography, entanglement, quantum extremal surfaces and islands, the lambda-deformation of supergravity backgrounds, exploring alpha prime corrections and DFT in non-Abelian T-duality, timelike entanglement in de Sitter, M5-branes and BPS states, double copy in Heterotic Double Field Theory, Penrose limits in Abelian and non-Abelian T-dual of AdS_3 background, map from Fefferman-Graham to Bondi coordinates, M5-branes and string soliton bound states and wall-crossing.

In Quantum Field Theory, classical and quantum aspects of the Rajeev-Ranken model, aspects of its integrability, spectral statistics, dispersion relations of quantized screw-type waves, and numerical analysis of the WKB quantization condition were studied.

In Nonlinear Dynamical Systems, the double pendulum, the three-rotor problem, perturbations of a vortex sheet, conservative compressible analogue of the Orr-Sommerfeld equation and bifurcations in the three-rotor problem were explored.

In Open Quantum Systems, research was carried out in studying the statistics parameter dependence of the entanglement entropy in a system of of identical particles in one dimension. Results were obtained in three different models, viz. The Leinaas-Myrheim model, the Calogero Sutherland model, and the anyonic Hubbard model. Another generalised Hubbard model, with fermions treated as composites of anyons and supporting exclusion statistics is also being studied. A project on Landuer erasure is being pursued. Also on the anvil are a quantum dynamical generalisation of the information theoretic approach to open quantum systems, and study of quantum entanglement in two dimensional anyons.

In addition to the above activities, books are being (co-)authored by the faculty members on Modern Physics, Quantum Field Theory, Classical Mechanics, and Quantum Hamilton-Jacobi Formalism (Springer), and School Mathematics for Gifted Children, under the auspices of the National Institute of Advanced Studies.

10 Publications

Journal Articles

Computer Science

J1 Hans van Ditmarsch, David Fernández Duque, Vaishnavi Sundararajan and S P Suresh: *Who holds the best card? Secure communication of optimal secret bits*, Australian Journal of Combinatorics, 80 (1), 1-29, (2021).

J2 Daniel Lokshtanov, Pranabendu Misra, Joydeep Mukherjee, Fahad Panolan, Geevarghese Philip and Saket Saurabh: *2-Approximating Feedback Vertex Set in Tournaments*, ACM Transactions on Algorithms, Volume 17, No. 2, p. 11:1-14.

J3 Sofya Raskhodnikova, Noga Ron-Zewi and Nithin Varma: *Erasures versus errors in local decoding and property testing*, Random Structures and Algorithms, 59, 4, (2021), p. 640-670.

J4 V. Arvind, Abhranil Chatterjee, Rajit Datta and Partha Mukhopadhyay: *Univariate Ideal Membership Parameterized by Rank, Degree, and Number of Generators*, Theory of Computing System, 66, no. 1, (2022), p. 56-88.

J5 Amit Levi, Ramesh Krishnan S. Pallavoor, Sofya Raskhodnikova and Nithin Varma: *Erasure-Resilient Sublinear-Time Graph Algorithms*, ACM Transactions on Computation Theory, 14, 1, (2022) Article No.1, p. 1-22.

J6 C. Aiswarya: *How Treewidth Helps in Verification*, ACM SIGLOG News 9(1): 6-21 (2022).

J7 V. Arvind, Abhranil Chatterjee, Rajit Datta and Partha Mukhopadhyay: *Fast Exact Algorithms using Hadamard Product of Polynomials*, to appear in Algorithmica.

J8 Pranjal Dutta and Nitin Saxena and Amit Sinhababu: *Discovering the Roots: Uniform Closure Results for Algebraic Classes under Factoring*, to appear in the Journal of the ACM (JACM), 2022.

Humanities

J9 Usha Mahadevan: *Nomad English translation of Tamil poem Nadodi*, to appear in Indian Literature.

J10 Usha Mahadevan: *Time's Long sigh English translation of the Tamil poem Kaalapperumuchu by Chidambaram IAS*, to appear in Indian Literature.

Maths

J11 Priyavrat Deshpande, Krishna Menon and Anurag Singh: *Counting regions of the boxed threshold arrangement*, Journal of Integer Sequences, vol 24, no. 5, Article 21.5.7.

J12 Priyavrat Deshpande, Krishna Menon and Anurag Singh: *A combinatorial statistics for labeled threshold graphs*, Enumerative Combinatorics and Applications, vol. 1, no. 3, Article #S2R22.

J13 Keshab Chandra Bakshi and Vijay Kodiyalam: *Commuting squares and Planar subalgebras*, Journal of Operator Theory, 86 (2021), Issue 1, pp. 145-161.

J14 Chaitanya Ambi: *An Estimate of the growth of cohomology with coefficients*, Journal of Indian Mathematical Society, Vol. 88, Nos. (3–4) (2021), 187–200.

J15 Jyothsnaa Sivaraman: *Primitive roots for Pjateckii-Sapiro primes*, J. Th. Nombres Bordeaux, 33 (2021) no.1, p.83-94.

J16 B V Rao: *Marginal Sufficiency*, Proceedings of Indian Academy of Sciences 2021 (131:16).

J17 Arindam Banerjee, Bidwan Chakraborty, Kanoy Kumar Das, Mousumi Mandal and S. Selvaraja: *Regularity of powers of squarefree monomial ideals*, J. Pure Appl. Algebra, 226 (2022), no. 2, Paper No. 106807, 12 pp.

J18 Indranil Biswas, Krishna Hanumanthu, D. S. Nagaraj and P. E. Newstead: *Seshadri constants and Grassmann bundles over curves.*, Ann. Inst. Fourier (Grenoble), 70 (2020), no. 4, 1477-1496.

J19 Chandranandan Gangopadhyay, Krishna Hanumanthu and Ronnie Sebastian: *Seshadri constants on some Quot schemes*, Forum Mathematicum 33 (2021), no. 6, 1591–1603.

J20 S. Senthamarai Kannan, Arpita Nayek and Pinakinath Saha: *Torus quotients of Schubert varieties in the Grassmannian $G_{2,n}$*, Indian Journal of Pure and Applied Mathematics, Vol. 53 (2022), pages 273-293.

J21 Krishna Menon and Anurag Singh: *Pattern avoidance and dominating compositions*, Enumerative Combinatorics and Applications, vol. 2, no. 1, Article #S2R4.

J22 Krishna Menon and Anurag Singh: *Pattern avoidance of [4,k]-pairs in circular permutations*, to appear in Advances in Applied Mathematics.

J23 M. Ram Murty and Siddhi Pathak: *A note on values of the Dedekind zeta-function at odd positive integers*, International Journal of Number Theory, Volume 17, Issue 8, (2021), 1753-1764.

J24 Mandira Mondal: *β density function on class group of projective toric varieties*, Journal of Pure and Applied Algebra, Volume 226, Issue no. 2, Paper No: 106845.

J25 Navnath Daundkar and Priyavrat Deshpande: *The moment polytope of the abelian polygon space*, Topology and its Applications, 302, Article ID 107834, 24 p. (2021).

J26 Shuchita Goyal, Anurag Singh and Samir Shukla: *Matching Complexes of 3 x n Grid Graphs*, Electronic Journal of Combinatorics, Volume 28, Issue 4, (2021), p4.16,

J27 Arvind Kumar and S. Selvaraja: *Upper bounds for the regularity of symbolic powers of certain classes of edge ideals*, to appear in Journal of Algebra and its Applications.

J28 Krishna Hanumanthu and Barian Harbourne : *Real and complex supersolvable line arrangements in the projective plane*, Journal of Algebraic Combinatorics, 54 (2021), no. 3, 767–785.

J29 Rajeeva L Karandikar: *Role of statistics in the era of data science*, Current Science, 121, 2021, pp1016-1021 .

J30 Keshab Chandra Bakshi and Ved Prakash Gupta: *Lattice of intermediate subalgebras*, Journal of the London Mathematical Society, (2), 104, 2021, 2082-2127,

J31 Manoj Kummini and Mandira Mondal: *On Hilbert ideals for a class of p-groups in characteristic p*, Proc. Amer. Math. Soc. volume 150 (2022), no. 1, pp.145-151.

J32 Priyavrat Deshpande and Samir Shukla, Anurag Singh: *Distance r-domination number and r-independence complexes of graphs*, to appear in European Journal of Combinatorics.

J33 Priyavrat Deshpande, Nageswaran Manikandan and Anurag Singh: *On the topology of bi-cyclo-permuto-hedra*, to appear in Indian Journal of Pure and Applied Mathematics.

J34 Tushar Parulekar and Sharad Sane: *Ryser Design Conjecture-III*, Journal of Algebraic Combinatorics, Volume 55, Number 1, (2022), pages 5-13.

J35 Oorna Mitra and Parameswaran Sankaran: *Twisted conjugacy in GL_2 and SL_2 over polynomial algebras over finite fields*, Geometriae Dedicata, vol 216, (2022) paper no. 21, 18p.

J36 Keshab Chandra Bakshi and Sruthymurali: *Intermediate planar algebra revisited, II* , to appear in International Journal of Mathematics.

J37 Anurag Singh: *Vertex decomposability of complexes associated to forests*, to appear in Transactions on Combinatorics.

J38 Shibi Vasudevan: *Instability of unidirectional flows for the 2D Navier-Stokes equations and related alpha models*, Journal of Mathematical Fluid mechanics, Vol 23, Article 35, 2021.

J39 Shuchita Goyal, Samir Shukla and Anurag Singh: *Topology of Clique Complexes of Line Graphs*, to appear in The Art of Discrete and Applied Mathematics.

J40 Tony J. Puthenpurakal and Sudeshna Roy: *Graded components of local cohomology modules-II*, to appear in Vietnam Journal of Mathematics.

J41 Nandini Nilkantan and Anurag Singh: *Neighborhood complexes of Kneser graphs, $KG_{3,k}$*, to appear in Southeast Asian Bulletin of Mathematics.

J42 M. Ram Murty and Siddhi Pathak: *The Okada space and vanishing of L(1,f)*, to appear in Functiones et Approximatio Commentarii Mathematici.

J43 Vikraman Balaji, David Mumford, W. Haboush, Peter Littelmann and V. Lakshmibai: *C. S. Seshadri (1932–2020)*, to appear in Notices of the AMS.

J44 P Sankaran: *Transcendental numbers*, to appear in Mathematics Student.

J45 P. Sankaran and P. Wong: *Twisted conjugacy and commensurability invariance*, to appear in Journal of Group Theory.

J46 Arvind Kumar: *Rees algebra and special fiber ring of binomial edge ideals of closed graphs*, to appear in Illinois Journal of Mathematics.

J47 Keshab Chandra Bakshi and Ved Prakash Gupta: *A few remarks on Pimsner-Popa bases and regular subfactors of depth 2*, to appear in Glasgow Mathematical Journal.

J48 M Mandal and P Sankaran: *Cohomology of generalized Dold spaces*, to appear in Topology and its Applications.

J49 Keshab Chandra Bakshi: *A short note on relative entropy for a pair of intermediate subfactors*, to appear in Proceedings of the American Mathematical Society.

J50 Indranil Biswas, Krishna Hanumanthu, Jyoti Dasgupta and Bivas Khan: *Seshadri constants on Bott towers*, to appear in Journal of Algebra.

Physics

J51 LIGO and Virgo collaboration including K G Arun: *Tests of General Relativity with Binary Black Holes from the second LIGO-Virgo Gravitational-Wave Transient Catalog*, Phys. Rev. D 103, 122002 (2021).

J52 Sayantani Datta, Anuradha Gupta, Shilpa Kastha, K.G.Arun and B.S.Sathyaprakash: *Tests of general relativity using multiband observations of intermediate mass binary black hole mergers*, Physical Review D, D 103, 024036 (2021).

J53 P V Athira, Debordina Ghosh, Alok Laddha and Akavoor Manu: *Classical Soft Theorem from Scattering Amplitudes*, to appear in Journal of High Energy Physics.

J54 Debodirna Ghosh, Alok Laddha, A. Manu and P.V. Athira: *Soft Radiation from scattering amplitudes revisited*, Journal of High Energy Physics(Jhep), 05 (2021) 056.

J55 A. Manu, K. Narayan and Partha Paul: *Cosmological singularities, entanglement and quantum extremal surfaces*, J. High Energy Phys., 04 (2021), 200, arXiv:2012.07351 [hep-th]..

J56 Parthapratim Mahapatra, Anuradha Gupta, Marc Favata, K. G. Arun and B. S. Sathyaprakash: *Remnant Black Hole Kicks and Implications for Hierarchical Mergers*, The Astrophysical Journal Letters, Volume 918, Number 2.

J57 K. Narayan: *On aspects of 2-dim dilaton gravity, dimensional reduction and holography*, Phys.Rev.D104, 026007 (2021), arXiv:2010.12955 [hep-th]..

J58 Divyajyoti, P. Baxi, C. K. Mishra and K. G. Arun : *Detectability of gravitational higher order modes in the third-generation era*, Physical Review D, 104, 084080.

J59 S. Roychowdhury and P. K. Tripathy: *Penrose limits in non-Abelian T dual of Klebanov-Tseytlin background*, Phys. Rev. D 104, no.12, 126016 (2021).

J60 Jose D. Edelstein, Rajes Ghosh, Alok Laddha and Sudipta Sarkar: *Causality Constraints in Quadratic Gravity*, JHEP 09 (2021) 150.

J61 Mrunmay Jagadale and Alok Laddha: *On positive geometries of quartic interactions: one loop integrands from polytopes*, JHEP 07 (2021) 136.

J62 Mrunmay Jagadale and Alok Laddha: *Positive Geometry for Quartic Interactions - III, One loop amplitudes*, to appear in Journal of High Energy Physics.

J63 Sk Jahanur Hoque and Amitabh Virmani: *The Kerr–de Sitter spacetime in Bondi coordinates*, Class. Quantum Grav. 38 (2021) 225002.

J64 Amitabh Virmani: *The fuzzball hair removal*, International Journal of Modern Physics D Vol. 31, No. 05, 2250033 (2022).

J65 Sumanta Chakraborty, Debodirna Ghosh, Sk Jahanur Hoque, Aniket Khairnar and Amitabh Virmani: *Supertranslations at Timelike Infinity*, Journal of High Energy Physics, JHEP 02 (2022) 022.

J66 Govind S Krishnaswami and T R Vishnu: *Quantum Rajeev-Ranken model as an anharmonic oscillator*, J. Math. Phys. 63, 032101 (2022), arXiv:2111.03858 [math-ph].

J67 Muhammed Saleem, Sayantani Datta, K. G. Arun and B. S. Sathyaprakash: *Parametrized tests of post-Newtonian theory using principal component analysis*, to appear in Physical Review D.

J68 M. Favata, C. Kim, K. G. Arun, J. Kim and H. Lee: *Constraining the orbital eccentricity of inspiralling compact binary systems with Advanced LIGO*, Phys. Rev. D 105, 023003 (2022).

J69 Ashok Kumar Kapoor: *A New Approach to Anomalous Axial Vector Field Theory - I*, to appear in International J. of Modern Physics A.

J70 Mrunmay Jagadale and Alok Laddha: *Towards Positive Geometry of Multi Scalar Field Amplitudes: Accordiohedron and Effective Field Theory*, Journal of High Energy Physics (JHEP), 04 (2022) 100.

J71 Kaberi Goswami, K. Narayan and Hitesh K. Saini: *Cosmologies, singularities and quantum extremal surfaces*, to appear in Journal of High Energy Physics (JHEP), arXiv: 2111.14906 [hep-th].

J72 E. Lescano and S. Roychowdhury: *Heterotic Kerr-Schild Double Field Theory and its double Yang-Mills formulation*, to appear in Journal of High Energy Physics.

Proceedings Articles

Computer Science

P73 Samir Datta, Anuj Tawari and Yadu Vasudev: *Dynamic Complexity of Expansion*, CSR 2021 (p. 56-77).

P74 Pranjal Dutta: *Real tau-Conjecture for sum-of-squares: A unified approach to lower bound and derandomization*, Computer Science – Theory and Application (16th International Computer Science Symposium in Russia, CSR 2021), Volume 12730, p. 78-101 (won the best paper and best student paper awards).

P75 Arkadev Chattopadhyay, Rajit Datta and Partha Mukhopadhyay: *Lower Bounds for Monotone Arithmetic Circuits Via Communication Complexity*, STOC'21: 53rd Annual (ACM) (SIGACT) Symposium on Theory of Computing, Virtual Event, Italy, June 21-25, 2021, p.786-799.

P76 Aadityan Ganesh, Vishwa Prakash H V, Prajakta Nimbhorkar and Geeverghese Philip: *Disjoint stable matchings in linear time*, Graph-Theoretic Concepts in Computer Science - 47th International Workshop, WG 2021, Vvolume 12911, p. 94–105.

P77 Govind Sankar, Anand Louis, Meghana Nasre and Prajakta Nimbhorkar: *Matchings with Group Fairness Constraints: Online and Offline Algorithms*, Proceedings of the Thirtieth International Joint Conference on Artificial Intelligence, IJCAI 2021, p. 377-383.

P78 Eric Allender, Archit Chauha and Samir Datta: *Depth-First Search in Directed Planar Graphs, Revisited*, MFCS 2021, 7:1-22.

P79 Samir Datta and Kishlaya Jaiswal: *Parallel Polynomial Permanent Mod Powers of 2 and Shortest Disjoint Cycles*, MFCS 2021, 36:1-22.

P80 Avinandan Das, Lawqueen Kanesh, Jayakrishnan Madathil and Saket Saurabh: *Odd Cycle Transversal in Mixed Graphs*, Proceedings of the International Workshop on Graph-Theoretic Concepts in Computer Science 2021, Volume 12911, (2021), p. 130-142.

P81 Rupak Majumdar, Madhavan Mukund, Felix Stutz and Damien Zufferey: *Generalising Projection in Asynchronous Multiparty Session Types*, Proc. 32nd International Conference on Concurrency Theory (CONCUR 2021), LIPIcs 203, Schloss Dagstuhl - Leibniz-Zentrum fur Informatik (2021) pp 35:1-35:24.

P82 V. Arvind, Abhranil Chatterjee, Rajit Datta and Partha Mukhopadhyay: *Equivalence Testing of Weighted Automata over Partially Commutative Monoids*, 46th International Symposium on Mathematical Foundations of Computer Science, (MFCS) 2021, Volume 202, (2021), p. 10:1-15.

P83 Meghana Nasre, Prajakta Nimbhorkar, Keshav Ranjan and Ankita Sarkar: *Popular Matchings in the Hospital-Residents Problem with Two-sided Lower Quotas*, 41st IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science, FSTTCS 2021, Volume 213, p. 30:1-21, (2021).

P84 Sandesh Kamath, Amit Deshpande, K V Subrahmanyam and Vineeth Balasubramanian: *Universalization of Any Adversarial Attack using Very Few Test Examples*, 5th ACM International Conference on Data Science and Management of Data, Bangalore, India, 2021.

P85 Sandesh Kamath, Amit Deshpande, K V Subrahmanyam and Vineeth Balasubramanian: *Can we have it all? On the trade-off between spatial and adversarial robustness of neural networks*, Proceedings of the 36th Conference on Neural Information Processing Systems (NeurIPS), 2021.

P86 Samir Datta, Chetan Gupta, Rahul Jain, Anish Mukherjee, Vimal Raj Sharma and Raghunath Tewari: *Reachability and Matching in Single Crossing Minor Free Graphs*, FSTTCS 2021, 16:1-16.

P87 Lawqueen Kanesh, Jayakrishnan Madathil, Abhishek Sahu, Saket Saurabh and Shaily Verma: *A Polynomial Kernel for Bipartite Permutation Vertex Deletion*, 16th International Symposium on Parameterized and Exact Computation (IPEC 2021), Volume 214, (2021), p. 23:1-18.

P88 Dániel Marx, Pranabendu Misra, Daniel Neuen and Prafullkumar Tale: *A Framework for Parameterized Subexponential Algorithms for Generalized Cycle Hitting Problems on Planar Graphs*, to appear in SODA 2022.

P89 Iden Kalemaj, Sofya Raskhodnikova and Nithin Varma: *Sublinear-Time Computation in the Presence of Online Erasures*, Innovations in Theoretical Computer Science 2022, p. 90:1-25.

P90 C. Aiswarya, Sahil Mhaskar and M. Praveen: *Checking Regular Invariance under Tightly-Controlled String Modifications*, to appear in The 26th International Conference Developments in Language Theory.

P91 Lawqueen Kanesh, Jayakrishnan Madathil, Sanjukta Roy, Abhishek Sahu and Saket Saurabh: *Further Exploiting c-Closure for FPT Algorithms and Kernels for Domination Problems*, 39th International Symposium on Theoretical Aspects of Computer Science (STACS 2022), Volume 219, (2022), p. 39:1-20.

P92 Mrinal Kumar, C. Ramya, Ramprasad Saptharishi and Anamay Tengse: *If VNP is hard, then so are equations for it*, Proceedings of 39th International Symposium on Theoretical Aspects of Computer Science (STACS 2022), Volume 219, (2022), p. 44:1-13.

P93 C Ramya, Anamay Tengse: *On finer separations between subclasses of Read-once Oblivious ABPs*, STACS 2022. Proceedings of 39th International Symposium on Theoretical Aspects of Computer Science (STACS 2022), Volume 219, (2022), p. 53:1-23.

P94 Arkadev Chattopadhyay, Rajit Datta, Utsab Ghosal and Partha Mukhopadhyay: *Monotone Complexity of Spanning Tree Polynomial Re-Visited*, 13th Innovations in Theoretical Computer Science Conference, ITCS 2022, Volume 215, p. 39:1-21.

P95 Pranjal Dutta, Prateek Dwivedi and Nitin Saxena : *Deterministic identity testing paradigms for bounded top-fanin depth-4 circuits*, 36th Computational Complexity Conference (CCC 2021), Volume 200, p. 11:1-27.

P96 Pranjal Dutta, Prateek Dwivedi and Nitin Saxena : *Demystifying the border of depth-3 algebraic circuits*, Annual Symposium on Foundations of Computer Science (FOCS 2021), p. 92–103.

P97 Pranjal Dutta and Mahesh Sreekumar Rajasree: *Algebraic Algorithms for Variants of Subset Sum*, Algorithms and Discrete Applied Mathematics - 8th International Conference, (CALDAM 2022), Volume 13179, p. 237–251.

P98 Pranjal Dutta and Mahesh Sreekumar Rajasree and Santanu Sarkar: *On the hardness of monomial prediction and zero-sum distinguishers for Ascon*, to appear in WCC 2022: The Twelfth International Workshop on Coding and Cryptography.

P99 Pranjal Dutta, Gorav Jindal, Anurag Pandey and Amit Sinhababu: *Arithmetic Circuit Complexity of Division and Truncation*, 36th Computational Complexity Conference (CCC 2021), Volume 200, p. 25:1–36.

P100 Abhiruk Lahiri, Ilan Newman and Nithin Varma: *Parameterized Convexity Testing*, Symposium on Simplicity in Algorithms (SOSA), p. 174-181.

P101 Diganta Mukhopadhyay, Kumar Madhukar and Mandayam Srivas: *Permutation Invariance of Deep Neural Networks with ReLUs*, to appear in Nasa Formal Methods 2022.

Maths

P102 Priyavrat Deshpande, Krishna Menon: *A statistic for regions of braid deformations*, to appear in (accepted for poster) FPSAC 2022 and will appear in Seminaire Lotharingien Combinatoire.

Physics

P103 Kaberi Goswami, K. Narayan, Hitesh K. Saini: *Cosmologies, singularities and quantum extremal surfaces*, J. High Energy Phys., 2203:201 (2022), arXiv:2111.14906 [hep-th].

Books

Computer Science

B104 G Venkatesh, Madhavan Mukund: *Computational Thinking: A Primer for Programmers and Data Scientists*, Notion Press.

Humanities

B105 Usha Mahadevan: *Poems of Roja, translation*, LKM publications Chennai.

B106 Usha Mahadevan: *Panditha M. Gopalakrishna Iyer*, Sahitya Akademi.

Preprints

Computer Science

P107 F Herbreteau, R Govind, B Srivathsan and I Walukiewicz: *Abstractions for the local-time semantics of timed automata: a foundation for partial-order methods.*

P108 R Ramanujam, Vaishnavi Sundararajan and S P Suresh: *Active intruder problem for disjunction-free assertions.*

P109 Vikraman Arvind, Abhranil Chatterjee and Partha Mukhopadhyay: *Black-box Identity Testing of Noncommutative Rational Formulas of Inversion Height Two in Deterministic Quasipolynomial-time.*

P110 Sandesh Kamath, Amit Deshpande, K V Subrahmanyam and Vineeth Balasubramanian: *Can we have it all? On the Trade-off between Spatial and Adversarial Robustness of Neural Networks.*

P111 Pranjal Dutta, Prateek Dwivedi and Nitin Saxena : *Demystifying the border of depth-3 algebraic circuits.*

P112 Eric Allender, Archit Chauhan and Samir Datta : *Depth-First Search in Directed Graphs, Revisited.*

P113 Fedor Fomin, Petr Golovach, Fahad Panolan, Geevarghese Philip and Saket Saurabh: *Diverse Collections in Matroids and Graphs.*

P114 Samir Datta, Chetan Gupta, Rahul Jain, Anish Mukherjee, Vimal Raj Sharma and Raghunath Tewari: *Dynamic Meta-theorems for Distance and Matching.*

P115 V. Arvind, Abhranil Chatterjee, Rajit Datta and Partha Mukhopadhyay: *Equivalence Testing of Weighted Automata over Partially Commutative Monoids..*

P116 Archit Chauhan, Samir Datta, Chetan Gupta and Vimal Raj Sharma: *Even-Path in single-crossing and single-crossing minor free graphs.*

P117 Bharat Adsul, Milind Sohoni and K V Subrahmanyam: *GCT - Lie algebraic methods for the projective orbit closures of stable points.*

P118 C. Aiswarya: *How Treewidth helps in Verification.*

P119 Govind S. Sankar, Anand Louis, Meghana Nasre and Prajakta Nimbhorkar: *Matchings Under Minority Protection Constraints.*

P120 Arkadev Chattopadhyay, Rajit Datta, Utsab Ghosal and Partha Mukhopadhyay: *Monotone Complexity of Spanning Tree Polynomial Re-visited.*

P121 Arkadev Chattopadhyay, Rajit Datta and Partha Mukhopadhyay: *Negations Provide Strongly Exponential Savings..*

P122 C. Aiswarya, Soumodev Mal and Prakash Saivasan: *On the Satisfiability of Context-free String Constraints with Subword Ordering.*

P123 Vikraman Arvind, Abhranil Chatterjee and Partha Mukhopadhyay: *On the power of linear pencil representation in rational identity testing.*

P124 Samir Datta and Kishlaya Jaiswal: *Parallel Polynomial Permanent Mod Powers of 2 and Shortest Disjoint Cycles.*

P125 Abhiruk Lahiri, Ilan Newman and Nithin Varma: *Parameterized Convexity Testing.*

P126 Kushagra Chatterjee and Prajakta Nimbhorkar: *Popular Edge Problem with Privileged Men.*

P127 R Ramanujam, Vaishnavi Sundararajan and S P Suresh: *Protocol Insecurity with Assertions.*

P128 C. Aiswarya, Vikraman Arvind and Saket Sourabh: *Recent Theory Research in India.*

P129 Ilan Newman and Nithin Varma: *Strongly Sublinear Algorithms for Testing Pattern Freeness.*

P130 Iden Kalemaj, Sofya Raskhodnikova and Nithin Varma: *Sublinear-Time Computation in the Presence of Online Erasures.*

P131 Somnath Dake, S. Senthamarai Kannan and K. Venkata Subrahmanyam: *Torus Quotients of Flag Varieties - a Computational Approach Based on Lattice Basis.*

P132 P Abdulla, M F Atig, A Bouajjani, K Narayan Kumar and P Saivasan: *Verifying Reachability for TSO Programs with Dynamic Thread Creation.*

Humanities

P133 Usha Mahadevan: *Ruined temple translation of the Tamil poem Pazhadaindha koil.*

P134 Usha Mahadevan: *translation of three of Chidambaram's Tamil poems: the epic of the rock, war drums, tick tock.*

Maths

P135 Manoj Kummini and Dharm Veer: *The Charney-Davis conjecture for simple thin polyominoes.*

P136 Chaitanya Ambi: *A Note On Bott's Theorem On Compact Lie Groups.*

P137 Priyavrat Deshpande and Krishna Menon: *A branch statistic for trees: Interpreting coefficients of the characteristic polynomial of braid deformations.*

P138 S. Senthamarai Kannan and Pinakinath Saha: *A characterisation of co-minuscule root.*

P139 Keshab Chandra Bakshi: *A short note on relative entropy for a pair of intermediate subfactors.*

P140 Neelam and Purusottam Rath: *Around a question of Baker.*

P141 Suprajo Das and Sudeshna Roy: *Asymptotic growth of symbolic multi-Rees algebra.*

P142 Huy Tai Ha, A. V. Jayanthan, Arvind Kumar and Hop D. Nguyen: *Binomial expansion for saturated and symbolic powers of sums of ideals.*

P143 B. V. Rajarama Bhat, Repana Devendra, Nirupama Mallick and K. Sumesh: *C^*-extreme points of entanglement breaking maps.*

P144 Fred M. Abdelmalek, Priyavrat Deshpande, Shuchita Goyal, Amit Roy and Anurag Singh: *Chordal graphs, higher independence and vertex decomposable complexes.*

P145 P. Sankaran and M. Mandal: *Cohomology of generalized Dold spaces.*

P146 Tanya Kaushal and Sofia Tirabassi: *Counting Twisted Tame Fourier-Mukai Partners of an Ordinary K3 Surface.*

P147 Suprajo Das: *Epsilon multiplicity for Noetherian graded algebras.*

P148 V. Kumar Murty and J. Sivaraman: *Euclidean ideal classes in Galois cubic fields.*

P149 Dharm Veer: *Green Lazarsfeld property N_p of Hibi rings.*

P150 Pritthijit Biswas: *Homological methods in certain Picard group computations.*

P151 Anton Dochtermann and Anurag Singh: *Homomorphism complexes, reconfiguration, and homotopy for directed graphs.*

P152 Keshab Chandra Bakshi, Vijay Kodiyalam and Sruthymurali: *Intermediate Planar algebra Revisted II.*

P153 Nikhilesh Dasgupta and Animesh Lahiri: *Isotropy subgroups of some almost rigid domains.*

P154 Amith Shastri K and A.J. Parameswaran: *Jacobians, ant-affine groups and torsion points.*

P155 Anbu Arjunan, Sruthymurali and S. Sundar: *KMS States on $C_c(\mathbb{N}^2)$.*

P156 Repana Devendra, Nirupama Mallick and K. Sumesh: *Mapping cone of k-Entanglement Breaking Maps.*

P157 Shuchita Goyal, Samir Shukla and Anurag Singh: *Matching complexes of $\mathbf{3} \times \mathbf{n}$ grid graphs.*

P158 V. Balaji and Y. Pandey: *On Bruhat-Tits theory over a higher dimensional base*

P159 Seoyoung Kim, Damaris Schindler and Jyothsnaa Sivaraman: *On Markoff type surfaces over number fields and the arithmetic of Markoff numbers.*

P160 Chaitanya Ambi: *On the Homotopy Type of Certain Minimal Fillings.*

P161 Indranil Biswas, Krishna Hanumanthu and S.Senthamarai Kannan: *On the Seshadri constants of equivaraint bundles over Bott-Samelson varieties and wonderful compactifications.*

P162 Indranil Biswas, S. Senthamarai Kannan and Pinakinath Saha: *On the geometry of the anti-canonical bundle of the Bott-Samelson-Demazure-Hansen varieties.*

P163 S. Dey, A. Saha, J. Sivaraman and A.Vatwani: *On the refined Koblitz conjecture.*

P164 A. V. Jayanthan, Arvind Kumar and Vivek Mukundan: *On the resurgence and asymptotic resurgence of homogeneous ideals.*

P165 Krishna Menon and Anurag Singh: *Pattern avoidance and dominating compositions.*

P166 Krishna Menon and Anurag Singh: *Pattern avoidance of [4,k]-pairs in circular permutations.*

P167 Pritthijit Biswas and Parameswaran Sankaran: *Picard groups of certain compact complex parallelizable manifolds and related spaces.*

P168 Arghya Mondal: *Property (T_n) and expanding CW complexes.*

P169 Arvind Kumar: *Rees Algebra and Special Fiber Ring of Binomial Edge Ideals of Closed Graphs.*

P170 Priyavrat Deshpande, Krishna Menon and Writika Sarkar: *Refinements of the braid arrangement and two parameter Fuss-Catalan numbers.*

P171 Arvind Kumar, Rajiv Kumar: *Regularity of integral closure of powers of edge ideals.*

P172 Sanoli Gun, Olivier Ramaré and Jyothsnaa Sivaraman : *Representing ideal classes of ray class groups by product of prime ideals of small size.*

P173 Jyoti Dasgupta, Bivas Khan and Aditya Subramaniam: *Seshadri constants of equivariant vector bundles on toric varieties.*

P174 Indranil Biswas, Krishna Hanumanthu, Snehajit Misra and Nabanita Ray: *Seshadri constants of parabolic vector bundles.*

P175 Chandranandan Gangopadhyay, Krishna Hanumanthu and Ronnie Sebastian: *Seshadri constants on some Quot schemes.*

P176 Chaitanya Ambi: *Some Characterisations of p-adic analytic Groups.*

P177 A. V. Jayanthan and Arvind Kumar: *Subadditivity, strand connectivity and multigraded Betti numbers of monomial ideals.*

P178 Navnath Daundkar, Priyavrat Deshpande, Shuchita Goyal and Anurag Singh: *The Borsuk-Ulam theorem for planar polygon spaces.*

P179 Manoj Kummini and Dharm Veer: *The h-polynomial and the rook polynomial of some polyominoes.*

P180 Navnath Daundkar and Priyavrat Deshpande: *The moment polytope of the abelian polygon space.*

P181 Navnath Daundkar, Priyavrat Deshpande: *The n-dimensional Klein bottle is a real Bott manifold.*

P182 S.Senthamarai Kannan and Arpita Nayek: *Torus quotients of Richardson varieties in* $G_{r,qr+1}$.

P183 Jyotirmoy Ganguly and Rohit Joshi: *Total Stiefel Whitney classes for real representations of* GL_n *over* F_q, R *and* C.

P184 Oorna Mitra and Parameswaran Sankaran: *Twisted conjugacy in SLn and GLn over subrings of* $F_p(t)$.

P185 Shripad Garge and Oorna Mitra: *Twisted conjugacy in classical groups over certain domains of Characteristic p¿0.*

P186 Chaitanya Ambi: *Two Applications of Topological Fixed Point Theory.*

P187 Chaitanya Ambi: *Two remarks on p-adic analytic groups.*

P188 Arvind Kumar and S. Selvaraja: *Upper bounds for the regularity of symbolic powers of certain classes of edge ideals.*

P189 Rajeeva Karandikar and BVRao: *stochastic integration and two filtrations (revised).*

Physics

P190 Miguel Campiglia and Alok Laddha: *BMS Algebra, Double Soft Theorems, and All That.*

P191 Govind S Krishnaswami: *Classical Mechanics: From particles to continua and regularity to chaos.*

P192 M. Favata, C. Kim, K. G. Arun and J. Kim, H. Lee: *Constraining the orbital eccentricity of inspiralling compact binary systems with Advanced LIGO.*

P193 Kaberi Goswami, K. Narayan and Hitesh K. Saini: *Cosmologies, singularities and quantum extremal surfaces.*

P194 Sriram Akela, Kishore Thapliyal, H.S. Mani and Anirban Pathak: *Dynamics of single-mode nonclassicalities and quantum correlations in the Jaynes-Cummings mode.*

P195 LIGO/Virgo collaboration including K. G. Arun as co-author: *GWTC-3: Compact Binary Coalescences Observed by LIGO and Virgo During the Second Part of the Third Observing Run.*

P196 Varun Gupta and K. Narayan: *M5-brane prongs, string soliton bound states and wall-crossing.*

P197 Muhammed Saleem, Sayantani Datta, K. G. Arun and B. S. Sathyaprakash: *Parametrized tests of post-Newtonian theory using principal component analysis.*

P198 S. Roychowdhury and P. K. Tripathy: *Penrose limits in massive type-IIA AdS_3 background.*

P199 Sourav Roychowdhury and Prasanta K. Tripathy: *Penrose limits in non-Abelian T-dual of Klebanov-Tseytlin Background.*

P200 Muhammed Saleem, N. V. Krishnendu, Abhirup Ghosh, Anuradha Gupta, W. Del Pozzo, Archisman Ghosh and K. G. Arun: *Population inference of spin-induced quadrupole moments as a probe for non-black hole compact binaries.*

P201 Ramadas N, V V Sreedhar: *Quantum Entanglement in the One-Dimensional Anyonic Hubbard Model.*

P202 Govind S Krishnaswami and T R Vishnu: *Quantum Rajeev-Ranken model as an anharmonic oscillator.*

P203 Parthapratim Mahapatra, Anuradha Gupta, Marc Favata, K. G. Arun and B. S. Sathyaprakash: *Remnant black hole kicks and implications for hierarchical mergers.*

P204 Yilber Fabian Bautista and Alok Laddha: *Soft Constraints on KMOC Formalism.*

P205 Debodirna Ghosh and Biswajit Sahoo: *Spin Dependent Gravitational Tail Memory in D=4.*

P206 Sumanta Chakraborty, Debodirna Ghosh, Sk Jahanur Hoque, Aniket Khairnar and Amitabh Virmani: *Supertranslations at Timelike Infinity.*

P207 Pankaj Saini, Marc Favata and K.G.Arun: *Systematic bias on parameterized test of general relativity due to neglect of orbital eccentricity.*

P208 LIGO/Virgo collaboration (K. G. Arun is a co-author): *Tests of General Relativity with GWTC-3.*

P209 Sk Jahanur Hoque and Amitabh Virmani: *The Kerr-de Sitter spacetime in Bondi coordinates.*

P210 K. G. Arun with the 3G collaboration: *The Next Generation Global Gravitational Wave Observatory: The Science Book.*

P211 Madhu Mishra and Amitabh Virmani: *Thermodynamics of BPS and Near-BPS AdS6 Black Holes.*

P212 Mrunmay Jagadale and Alok Laddha: *Towards Positive Geometry of Multi-Scalar Field Amplitudes.*

Ph.D. Thesis

(1) Sarjick Bakshi: Torus quotients of Richardson Varieties in the Grassmannian (April 2021).

(2) Govind R: Partial order reduction for timed systems (June 2021).

(3) Ghanwat Abhijeet Atmaram: Flexible surfaces in 4–manifolds and embeddings of low dimensional manifolds (June 2021).

(4) Aditya N K Subramaniam: Bounded Negativity and Harbourne Constants on Algebraic Surfaces (July 2021).

(5) Rajit Datta: Algebraic Circuit Complexity: New Lower Bounds, Algorithms, and Applications (July 2021).

(6) T R Vishnu: Integrability and dynamics of the Rajeev-Ranken model (September 2021).

(7) A. Manu: Perturbative and non - perturbative aspects of quantum gravity (October 2021).

(8) Athira P V: A study of Scattering Amplitudes in the Infrared regime (November 2021).

(9) Aneesh P B: Mathematical aspects of gravitational physics and scattering amplitudes (November 2021).

(10) Sayan Mukherjee: Reachability in Timed Automata with Diagonal Constraints and Updates (March 2022)

11 The National Undergraduate Programme

In 1998, CMI initiated an National Undergraduate Programme in the Mathematical Sciences in collaboration with Madhya Pradesh Bhoj Open University with a 3 year course in Mathematics and Computer Science, leading to a B.Sc. Honours degree. In 2001, this programme was extended to the postgraduate level with separate 2 year courses leading to M.Sc. degrees in Mathematics and Computer Science. The scope of the undergraduate programme was expanded in 2003 to incorporate a 3 year course leading to a B.Sc. Honours degree in Physics. CMI commenced a two year course leading to an M.Sc. degree in Applications of Mathematics in 2010.

From 2012, the B.Sc. Physics programme has been restructured as a B.Sc. programme in Mathematics and Physics. There is a common admission to the B.Sc. programmes in Mathematics and Computer Science and Mathematics and Physics and all students do the same courses in the first semester. Students choose their stream at the end of the first semester.

In 2018, MSc Data Science program has been launched, keeping in view the current requirement from the industry.

The undergraduate and postgraduate teaching programmes at CMI are both run in cooperation with the Institute of Mathematical Sciences (IMSc), Chennai. These programmes tap the teaching talent available at the elite research institutes of the country, which are normally outside the university system. Students are thus exposed to lectures by active researchers who bring a very different perspective to the teaching.

B.Sc. (Hons.) Mathematics and Computer Science

In 2021, the twentyourth batch of students was admitted to the undergraduate programme. At the end of the first semester, 47 students opted for B.Sc. in Mathematics and Computer Science. The second year B.Sc. class has 34 students in Mathematics and Computer Science and the third year B.Sc. class has 55 students. Out of the 20 students of the 2018 batch who took their degrees at the convocation in July 2021, several have been placed in very prestigious institutions.

- Akash Singha Roy
- Aditya Prakash
- Urshita Pal
  PhD Mathematics, University of Michigan, Ann Arbor
- Lakshay Modi
- Saketh Narayanan

- Anant Mudgal
  Master of Advanced Study in Pure Mathematics, Trinity College, University of Cambridge, UK.
- Pranay Agrawal
  M1 MPRI, ENS Paris-Saclay, France
- Neha Ann Rino
  M1 Parisian Master of Research in Computer Science, ENS Paris-Saclay, France
- Ananthu M S
- Sutirtha Datta
- Arghadeep Ghosh
- Sagnik Dutta
- Hrishikesh Balakrishnan
- Ameya Anand Kamat
- Shivang Paliwal
- Shankar Ram Vasudevan
- Anupam Datta
  Master of Science Mathematics, University of Münster, Münster, Germany
- Maitreyi Vijay
- Sarvesh Sunil Bandhaokar
  Assistant Manager, MAN Trucks and Buses India Pvt Ltd
- Samarth Ramesh
  Machine Learning Engineer, Soroco, Bangalore

B.Sc. (Hons.) Mathematics and Physics

Of the 54 students admitted to the undergraduate programme in 2021, 7 students opted for B.Sc. in Mathematics and Physics as the end of the first semester. The second year class has 9 students. The third year class has 6 students. Out of the 2 students of the 2018 batch who took their degrees at the convocation in July 2021, several have been placed in very prestigious institutions.

- Akella Sriram
  Integrated PhD programme in Physics, Tata Institute of Fundamental Research, Mumbai

- Nived J M

M.Sc. Mathematics

In 2021, 8 students have joined the programme. There are 7 students in the second year of the programme. 3 students who joined the programme in 2019 have completed the programme successfully.

- Chinthalagiri Venkata Sriram
  PhD Mathematics, Heidelberg University, Germany

- Krishna Menon P
  PhD Mathematics, Chennai Mathematical Institute, Chenai

- Rahul Ghosh

M.Sc. Computer Science

In 2021, 17 students have joined the programme. There are 20 students in the second year of the programme. 17 students who joined the programme in 2019 have completed the programme successfully.

- Ashwani Anand
  PhD Computer Science, Max Planck Institute for Software Systems, Kaiserslautern, Germany

- Ativ Joshi

- Saideep Bhosle

- Sai Praveen Chinthaginjala

- Deeksha Gopalan

- Hitarth S
  PhD Computer Science, HKUST, Hong Kong

- Jayan Sarkar

- Kishlaya Jaiswal

- Kushagra Chatterjee
  PhD Computer Science, National University of Singapore, Singapore
- Rajat De
  PhD Computer Science, University-Stony Brook University, USA
- Satya Prakash Nayak
  PhD. in Computer Science, Max Planck Institute for Software Systems, Germany
- Rao Shrisha Shripathi
- Soumodev Mal
  PhD Computer Science, Chennai Mathematical Institute, Chennai
- Sricharan A R
  PhD Computer Science, University of Vienna, Austria
- Subham Jaiswal
- Zubin Duggal
- Sreejata Kishore Bhattacharya
  PhD Computer Science, Tata Institute of Fundamental Research, Mumbai

M.Sc. Data Science

In 2021, third batch of 46 students joined the programme. There are 46 students in the second year of the programme. 38 students who joined the programme in 2019 have completed the programme successfully.

- Aashish Ranjan
- Anubhab Chatterjee
- Arivoli K
  Data Scientist, Micron Technologies Operations India LPP, Hyderabad
- Ashish Kumar Sinha
  Machine Learning Engineer, HP, Banglore
- Ashray Anand
- Ashwary Sharma
- Avinash Kumar

- Avirup Chakraborty
  Data Science Engineer, Micron Technology, Hyderabad
- Biyyam Naveen Kumar Reddy Machine Learning engineer, HP, Bangalore
- Debangshu Bhattacharya
- Deepti Boddeda
- Hardik Prabhu
- Ipsita Ghosh
- Joel Joy
- Kshitish Krit Nanda
  Analyst, Fischer Jordan, Mumbai
- Kushal Motwani
  Systems Engineer - Innovator, TCS, Gurgaon
- Saager Babu N G
  Junior Research Engineer Trainee, BUDDI.AI, Chennai
- Nachiket Dravid
  Data Scientist, Micron Technology, Hyderabad.
- Nilanjan Debnath
  Post graduate Engineer Trainee, Mercedes Benz Research and Development, Bangalore
- Pratap Chandra Das
  Data Scientist, Larsen & Toubro Infotech, Mumbai
- Prateek Chandra Jha
- Prince Kumar
- Ragavendra Tiwari
- Rishabh Gupta
- Rohit Aich Bhowmick
- Saikrishna Ranganathan
- Shadaab Ghani
- ShailenderJoseph

- Shoraj Tomer
- Sougata Bhattacharya
- Soundarya Devi R
- Subhadutta Mahapatra
- Suman Polley
- Swaraj Bose
  PhD Biostatistics, University of Michigan
- Syed Salman Abbas Baqri
- Tanmey Rawal
- Vanshi Mishra
- Vruddhi Satra
  Data Scientist, L & T Infotech, Mumbai

Convocation

The 18th Annual Convocation of CMI was held online on 20 July 2021. Degrees were awarded to 87 successful candidates at various levels. Of these, 23 were B.Sc. candidates, 56 were M.Sc. candidates and 8 were a Ph.D. candidates. Prof. Sujatha Ramdorai, University of British Columbia, was the Chief Guest and delivered the convoation address.

12 Activities of the Undergraduate Students

Informatics Olympiad

CMI faculty coordinate the training and selection of students to represent India at the International Olympiad in Informatics through the Indian Association for Research in Computer Science (IARCS). CMI hosts the official IARCS website. From September 2004, a monthly online programming competition has been conducted by the CMI faculty via the IARCS website.

Internship

- Shiuli Subhra Ghosh
  - did internship at Legato Health Technologies under Dr. Shaheen Gauher on "Exploration of Multiple Statistical Tests and Correction Methods to detect bias using Calibration Curve, Calculating Disparities for detecting bias in classification models" during July-October 2021.
  - did internship at INESC TEC, Portugal under Dr. Ricardo Bessa on "Towards the Development of Energy Data Market" during October 2021 - January 2022.
  - did internship at imec, Belgiumunder Dr. Sandip Halder and Dr. Stefan De Gendt on "Machine Learning Applications for Advanced Process Control" during January-March 2022.
- Oshita Saxena
  - did internship at IBM Global Remote Mentoring (Online) under Prof. Venkatesh Vinayakarao on "Commit Message Generation" during June to September 2021.
  - did internship at Synergy Marine Group (Data Science Intern) (Online (Company office in Chennai)) under Prof. Kavita Sutar on "Industry Project" during October - December 2021.
  - did internship at Synergy Marine Group (Data Science Intern) (Online (Company office in Chennai)) on "Industry Project" during January - March 2022.
- Senjuti Dutta did internship at PROMYS Boston on "Number theory, Galois Theory and Fermat Numbers" during July - August 2021.
- Krishnan D did internship at IIT Madras under Nishad Kothari on "Matching theory" during November 2021 - March 2022.
- Chandrashish Prasad

  - did internship at USHUR, Bangalore under Prof. Sourish/ Prof. Kavita Sutar (from CMI) & Ravil Kashyap (from USHUR) on "Benchmarking of OCR Models / Structured data extraction using OCR" during January - March 2022.
  - did Internship at Coriolis Tech. Pvt. Ltd., Pune under Prof. Sourish/ Prof. Kavita Sutar (from CMI) & Sudhir (from Coriolis) on "Visual Search Engine using similarity search" during July - Septemper 2021.

- Aritra Kundu did internship at Chennai Mathematical Institute under prof.Krishna Hanumanthu about Algebraic Geometry from May - August 2021.

- Arka Karmakar

  - did internship at TIFR Mumbai in the Visiting Students Research Program under Swarnava Mukhopadhyay on "Riemann-Hilbert correspondence" during May - June 2021.
  - did internship at IISc Bangalore in Summer Research Fellowship Program under Subhojoy Gupta on "Teichmuller Theory" during June - August 2021.
  - did internship at CMI under Prof. Vikraman Balaji on "Moduli space of stable vector bundles" during October - November 2021.

- Aadityan Ganesh

  - did internship at Northwestern University under Prof Hartline on "Mechanism design with irrational agents", during May 2021 - March 2022.
  - did internship at CMI under Prof Prajakta Nimbhorkar on "Fair healthcare rationing" during May - December 2021.

- Amik Raj Behera

  - did internships at Aarhus University under Prof. Srikanth Srinivasan on "Interactive Proofs and Zero-Knowledge Proofs (Complexity Theory)" during May - July 2021.
  - did internship at University of Bordeaux under Géraud Sénizergues on "One-rule Semi-Thue systems (Automata Theory)" during May - July 2021.

- Soumya Das Gupta

  - did internship (Online) at IISC Bangalore under Prof. Soumya Das on "Analytic Number theory" during May - July 2021.
  - did internship (Online) at ISI Bangalore under Prof. Ramesh Shrikantan on "Algebraic Number theory" during September - December 2021.
  - did internship (Online) at ISI Bangalore under Prof. Soumyashant Nayak on "Application of Differential geometry to robotics" during November 2021 - March 2022.

– did internship (Online) at IIT Madras under Prof. Ramesh Kasilingam on "Advanced Algebraic Topology and Obstruction theory" during January - March 2022.

– did internship (Online) at NISER Bhubaneshwar under Prof. Ritwik Mukherjee on "Analysis of asymptotic of Gromov-Witten Invariants" during December 2021 - March 2022.

– did internship (Online) at Illinois University, UC under Prof. Igor Mineyev on "Riemannian Geometry" during April 2021 - March 2022.

13 Undergraduate/Graduate Courses

September–December 2022

Algebraic Curves & Riemann Surfaces	:	Tanya Srivastava
Advanced Algorithms	:	Prajakta Nimbhorkar/Nithin Varma
Algebraic Geometry I	:	Pramath Sastry/Rupam Karmakar
Algebra I	:	T R Ramadas
Algebra III	:	S Senthamarai Kannan/Arvind Kumar
Design & Analysis of Algorithms	:	Prajakta Nimbhorkar/Nithin Varma
Advanced Machine Learning	:	Madhavan Mukund/Pranabendu Misra
Analysis I	:	Rajeeva Karandikar
Analysis III	:	Parameswaran Sankaran
Alg. Number Theory	:	Purusottam Rath/Jyothsnaa S
Commutative Alg. & Invariants of Groups	:	Manoj Kummini
Calculus	:	T R Ramadas
Commutative Algebra	:	Mandira Mondal
Classical Mechanics I	:	Govind Krishnaswami
Concurrency Theory	:	Aiswarya Cyriac/K Narayan Kumar
Coding Theory	:	Sharad Sane
English	:	Usha Mahadevan
Foundations of Machine Learning	:	K V Subrahmanyam/Pranabendu Misra
Financial Modelling with Python	:	Mousum Dutta
Graduate Algebra I	:	Sukhendu Mehrotra/Mallika Roy
Graduate Analysis I	:	Krishna Hanumanthu/Amith Shastri
German I	:	Pavithra Ravishankar
Graph Algorithms I	:	Pratik Ghosal(Sep-Oct)
Graph Algorithms II	:	Samir Datta(Nov-Dec)
General Relativity	:	Amitabh Virmani
Graduate Topology I	:	Manoj Kummini/Oorna Mitra
Homological Algebra	:	Clare DCruz/S Selvaraja
Introduction to Ergodic Theory	:	Keshab Chandra Bakshi
Intro to Generating Functions	:	Shuchita Goyal
Information Retrieval	:	V Venkatesh
Linear Groups	:	Kamalakshya Mahatab
Mathematical Logic	:	M Praveen
Introduction to Manifolds	:	Priyavrat Deshpande/Chaitanya Ambi
Matrix Computations	:	Kavita Sutar
Mathematical Methods – Analysis	:	Kavita Sutar/Sourish Das
Measure-Theoretic Probability	:	B V Rao
Online Optimization	:	K V Subrahmanyam
Optimization Techniques	:	Sujatha Babu
Regression & Classification	:	Sushma Kumari/Rajeeva Karandikar

Probability and Statistics with R	:	Siva Athreya
Programming & Data Structures with Python	:	Madhavan Mukund
Parameterized & Exact Algorithms	:	Philip Geevarghese
Introduction to Programming(Haskell)	:	S P Suresh
Proofs & Types	:	S P Suresh
Intro to Quantum Computing	:	Partha Mukhopadhyay/C Ramya
Quantum Mechanics I	:	Alok Laddha
Representations of algebras & quivers	:	Upendra Kulkarni
Representation Theory of Finite Groups	:	Arpita Nayek
Constraint (SMT) Solving & Deep Neural Networks	:	M K Srivas
Stochastic Processes I	:	S Ramasubramanian
Statistical Mechanics	:	G Date
Timed Automata	:	B Srivathsan
Theory of Computation	:	Aiswarya C/Narayan Kumar
Thermal Physics	:	H S Mani
Time Series Analysis	:	V Swaminathan
Visualization(2 credits)	:	Sourish Das
Values Through Literature	:	M Usha

January–May 2022

Approximation Algorithms	:	Pranabendu Misra/Nithin Varma
Algebraic Automata Theory	:	Pascal Weil
Algebraic Geometry II	:	V Balaji
Algebraic Groups	:	Arpita Nayek
Advanced Information Retrieval	:	Venkatesh V
Algebra II	:	Manoj Kummini
Algebra IV	:	V Balaji
Design & Analysis of Algorithms	:	Philip Geevarghese/Nithin Varma
Applied Machine Learning	:	Raghav Kulkarni
Analysis II	:	Upendra Kulkarni
Advanced Programming	:	Samir Datta
Bayesian Data Analysis	:	Durba Bhattacharya
Big Data with Hadoop	:	Venkatesh V
Commutative Algebra II	:	Sudeshna Roy
Complex Analysis	:	B V Rao
Combinatorics & Commutative Algebra	:	S Selvaraja
Classical Mechanics II	:	K Narayan
Complex Analysis	:	Purusottam Rath

Complexity Theory	:	Prajakta Nimbhorkar
Computer Vision	:	Kavita Sutar
Differential Equations	:	Clare D'Cruz
Discrete Mathematics	:	Partha Mukhopadhyay/C Ramya
Data Mining & Machine Learning	:	Madhavan Mukund
Economics	:	Malathi Velamuri
Electrodynamics I	:	K G Arun
Financial Risk Management	:	Mousum Dutta
Formal Security Analysis	:	S P Suresh/Karthikeyan Bhargavan
Graduate Algebra II	:	Sukhendu Mehrotra/Nabanita Ray
Graduate Analysis II	:	R Srinivasan/Sruthymurali
German II	:	Pavitra Ravishankar
Game Theory	:	Sujatha Babu
Introduction to Graph Theory	:	Sharad Sane
Graduate Topology II	:	Priyavrat Deshpande/Arghya Mondal
Introduction to Physics of Information	:	H S Mani
Infinite State Verification	:	Narayan Kumar/Prakash Saivasan
Logic, Automata and Games	:	M Praveen
Linear Algebra & its Applications	:	Kavita Sutar
Linear Programming & Combinatorial Optimization	:	B Srivathsan
Model Theory	:	Manoj Kummini/S P Suresh
Introduction to Modular Forms	:	Siddhi Pathak
Non Convex Optimization(Mar-May)	:	K V Subrahmanyam
Natural Language Processing	:	Ramaseshan R
Optics	:	H S Mani
Partial Differential Equations	:	Mythily Ramaswamy
Programming Language Concepts	:	S P Suresh/Madhavan Mukund
Probability Theory	:	Parameswaran Sankaran
Quantum Field Theory	:	G Date
Quantum Mechanics II	:	Alok Laddha
Reinforcement Learning	:	
Survival Analysis with Machine Learning	:	Shibasish Dasgupta
Semisimple Lie Algebras	:	S Senthamarai Kannan
Stochastic Processes II	:	S Ramasubramanian
Statistical Inference	:	V Swaminathan
Software Verification and Analysis	:	M K Srivas
The Art of Short Fiction	:	Usha Mahadevan
Topological Data Analysis(Jan-Mar)	:	Priyavrat Deshpande
Topology	:	Krishna Hanumanthu
Introduction to Valuation Theory	:	Suprajo Das
Weighted Automata and Transducers	:	C Aiswarya

14 Special Lectures

- Mallika Roy: Algebraic and algorithmic aspects of free-abelian times free groups: rank of subgroups and fixed subgroups of automorphisms (Two talks) (April 2021).
- Oorna Mitra: On structure of SL_2 over a field with discrete valuation (April 2021).
- Keshab Chandra Bakshi: Mini-course on Planar Algebras (May–June 2021).
- Samit Ghosh: Research methodology talks: Gorenstein Ring and It's Ubiquity (July 2021).
- Arkadev Ghosh: Research methodology talks: Macaulay'S Inverse System and Related Duality (July 2021).
- Navnath Daundkar: Research Seminar 1: Building planar polygon spaces from the projective Coxetercomplex (September 2021).
- Cyril Jacob: Research Seminar 2: Intersection number for projective plane curves (September 2021).
- Nirmal Kotal: Research Seminar 3: On a relationship of test ideal and F-rationality of Proj of the Rees algebra (September 2021).
- Pritthijit Biswas: Research Seminar 4: Picard Groups of Certain Compact Complex Parallelizable Manifolds And Related Spaces (September 2021).
- Malay Mandal: Research Seminar 5: On the state space of certain C^*-algebra (September 2021).
- Jagadish Pine: Research Seminar 6: Degenerations of parabolic moduli space (September 2021).
- Sadhanand Vishwanath: Research Seminar 7: Partition Algebras and their representation theory (September 2021).
- Dharm Veer: Research Seminar 8: Green-Lazarsfeld property N_p for Hibi rings (September 2021).
- K.V. Subrahmanyam: A Local Model Towards Understanding Projective Limits (February 2022).
- K.V. Subrahmanyam Projective limits of stable points - Part 2 (March 2022).

15 Data Science Colloquium Series

- Ganesh Sankaralingam, Latentview Analytics: Emergence of Machine Learning Platforms in Data science (April 2021).
- Rick Sarkar, Senior manager and the lead data scientist, Genpact, Bengaluru: A Comprehensive Study of Server Failures & Tickets using Advanced Statistical & Machine Learning Techniques (June 2021).
- Sushma Kumari, Chennai Mathematical Institute: Universal Consistency of the k-NN Rule: A Review (June 2021).
- Siddharth Pritam, DataShape, Inria, France: Collapses and Persistent Homology (June 2021).
- Naveen Yeri, Wells Fargo, Begaluru: Role of analytics techniques in the finance industry (September 2021).
- Vijay Perincherry, Chief data scientist, Indiggo.ai, USA: An AI Platform to Understand and Leverage Human Choice Architecture (October 2021).
- Anand Nath Jha, Assistant Vice President at Genpact, India: Curse of Dimensionality (October 2021).
- Sourav Mazumdar, AI/ML architect, Indiggo.ai, USA: Applications of Machine Learning and Data Science for the Enterprise (October 2021).
- Rajeswaran Viswanathan, Head of AI CoE, Capgemini, India: NLP and Deep Learning (November 2021).
- Balasubramanian Narasimhan, Senior research scientist, Department of Biomedical Data Science and Department of Statistics, Stanford University, USA: CVXR: Disciplined Convex Programming in R (November 2021).
- Ravi Kumar, Genpact, India: Churn Identification and Management (November 2021).
- Prakash Selvakumar, Assistant Vice President at Genpact digital: Information extraction in NLP (November 2021).
- Indrabati Bhattacharya, Department of Biostatistics and Computational Biology at University of Rochester, USA: Nonparametric Bayesian Q-learning for adjusting partial compliance in Sequential Decision Making (December 2021).
- Hemen Sampat, Vice President (data & analytics), Jefferies, New York: Resolving investment debates using alt data (February 2022).

16 Conferences/Workshops/Schools

I Symposium for Prof. Rajeeva Karandikar (April 2021)

Prof. Rajeeva L. Karandikar retired from CMI after an association of 11 years, including a decade as Director of the Institute and the Symposium was held to mark this occasion. The following lectures were delivered.

- Shekhar Mande (CSIR): Mortality due to COVID-19 in different countries is associated with their demographic character and prevalence of autoimmunity.
- Siva Athreya (ISI, Bangalore): Sero-Survey in Karnataka State.
- Siva Athreya (ISI, Bangalore): Small ball probabilities and a support theorem for the stochastic heat equation.
- Abhay Bhatt (ISI, Delhi): Rajeeva L Karandikar: Glimpses of his work over four decades

II Statistical Methods in Finance 2021 (June—July 2021)

The sixth conference and workshop on Statistical Methods in Finance aimed to expose the participants to new and active areas of research and to engage researchers into active working groups. The conference was jointly hosted by Chennai Mathematical Institute (CMI), Indian Statistical Institute, and North Dakota State University.

Plenary Speakers

- Anil Bera, University of Illinois, Urbana-Champaign, USA: Spatial Analysis: From the Big Bang to the Frontier.
- René Carmona, Princeton University, USA: Model-Free Mean-Field Reinforcement Learning.
- Svetlozar (Zari) Rachev, Texas Tech University, Lubbock, USA: A New Approach to Discrete Option Pricing in Finance.

A Workshop on Data Science in Finance was organized with the following invited speakers.

- Sumanta Basu, Cornell University, Ithaca, USA: Learning Financial Networks with Graphical Models of Time Series Data.
- Erhan Bayraktar, University of Michigan, Ann Arbor, USA: Graphon mean field systems: large population and long time limits.

- Yulia Gel, University of Texas, Dallas, USA: Dissecting Ethereum Blockchain Analytics: What We Learn on Token Price from Topology and Geometry of Ethereum Transaction Graph.
- Tomoyuki Ichiba, University of California, Santa Barbara, USA: Relative arbitrage among investors.
- Rafal Kulik,University of Ottawa, Ottawa, Canada: Estimation of Extreme Risk Measures for Heavy Tailed Time Series.
- Vidyadhar G. Kulkarni, University of North Carolina, Chapel Hill, USA: Bouncing GBMs as a model of limit order books.
- Youcheng Lou, Chinese Academy of Sciences, Beijing, China: Information aggregation in a financial market with general signal structure.
- Yarema Okhrin, University of Augsburg, Augsburg, Germany: Optimal shrinkage-based portfolio selection in high dimensions.
- David Puelz, University of Chicago, Chicago, USA: Monotonic Effects of Characteristics on Returns.
- Hanlin Shang, Macquarie University, Sydney, Australia: Bootstrap prediction bands for functional time series.

A Young Researcher's Session was organized with the following speakers:

- Siphumlile Mangisa, Nelson Mandela University, South Africa: Analysing the Impact of Brexit on Global Uncertainty Using Functional Linear Regression with Point of Impact: The Role of Currency and Equity Markets.
- Arnab Chakrabarti, Indian Institute of Management, Ahmedabad, India: Filtering of comovement networks from high-dimensional data.
- Purba Das, University of Oxford, UK: Quadratic variation and quadratic roughness.
- Sourav Majumdar, Indian Institute of Management, Ahmedabad, India: Pairs trading with topological data analysis.

III CMI NASI Online Outreach Lectures for Schools (July–August 2021)

- Dr. S. Sivakumar (Mathematics): Pick's Theorem.
- Dr. Jaikumar Radhakrishnan (Computer Science): Max-Flow Min-Cut Theorem.

- Dr. Gauthaman Kalamegam (Life Sciences): Stem Cells.
- Dr. John Kurien (Environmental Science): The Human Relationship with our Ocean Planet.
- Dr. Rama Shanker Verma (Life Sciences): Immune Systems.
- Dr. V. Balakrishnan (Physics): Scaling and Power Laws in the Natural Sciences and Beyond.
- Dr. V. Madhurima (Physics): Dancing Demystified.

IV Conference on Modular Forms (September 2021)

Prof. Ramakrishnan has made significant contributions in the theory of integral and half-integral weight modular forms, Jacobi forms and Siegel modular forms. The conference highlighted his work in these areas on the occasion of his 60th birthday. The organisers were: Rashi Lunia (IMSc, Chennai), Biplab Paul (Kyushu University, Japan) and Jyothsnaa Sivaraman (CMI, Chennai).

- Dipendra Prasad (IIT Bombay, India): A survey on Explicit Waldspurger formula relating toric periods to central L-value for GL(2).
- Sukumar Das Adhikari (RKMVERI Belur, India): Visibility of integer lattice points and related questions.
- C.S. Rajan (TIFR Mumbai, India): Finiteness theorems for potentially equivalent Galois representations.
- Kalyan Chakraborty (KSoM Kerala, India): Sturm-type bound for square-free coefficients of Hilbert modular forms.
- Bernhard Heim (RWTH Aachen, Germany): From Ramanujan to Rota: Lehmers Conjecture.
- M. Ram Murty (Queen's University, Canada): The arithmetic of function fields over finite fields.
- Kaneenika Sinha (IISER Pune, India): Central limit theorems in number theory and graph theory.
- Shuichi Hayashida (Joetsu University of Education, Japan): Kohnen plus-space for Jacobi forms of half-integral weight.
- Eknath Ghate (TIFR Mumbai, India): Non-admissible modulo p representations of GL2(Qp 2).

- V.P. Ramesh (Central University of Tamil Nadu, India): A generalisation of Sophie Germain primes in the direction of primitive roots.
- Abhishek Saha (Queen Mary University of London, UK): Fundamental Fourier coefficients of Siegel cusp forms of degree 2.
- V. Kumar Murty (University of Toronto, Canada): Nonvanishing of Poincare series.
- Soma Purkait (Tokyo Institute of Technology, Japan): Hecke Algebra and Whittaker functions.
- Karam Deo Shankhadhar (IISER Bhopal, India): On certain correspondences between Jacobi forms and modular forms.
- Jaban Meher (NISER Bhubaneswar, India): Converse theorem for quasimodular forms.
- Soumya Das (IISc Bangalore, India): Sup-norm of holomorphic Siegel cusp forms.
- Nils-Peter Skoruppa (Universitat Siegen, Germany): The Macdonald identities and Jacobi forms of lattice index.
- Murugesan Manickam (IISER Bhopal, India). Overview of the work with B. Ramakrishnan and some recent results.

V ACM Winter School on Algorithms and Lower Bounds (January 2022)

This school was hosted by Chennai Mathematical Institute and Indian Institute of Technology, Madras and the academic coordinators were Akanksha Agrawal (IITM) and G. Philip (CMI). During this school we revisited some "easy" polynomial-time solvable problems. We explored some recent developments that gave us algorithmic improvements using new techniques (like FFT-based methods and the polynomial method), and better lower bounds based on some well-known conjectures other than P $\neq$ NP. Here is a list of subtopics covered:

- Recap on basics of algorithms
- Simple algorithmic improvements using look-ups, and their applications
- Improvements based on Fast Fourier Transformation
- The Polynomial Method and its applications
- Linear Decision Trees
- Bottlenecks to faster algorithms, famous conjectures from P and beyond

- Relating difficulties among problems in P and beyond

List of speakers

- Akanksha Agrawal (Indian Institute of Technology Madras, Chennai)
- G. Philip (Chennai Mathematical Institute)
- Saket Saurabh (Institute of Mathematical Sciences, Chennai)
- Venkatesh Raman (Institute of Mathematical Sciences, Chennai)

VI GCT2022: School and Conference on Geometric Complexity Theory (January 2022)

The GCT2022 workshop brought researchers working in the diverse fields of algebraic circuits, algebraic geometry, representation theory and optimization theory under one common umbrella. The aim was to expose students and young researchers to the fascinating connections between these areas by studying problems arising from algebraic complexity theory and solutions to some of these problems.

The workshop was organized by Thomas Seiller (CNRS and Sorbonne Paris Nord University) and K. V. Subrahmanyam (Chennai Mathematical Insitute). Additional organisers for the online lectures were: Christian Ikenmeyer (University of Liverpool), Neeraj Kayal (Microsoft Research), Visu Makam (Institute for Advanced Study) and Michael Walter (University of Amsterdam).

- Lecture 1: Christian Ikenmeyer - GCT, an overiew.
- Lecture 2: Krishna Hanumanthu - Basics of Algebraic Geometry.
- Lecture 3: Komaranapuram N Raghavan - Actions on varieities, representations, and Chevalley's theorem.
- Lecture 4: Upendra Kulkarni - Representations, Isotypic components, Reductive groups, Actions on coordinate ring, Local finiteness.
- Lecture 5: Krishna Hanumanthu - Basics of Algebraic Geometry II.
- Lecture 6: Komaranapuram N Raghavan - Stabilizers, Affine Orbits, Homogeneous Spaces.
- Lecture 7 and 8: T. R. Ramadas - Geometric Invariant Theory.
- Lecture 9: S. Srinivasan – Algebraic Complexity: An Introduction.

- Lecture 11: A. Garg – The matrix scaling problem.
- Lecture 12: A. Wigderson – Determinant and Permanent, non-identical twins.
- Lecture 13: S. Tavenas – Algebraic complexity: upper bounds.
- Lecture 14: A. Garg – Computational problems for torus action.
- Lecture 15: R. Oliveira – Non-commutative PIT, Operator Scaling.
- Lecture 16: S. Tavenas – Algebraic complexity: structural results:
- Lectures 18 and 19: Luke Oeding: Representations in coordinate rings, GLn representations.
- Lecture 20: Jesko Hüttenhain – Orbit closures in GCT, techniques from projective geometry.
- Lecture 23: Ramprasad Saptharishi – Lower bounds 1.
- Lecture 24: Greta Panova – Kronecker and plethysm coefficients.
- Lecture 25: Peter Bürgisser – Geometric Complexity Theory: No Occurrence Obstructions for Determinant vs Permanent.
- Lecture 26: Ramprasad Saptharishi – Lower bounds 2.
- Lecture 27: K. V. Subrahmanyam – Algebraic algorithm for null cone membership for left-right actions.
- Lecture 28: Michael A. Forbes – Explicit dimension reduction for varieties, and the polynomial identity testing problem.
- Lecture 29: Chandan Saha – Arithmetic circuit reconstruction 1.
- Lecture 31: Hiroshi Hirai – Discrete Convex Optimization for Left-Right Action (nc-rank & det), part 1.

VII Perspectives in Mathematical Sciences, Dr. F.C. Kohli Centre Inaugural Conference (January–February 2022)

The Dr. F.C. Kohli Centre of Excellence was set up at CMI in December 2020. The Centre aims to promote research and innovation through a strong visitors' programme, built around regular thematic events.

The inaugural activity of the centre was entitled Perspectives in Mathematical Sciences. This consisted of a series of online talks, highlighting accomplishments and future directions acrose diverse areas. The details are given below.

- Avi Wigderson, Institute for Advanced Study (IAS), Princeton: Imitation Games.
- V Kumar Murty, Fields Institute, Toronto: ζ (3), log 2 and π.
- Sarah Shandera, Institute for Gravitation and the Cosmos (IGC), Pennsylvania State University: Cosmology in the 2020.
- Ananth Shankar, University of Wisconsin, Madison: Special points on moduli spaces.
- Visu Makam, Radix Trading: Interactions between invariant theory and complexity theory.
- Nima Arkani-Hamed, Institute for Advanced Study (IAS), Princeton: Spacetime, Quantum Mechanics and the Vacuum.
- Saket Saurabh, Institute of Mathematical Sciences (IMSc), Chennai: Graph Isomorphism (on structured inputs) (Video Recording)
- Cynthia Rudin, Duke University: Interpretable Machine Learning for High-Stakes Decisions.
- Kurt Mehlhorn, Max Planck Institut für Informatik, Saarbrücken: Fair Allocation of Indivisible Goods.
- Caucher Birkar, Tsinghua University and University of Cambridge: Recent progress in birational geometry.
- Ronald de Wolf, QuSoft, Centrum Wiskunde and Informatica (CWI) and University of Amsterdam: Quantum computing.
- Rajesh Gopkumar, International Centre for Theoretical Studies (ICTS), Bangalore: Deriving Gauge-String Duality.
- Ronak Soni, University of Cambridge: How Does Entanglement Build Spacetime?
- Chandrashekhar Khare, University of California at Los Angeles (UCLA): Modular forms, Galois representations and the Ramanujan prime 691.
- Shiladitya Banerjee, Carnegie-Mellon University (CMU): Physics of living and evolving matter.
- Uma Girish, Princeton University: Eliminating Intermediate Measurements in Quantum Algorithms.

VIII CMI Arts Initiative Online Talks and Readings

- Ruth Padel, Professor of Poetry, King's College London: Beethoven: How to Think About the Making of an Artist (April 2021).
- Ranjit Hoskote: Hunchprose: Of Language and Languages (June 2021).
- Arshia Sattar: Translation as an Act of Reading: Valmiki's Ramayana (July 2021).
- Carlos Eduardo de Magalhaes Ledig House, USA: Writing a novel (August 2021).
- Resource Person: Shloka Shankar, Poet: Poetry Is Everywhere: An Introduction to Found and Visual Poetry (September 2021).
- Priya Sarukkai, Award-winning poet, translator and writer: Revisioning Tagore's Gitanjali (October 2021).
- Krupa Ge, Writer: Discussion on "What We Know About Her" (November 2021).

17 Conferences, Visits and External Lectures

Amitabh Virmani

- Visited IIT Madras in August 2021 and gave talks.
- Visited Indian Strings Meeting, IIT Roorkee (online) in December 2021 and gave talks.
- Visited S N Bose Center, Future trends in gravitational physics in February 2022 and gave talks.
- Visited IIT Madras, Chennai Symposium on Gravitation and Cosmology in February 2022 and gave talks.

Amith Shastri K

- Attended Tibar60 workshop.
- Attended congress on toposes organized by IHES.
- Attended International Conference on discrete groups, geometry and arithmetic in August 2021.
- Attended Faces of Singularity Theory Conference in November 2021 at CIRM.
- Attended online school on toposes organized by IHES.
- Participted in milnor fibrations, degenerations and deformations from modern perspectives (2570).

Dharm Veer

- Gave talk in 4th BRICS maths Conference at IISER TVM.
- Presented paper in NSMA at IIT madras.

Govind Krishnaswami

- Visited Shastra University, Thanjavur in May 2021.
- Visited Saha Institute of Nuclear Physics, Kolkata in July 2021 and gave talks.
- Visited Chennai Strings Meeting, IMSc, Chennai in November 2021 and gave talks.
- Visited CNSD 2021, SASTRA University, Thanjavur in December 2021 and gave talks.

- Visited Department of Nonlinear Dynamics, School of Physics, Bhrathidasan University, Tiruchirappalli in March 2022 and gave talks.

Krishna Hanumanthu

- Gave a course on group theory during Mathematics Training and Talent Search (MTTS) programme 2021.
- Gave a talk on "Diagonalization of matrices" at VIT, Chennai in June 2021.
- Gave a talk on "Rationality questions on Seshadri constants" at Zoom Algebraic Geometry (ZAG) seminar in June 2021.
- Gave a virtual talk on "Introduction to the Nagata Conjecture on plane curves" at IIT Palakkad in July 2021.
- Gave a virtual talk on "Seshadri constants" at SRM University, Amaravati in July 2021.
- Gave two virtual talks on "Basics of algebraic geometry" during the workshop on Geometric Complexity Theory at CMI during August - September 2021.
- Gave a virtual talk on "Some results on Seshadri constants" at TIFR Algebraic Geometry Seminar in September 2021.
- Gave a virtual talk on "Seshadri constants" at IIT Bombay Virtual Commutative Algebra Seminar in October 2021.
- Gave a talk on "Nagata Conjecture" at Ramanujan Institute for Advanced Study in Mathematics, University of Madras in March 2022.
- Gave a talk on "Seshadri constants" at Tata Institute of Fundamental Research, Mumbai in March 2022.

Jyothsnaa Sivaraman

- Gave a talk at the Women in Numbers conference.

H. S. Mani

- Attended Cheenai Outreach Programme and gave four lecures on quantum mechanics for Abdur Rehman University.
- Gave two lectures in childrens outreach programme.

- Gave lecture at central university of Himachal in September 2021.
- Organized Outreach Programme Course in Sivakasi.

Madhavan Mukund

- Visited IOI Training Camp (online) in April-June 2021.
- Visited Isaac Newton Institute Workshop on Verified software: from theory to practice (online) in May 2021.
- Visited 17th International Bebras Task Workshop (online) in May 2021.
- Visited SSN College of Engineering in June 2021 and gave talks.
- Visited ICALP 2021 in July 2021.
- Visited FM Update Meeting in July 2021.
- Visited SSN College of Engineering, Chennai in September 2021 and gave talks.
- Visited Oriental Institute of Technology, Bhopal in September 2021 and gave talks.
- Visited Shiv Nadar University, Chennai in September 2021 and gave talks.
- Visited Computational Thinking in Schools in October 2021.
- Visited Manipal Academy of Higher Education in October 2021 and gave talks.
- Visited Sai University, Chennai in October 2021 and gave talks.
- Visited ACM Compute 2021 in November 2021.
- Visited Thiagarajar College of Engg, Madurai in December 2021 and gave talks.
- Visited SSN College of Engg in January 2022 and gave talks.
- Visited NIT Silchar in March 2022 and gave talks.

Mandira Mondal

- Virtually attended the workshop 'Newton-Okounkov Bodies and Fanosearch' held at Levico Terme, Italy in October, 2021.

Manoj Kummini

- Visited IIT Hyderabad (online talk) in September 2021 and gave talks.

- Visited Hansraj College in December 2021 and gave talks.
- Visited VIT Chennai in December 2021 and gave talks.

Oorna Mitra

- Attended workshop on Finite Groups of Lie Type.
- Gave a talk at GAGTA-2021 in June 2021.
- Gave an invited talk at Otto von Guericke University Magdeburg in July 2021.

Pankaj Saini

- Gave an oral presentation at "14th Edoardo Amaldi Conference on Gravitational Waves" titled "Systematic biases due to the neglect of orbital eccentricity on parameterized test of GR" in July 2021.
- Gave oral presentation in CSGC-2022 conference organised by IIT Madras on "Systematic bias on parameterized test of general relativity due to neglect of orbital eccentricity".

B. Srivathsan

- Gave talks in the seminar series conducted at CMI and at Institute of Mathematical Sciences, Chennai.

Sharad S. Sane

- Gave an invited talk at Mathematics Research Institute, on the occasion of National Mathematics Day, on "The prisoner-hat problem: An introduction to Hamming codes", in December 2021.
- Gave an invited talk at the ICLAA, Manipal (International Conference on Linear Algebra and its Applications) on " On the Ryser design conjecture", in December 2021.
- Gave an invited talk on "The prisoner-hat problem: An introduction to Hamming codes" at the I.I.T. Palakkad, in January 2022.
- Nurturing Research Skills in Mathematics: Personal Experiences and Opinions, Keynote address at the SIES College, Mumbai Webinar, in March 2022.

Sudeshna Roy

- Delivered a lightning talk on "Derived functors of graded local cohomology modules", virtually at ICERM workshop on D-modules, Group Actions, and Frobenius: Computing on Singularities, in August 2021.

Tanya Kaushal

- Gave Multiple Talks in Seminar at Perverse sheaves, University of Sheffield, United Kingdom.

Venkatesh Vinayakarao

- Gave a talk at National University of Computer & Emerging Sciences, Karachi Campus, on "Code Search".

Usha Mahadevan

- Visited Airports Authority of India in September 2021.
- Visited Airports Authority of India in March 2022.

Nithin Varma

- Gave a talk on "Erasure-Resilient Sublinear-Time Graph Algorithms" at University of Haifa.
- Gave a talk on "Improved algorithms for permutation freeness testing" at Rutgers University & DIMACS.
- Gave outreach lecture on "Efficient Communication: Huffman Encoding" with Raising a Mathematician Foundation.
- Presented paper on "Parameterized Convexity Testing" at SOSA'22
- Gave a talk at ICALP 2021.

K. Narayan

- Attended QASTM seminar series at NISER Bhubaneshwar in August 2021 and gave talks.
- Attendeded IIT Madras Dual Mystery Channel online seminar on "Cosmologies, entanglement and extremal surfaces" in October 2021 and gave talks.

- Attended Indian Strings Meeting ISM2021, international string theory conference, IIT Roorkee, seminar on "Cosmologies, singularities and quantum extremal surfaces" in December 2021 and gave talks.

Prajakta Nimbhorkar

- Gave 9 hours lectures in the raising a mathematician program for school children.
- Gave two talks on spectral graph theory in the refresher course conducted by Pune University.

Purusottam Rath

- Visited IISER, Pune (online conference) in July 2021 and gave talks.
- Visited University of Paris in October 2021.
- Visited Vivekananda University, Belur in March 2022 and gave talks.

Sourav Roychowdhury

- Visited IISER Pune, Pune in October 2021 and gave talks.
- Visited Sofia University, Bulgaria in November 2021 and gave talks.
- Visited IISc Bengaluru in November 2021 and gave talks.
- Visited IMSc, Chennai in November 2021 and gave talks.
- Visited APCTP, Pohang, South Korea in November 2021 and gave talks.
- Visited TIFR, Mumbai in December 2021 and gave talks.
- Visited TU-Wien, Vienna in December 2021 and gave talks.
- Visited HRI, Prayagraj in December 2021 and gave talks.
- Visited IISER Thiruvananthapuram, Kerala in December 2021 and gave talks.
- Visited IST Lisbon, Portugal in December 2021 and gave talks.
- Visited ICTS-TIFR, Bengaluru in December 2021 and gave talks.

18 Other Professional Activities

C. Aiswarya

- Program Committee of CONCUR.

Amitabh Virmani

- Asian Physics Olympiad 2022, core and academic committee member.
- Editor for GERG topical collection "In Memory of Prof. T. Padmanabhan".
- Organising committee member of Chennai Symposium on Gravitation and Cosmology.
- Delivered a 15 hour lecture course on history of Indian Mathematica at IIT Gandhinagar under the HoMI project.
- Editor of GERG.
- Invited member of core and question setting committee of Asian Physics Olympiad 2022.
- Paper setting committee member for Indian Association of Physics Teachers.
- Taught at HBCSE in physics olympiad camp.

B.V. Rao

- Handled Information theory, summer project.
- Did guidance to two students in summer.

Chaitanya Ambi

- Co-instructor for the course 'Introduction to Manifolds'.
- One review publised in AMS.
- Reviewed a paper for AMS.

Clare D'cruz

- Refereed paper for Math Student.

C Ramya

- Read project on computational complexity theory (with Hrishikesh Saikia).
- Reviewed article for SICOMP.

Govind Krishnaswami

- Mentored postdoc T R Vishnu.
- PhD student T R Vishnu defended his PhD theses in September 2021.
- Reviewed a PhD thesis.
- Reviewed a book.
- Supervised PhD students Ankit Yadav and Pritish Sinha.
- Supervised two PhD students T R Vishnu and Ankit Yadav.
- Writing a book on classical mechanics.

H. S. Mani

- Attended Council Meeting of Raman Research Institute in September 2021.
- Member of the Council of Raman Research Institute.
- Particpated in a committee of Indian National Science Academy in September 2021.
- Planned for CMI-NASI online childrens programme during July-August 2021.

Jyothsnaa Sivaraman

- Organized a conference on Modular forms for Prof. B. Ramakrishnan's 60th birthday.

K G Arun

- Editorial Team Chair for Tests of GR paper using LIGO 3rd Observing run.
- Invited panelist on Tests of GR session in Physics At Extremes workshop.
- Invited talk in the conference named Astrophysical jets and observational facilities: National perspective

- Organizer of ICTS summer school of gravitational wave astronomy 2021.
- Chair of the editorial team of LIGO/Virgo Test of GR using GWTC-3 paper.
- Member of the IAGRG council.
- Referee of the ph.d. thesis of Sayak Datta, IUCAA, Pune.
- Scientific organization committee of astronomical society of India.

Sushma Kumari

- calculated the projecting dimension according to the Johnson-Lindenstrauss lemma.
- comparison of random projection and principal component analysis for high-dimensional settings.
- estimated the computational cost of random projection for real high-dimensional data.
- implemented random projection for synthetic and real data sets in MATLAB.
- instructor for predictive analysis PG course.
- studied sparse projection matrices for computationally efficient dimension reduction.

K. Narayan Kumar

- Coach, Selection Camp Indian National Olympiad in Informatics.
- Deputy Leader, Indian Team to IOI 2021.
- Member, Program Committee, MOVEP 2022.

K.V. Subrahmanyam

- Organized the Foundations of Machine learning session at the Indo-French Knowledge summit for the Institut Francais in India / French Embassy in November 2021.
- Coorganized a online lecture series on GCT as preparation for a conference in January 2022.

Madhavan Mukund

- Deputy Team Leader, EGOI 2021.
- Member, Editorial Board, Indian Journal of Pure and Applied Mathematics.

- Member, Programme Committee, ICALP 2021.
- Team Leader, IOI 2021.

Sukhendu Mehrotra

- Participated in a learning seminar on perverse sheaves.

Usha Mahadevan

- As a member of the expert committee, translation dept TN Govt. helped to select texts for translation projects eelecting.
- Learnt Tamil Prosody.
- Trained school children in handwriting and vocabulary.
- Attended book discussions.
- Discussed books as member of book lovers club.
- Edited articles for magazine.
- Participated in book lovers club meetings.
- Poetry reading and discussion at Book lovers club.
- Taught English grammar to school children.
- Taught spoken English.

Nithin Varma

- Contributed an entry (for Feb 2022) to the monthly blog on sublinear-time algorithms.
- Subreviewer for FSTTCS 2021.

Partha Mukhopadhyay

- Design of discrete mathematics teaching/curriculum for AICTE.
- Worked on the design and teaching methods of discrete mathematics for colleges at the national level.

Priyavrat C Deshpande

- Conducted Madhava Mathematics Competetion for Chennai region.
- Conducted weekly online math circle from January 2022.

Parthapratim Mahapatra

- Read the paper "Anatomy of the binary black hole recoil: A multipolar analysis".
- Read the paper "Comparison of post-Newtonian templates for compact binary inspiral signals in gravitational-wave detectors".
- Read the paper "Measurement of general-relativistic precession in a black-hole binary".
- Reproduced the paper "Comparison of post-Newtonian templates for compact binary inspiral signals in gravitational-wave detectors".
- Studied the paper "Tests of General Relativity with GWTC-3".
- Studied the paper "Comparison of post-Newtonian templates for compact binary inspiral signals in gravitational-wave detectors".
- Studied the paper "Testing the multipole structure and conservative dynamics of compact binaries using gravitational wave observations: The spinning case".
- Worked out the paper "Gravitational waves from inspiralling compact binaries: Energy loss and waveform to second–post-Newtonian order".

M. Praveen

- Program committee member of conference FSTTCS 2021.
- Member of the program committee in FSTTCS 2021 .
- Reviewed papers for FOSSACS 2022.
- Reviewed paper for ACM TOCL.
- Started industrial research project with Micron for formally verifying verilog code.

Rajeeva L. Karandikar

- Member of the CEIC committee of International Mathematics Union and have continued to have online meetings.
- Member of the Mathematical Sciences Jury for the Infosys Award in 2021.

Siddhi Sudhir Pathak

- Attended online seminars and conferences.
- Referee for journals.
- Reviewer for AMS MathSciNet.

B. Srivathsan

- Programme Committee of conference Reachability Problems 2021.
- a co-supervised PhD student R. Govind defended his dissertation.

Sharad S. Sane

- Referee work: European Journal of Combinatorics.
- Referee work: The Mathematical Consortium Bulletin.

Sudeshna Roy

- Referee for an article in the peer-reviewed journal: Indian Journal of Pure and Applied Mathematics.
- Teaching Assistant, AIC Commutative Algebra, online mode, India.

Tanya Kaushal

- Organised Math Guest seminar at CMI.
- Organized/ planned Mirror symmetry seminar.
- Reviewer for MathSciNet.

Venkatesh Vinayakarao

- Program Committee member for IC3 conference.

19 Visitors

- Madhusudhan Raman, TIFR. Gave a talk on "Virasoro Blocks and Modular Structures" (April 2021).
- Piotr Achinger, Institute of Mathematics of Polish Academy of Science, (IMPAN), Warsaw, Poland. Gave a talk on "Fundamental groups in non-archimedean geometry" (May 2021).
- Pieter Belmans, University of Bonn, Germany. Gave a talk on "Automorphisms and deformations of Hilbert schemes of points on surfaces" (June 2021).
- Safdar Quddus, IISc. Gave a talk on "Group Actions in Noncommutative Geometry" (June 2021).
- Kyoung-Seog Lee, University of Miami, USA. Gave a talk on "Derived categories and motives of moduli spaces of vector bundles on curves" (June 2021).
- Fabio Tonini, University of Florence. Gave a talk on "Cox rings and Algebraic Stacks" (June 2021).
- Malay Ghosh, University of Florida. Gave a talk on "Small Area Estimation: Its Evolution in Five Decades" (National Statistics Day Symposium at Chennai Mathematical Institute) (June 2021).
- Anurag Pandey, Saarland University, Germany. Gave a talk on "Heroes Zeros in computational complexity" (July 2021).
- Sutanu Gayen, NUS, Singapore. Gave a talk on "Efficient Causal Inference in High Dimensions" (August 2021).
- Yuri Santos Rego, Otto-von-Guericke Universität Magdeburg. Gave a talk on "Soluble matrix groups and twisted conjugacy classes" (August 2021).
- Omprokash Das, TIFR. Gave a talk on "Contraction theorem for Kahler manifolds" (September 2021).
- Binata Panda, IIT Dhanbad. Gave a talk on "Seeley DeWitt Coefficients and Logarithmic corrections to the entropy of black holes in N = 1 Einstein-Maxwell Supergravity" (September 2021).
- Abhishek Mathur, Raman Research Institute. Gave two talks on "Sorkin-Johnston formalism for QFT in curved spacetime" (October 2021).
- Pranjal Dutta, Chennai Mathematical Institute (& Visiting Scholar, IIT Kanpur). Gave a talk on "Demystifying the border of depth-3 algebraic circuits" (November 2021).

- Arun Padakandla, University of Tennessee, Knoxville, USA. Gave a talk on "PAC Learning on a Quantum Computer : A New ERM Algorithm and Sample Complexity Bounds" (December 2021).
- I Murugeshwari Oregon State University. Gave a talk on "The Choice Function Framework for Online Policy Improvement" (January 2022).
- Chaitanya Leena Subramaniam, University of San Diego. Gave a talk on "Higher category theory and homotopy type theory" (January 2022).
- Akash Kumar, EPFL, Switzerland. Gave a talk on "Spectral Methods in Modern Graph Algorithms" (February 2022).
- Lucius Greg Meredith, RChain. Gave a talk on "Reflection in concurrent computation and other formalisms" (February 2022).
- Olivier Pironneau, "Université Pierre et Marie Curie, Laboratoire Jacques-Louis Lions". Gave a talk on "Mathematics for Climatology" (March 2022).
- Enric Ventura, Universitat Politècnica de Catalunya, Spain. Gave a talk on "Twisted conjugacy and orbit decidability in groups" and "The technique of Stallings graphs" (March 2022).
- Arun Suggala, Research Scientist, Google India. Gave a talk on "Bandit Optimization beyond linear losses + Research opportunities at Google Research India" (March 2022).
- Jacques Sakarovitch, IRIF, CNRS - U. Paris & LTCI, Télécom Paris, IPP, France. Gave a talk on "Derived terms without derivation" (March 2022).
- Aditya Karnataki, BICMR, Peking University. Gave a talk on "Trianguline property of Galois representations at the boundary of the eigencurve" (March 2022).
- V. Vinay Kumaraswamy, Tata Institute of Fundamental Research, Mumbai. Gave a talk on "Quantitative Diophantine approximation for generic ternary diagonal forms" (March 2022).
- Sudipta Sirkar, IIT Gandhinagar. Gave a talk on "Towards Relativity: Einstein and His Compass" (March 2022).
- Rekha Biswal, University of Edinburgh. Gave a talk on "Macdonald polynomials and level two Demazure modules for affine $sl_{n+1}4$" (March 2022).
- Srinivas Bhogle, Honorary Scientist, CSIR-4PI. Gave series of lectures on "The Statistical Innings" (March 2022).
- Karthikeyan Bhargavan, INRIA, France (January-March 2022).
- Pascal Weil, Universite Bordeaux, France (April 2021-March 2022).