Chennai Mathematical Institute

Annual Report

April 2020–March 2021

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 the country. The focus areas of research in mathematics include algebraic geometry, commutative algebra, number theory, operator algebras, representation theory, topology and some aspects of probability theory and statistics. In computer science, the focus areas are automata theory, concurrent systems, verification, algorithms, computational complexity and machine learning. The areas pursued in physics are theoretical and mathematical physics, gravitational astronomy and string theory. Many CMI researchers are acknowledged internationally as experts in their subject areas. Several faculty members are members of national and international academic societies and policy-making bodies.

2021 marks two decades since the first batch of undergraduates obtained their degrees from CMI. 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 industry-oriented focus, targetting employment opportunities in the fast growing areas of analytics and machine learning.

CMI has made significant contributions to India's scientific manpower. CMI graduates are now faculty members at institutions such as IISc, ISI, IITs, IISERs, IIMs, TIFR, IMSc and CMI, as well as 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.

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.

An exciting new development during 2020–2021 has been the establishment of a Centre of Excellence named after Dr. F.C. Kohli, the pioneer of the Indian IT industry. The Centre has received a generous seed endowment and will focus on attracting visiting scientists to participate in academic activities that will benefit both the faculty and students at CMI as well as the Indian academic community at large.

The past year has been challenging across the globe thanks to the shutting down of all in-person activities due the Covid pandemic, and CMI is no exception. During the year, the Institute has successfully managed the transition to online teaching. Though admissions for the academic year were delayed, there was no reduction in the number or quality of students admitted. CMI has also continued to conduct research seminars as well as conferences and workshops online. Like everyone else, CMI hopes to resume more normal activities during 2021–2022. However, the enforced shift to technology-assisted teaching and learning has equipped the faculty with new skills that can be exploited to enhance the reach and scope of CMI's activities in the years to come.

For CMI, 2020–2021 also unfortunately marked the end of an era, with the passing of Prof. C.S. Seshadri, the Founder-Director of CMI in July, 2020. Prof. Seshadri was instrumental in moulding the vision of the Institute and setting it on its present course. He remained involved in all aspects of CMI's activities till the end. His guidance and support will be greatly missed. The best homage that CMI can pay to Prof. Seshadri is to remain committed to his vision of establishing CMI as the chosen destination for anyone who has a passion for the mathematical sciences.

Rajeeva L. Karandikar
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12. T.R. Ramadas
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    Professor, Indian Institute of Technology Bombay, Mumbai

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Computer Science

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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)
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Undergraduate Studies

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

6 Institute Members

Director

Rajeeva L. Karandikar

Deputy Director and Dean of Studies

Madhavan Mukund

Director-Emeritus

C.S. Seshadri (until July 2020)

Professors

K.G. Arun
V. Balaji
Clare D'Cruz
Govind S. Krishnaswami
Samir Datta
K. Narayan
K. Narayan Kumar
Purusottam Rath
T.R. Ramadas
P. Sankaran
Pramathanath Sastry
S. Senthamarai Kannan
V.V. Sreedhar
K.V. Subrahmanyam

Associate Professors

Aiswarya Cyriac
Sourish Das
Krishna Hanumanthu
Upendra Kulkarni
Manoj Kummini
Alok Laddha
Sukhendu Mehrotra
Partha Mukhopadhyay
Prajakta Nimbhorkar
Geevarghese Philip
M. Praveen
R. Srinivasan
B. Srivathsan
M. Sundari
S.P. Suresh
Amitabh Virmani

Assistant Professors

Priyavrat C Deshpande

8

Visiting Faculty

Anup Dixit
Keshab Chandra Bakshi
Kamalakshya Mahatab
Parangama Sarkar
S. Selvaraja
Issan Patri
Kavita Sutar
V. Swaminathan
Venkatesh Vinayakarao

Post-doctoral Fellows

Chaitanya Ambi
Suratno Basu (until January 2021)
Sajat Ahmad Bhat
Ritabrata Bhattacharya
Suprajo Das
Abhijeet Ghanwat
Pratik Ghosal
Suchita Goyal
Rupam Karmakar
Tanya Kaushal
Arvind Kumar
Sushma Kumari
Nirupama Mallick
Sayanta Mandal
Oorna Mitra
Mandira Mondal
Arpita Nayak
Partha Paul
Mallika Roy
Sudeshna Roy
Muhammed Saleem (until August 2020)
Himalaya Senapati (until January 2021)
Anurag Singh
Shivdutt Sharma
Amith Shastri K
Jyothsnaa Sivaraman
Priyamvad Srivastav (until December 2020)
Sruthymurali
Anuj Tawari (until December 2020)
Shibi Vasudevan

9

Adjunct Professors

Manindra Agrawal
Shibasish Dasgupta
Ghanshyam Date
T. R. Govindarajan (until May 2020)
Ramesh Hariharan
R. Jagannathan
S. Kesavan
V. Lakshmibai
Ashok Kumar Kapoor
Usha Mahadevan
H. S. Mani
Neeraj Kayal
Raghav Kulkarni
Usha Mahadevan
R. Parthasarathy (until April 2020)
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
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Adwitee Roy
Aneesh P B
Ankit Yadav
Archit Chauhan
Arkadev Ghosh
Asif Khan
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A Manu
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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.

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.

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.

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.

8 Achievements

- FC Kohli Centre of Excellence for advanced research in Mathematics and Computing Science is to be set up at CMI.

- V Balaji elected Fellow of National Academy of Sciences, India in 2021.

9   Research Activities

Computer Science

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

In algorithms the work done includes: algorithms for finding disjoint stable matchings, bounding the number of solutions of a stable matching instance, the classical parameterized complexity of finding diverse stable matchings, the parameterized complexity of finding diverse collections of stable matchings, popular matchings in hospital-residents problem with lower quotas, finding disjoint stable matchings in the stable roommates problem, restricted b-matching problem (both weighted and unweighted), upper and lower bounds for finding Morse matchings, fair vertex cover, parallel algorithms for planar disjoint paths, approximate algorithm for minBP problem, efficient parallel algorithms to find a separator in planar directed graphs and improve the current algorithm for parallel DFS in planar directed graphs, developing approaches to place DFS in undirected general graphs in NC, parallel (univariate) polynomial permanent modulo powers of 2 with applications to disjoint paths and cycles, the parameterized complexity of finding diverse sets of solutions for various questions about matroids and the complexity of even path problem in graph classes like bounded genus and single crossing minor free and other H-minor free graphs. Other work includes settling the dynamic complexity of reachability and finding applications of dynamic complexity in other areas of computer science, the static and dynamic complexity of distance and matching in single crossing minor free graphs, the dynamic complexity of distance in general directed graphs, dynamic reachability witness in directed graphs, dynamic algorithms for single source shortest paths, dynamic planarity testing and embedding under bulk changes in DynFO and the dynamic depth first search problem.

In formal verification work was done on algorithmic verification of programs executing over modern memory architectures, program analysis for message passing programs, disjunctive invariants synthesis, on distributed representations for source code, on predicting complexity of source code, communication-safe realizability for message-passing specifications, random testing of distributed protocols with coverage assurance, K-safety verification with application to program equivalence checking, and synthesizing disjunctive invariants using max-strategy iteration. Work was also done on algebraic automata theory, pure and applied fixed-point logics, expressive equivalence of least and inflationary fixed-point logics, on regular separability of one-counter automata, on the complexity of the word problem for multi-tape weighted automata, window expressions for stream data processing, underapproximate decidability of MSO/FO over nested words and separability of restricted string constraints.

Work on timed systems includes improvements in reachability checking in timed automata in the presence of updates and diagonal constraints, timed negotiations, partial-order reduc-

tions for timed automata, simulation relations for the local-semantics of networks of timed automata, developing a unified framework for constraint based simulations for timed automata and the notion of trace-closure for timed distributed systems.

Work on the theory of database systems includes definability and descriptive complexity on databases of bounded treewidth, querying graph databases using fragments of rational relations, temporal logics for database driven systems, understanding the role of LTL-FO in data-driven web applications, recency-bounded database-driven systems, designing query language for stream data processing based on regular expressions, and on the treewidth and pathwidth on databases-driven systems.

Work was also done on designing a framework to formalize bet hedging and improving the complexity bounds for imperfect recall games. In computer security work was done on new decidability results for security protocols with unbounded nonces and exploring theorem proving tools for cryptographic protocol verification.

Work on geometric complexity theory includes design and implementation of algorithms to find min max elements in the poset defined on standard monomials, exploring sum of small powers of univariates and connection to derandomization/lower bounds, torus quotients of Schubert varieties in the Grassmannian of 3 dimensional subspace, understanding leading terms which occur in the projective orbit closures of stable points, generators and relations for invariants of the action of diagonal matrices on the grassmannian of r dimensional subspaces of an n dimensional space, triple commuting action on wedge modules, projective normality of schubert variety, the poset of young tableau restricted to torus invariants and understanding the closure of the orbit of a stable point in the associated projective space.

In algebraic complexity theory work includes polynomial identity testing for special depth 4 circuits, exploring approximative complexity of restricted depth-3 circuits, connecting lower bounds on sum-of-squares to algebraic complexity, proving lower bounds against monotone arithmetic circuits, on lower bound and PIT for restricted classes in border complexity, a LogDCFL bound for one-input-face monotone bounded genus circuit value problem and studying monotone arithmetic circuits and improving state of the art lower bounds.

In machine learning work was done on local interpretation for blackbox ML models, ML techniques for analyzing source code, active learning algorithms for discrete timed automata, query learning for real-time systems, improving online judges for competitive programming contests, learning embeddings of source code to estimate complexity, trying to implement CNN's by working in the Fourier domain instead of pixel domain, developing a active learning algorithm for an industry formalism called Expressive Decision Tables, SMT for deep learning, GANs and interpretability.

Mathematics

In Mathematics research was carried out on several areas including logic, number theory, algebraic geometry, representation theory, algebraic groups, analysis, probability theory and

statistics, topological combinatorics and fluid mechanics. The details are as follows.

In logic work was done on forcing and axiom of constructibility. In number theory work was done on arithmetic of Fourier coefficients of Hecke eigenforms vis-a-vis the Lehmer and Maeda conjectures, linear independence of special values Hecke L-functions, Euclidean ideal classes in cubic number fields, products of prime ideals in a given class of a ray class group and Koblitz's conjecture on elliptic curves, extending work with Patrice Philippon on traces of algebraic numbers, relative norms of Ramachandra units, on L-functions associated to the Selberg class, application of height theory to modular forms and establishing a result on circular integer sequence generalised to arbitrary integer sequences over groups.

In algebraic geometry and commutative algebra work was done on invariant ring under action of finite p-groups in positive characteristic, ramification, syzygies of Hibi rings, working towards a necessary and sufficient condition for the $\beta_{24} = 0$, and the classification of Hibi rings those satisfy property N_p for $p = 2, 3$, Noetherian-ness of symbolic blow-up algebras and Hilbert functions, Hilbert-Kunz density function, Castelnuovo-Mumford regularity, set theoretic complete intersections, growth of Hilbert function and, multiplicity with respect to powers of ideals, resurgence, associated primes of local cohomology modules, cohomology of normalized blow up, associated primes of local cohomology modules, and test ideal over a commutative ring of prime characteristic and β-density function on class group of projective toric varieties.

In algebraic geometry and representation theory work was done on GIT quotient of Schubert varieties in the Grassmannian modulo maximal torus, GIT quotients of the Schubert varieties in the Grassmannian $G_{2,n}$, proving that the GIT quotient of the minimal dimensional Schubert variety admitting stable point in $G_{2,n}$ is a projective space, studying the automorphism groups of Schubert varieties in non simply laced case, torus quotients of Schubert varieties in Grassmannian, on automorphism groups of Schubert varieties in partial flag varieties and Gelfand-Tsetlin bases for permutation representations.

Other work in algebraic geometry includes linear systems on rational surfaces, multiplicity theory and valuations, local Okounkov body, Seshadri constants and positivity of linear systems on algebraic surfaces, Seshadri constants on products of projective spaces, Fano varieties, Quot schemes, Bott towers, Seshadri constants for vector bundles, positivity of vector bundles on toric varieties and homogeneous varieties and Seshadri constants in positive characteristic.

In algebraic geometry related to moduli theory work was done on rational curves on Seshadri's compactification of the moduli of bundles of rank 2 and even degree on a curve, components of the moduli of (maps of) rational curves to the Seshadri compactification, using parahoric torsors to construct new classes of representations of Fuchsian groups, lifting moduli spaces to fields of positive characteristics and their singularities, theory of unexpected curves and hypersurfaces, toroidal compactifications of groups and Bruhat-Tits group schemes, compactification of moduli stacks of bundles, construction of universal Bruhat-Tits group schemes on "wonderful" compactifications, parahoric torsors on the punctured projective line, modular sheaves on holomorphic symplectic varieties and Schoen's problem on

whether the general K3 surface is dominated by a product of curves. counting twisted Fourier-Mukai partners of a K3 surface and proving a criterion for checking when a Fourier-Mukai transform between two smooth proper DM stacks is fully faithful.

On algebraic groups work was done on twisted conjugacy in classical groups over polynomial and Laurent polynomial algebras over finite fields, twisted conjugacy in general linear group over rational functional fields in several variables over finite fields, uniform non-arithmetic lattices, geometric cycles and intersection product.

In functional analysis work was done on a suitable pictorial language for commuting square of certain finite factors, E_0-semigroups, semigroups of isometries, Gaussian states and quantum gaussian states. In harmonic analysis work was done on the analogue of the Cowling-Price theorem for wavelet transform. In Riemannian geometry work was done on filling volumes of manifolds.

In probability and statistics work was done on sufficiency and consistency in statistics, dependence of stochastic integral on filtration, large deviations for markov chains, looking at applications of Markov chains/processes in data science and computer science, analysis of death rates and its association with various parameters - demographic, hygiene, economic variables etc., Bayesian causal network and generative models.

In topological combinatorics work was done on the homotopy type of bounded degree complexes of complete graphs and complete bipartite graphs, higher independence complexes of several classes of graphs; in particular their Cohen-Macaulay properties were studied, matching complex of rectangular grid graphs, star chromatic index of graphs, properties of tournament graphs and the study of Hom complexes for directed graphs, collapsibility number of non k-matching complexes of graphs. homotopy type of cliques complexes of line graphs.

Work was also done on arrangements, polygon spaces: on questions related to a paper of Deligne-Mostow, line arrangements. Borsuk-Ulam theorem for planar polygonal spaces, topological complexity of planar polygon spaces, building polygon spaces using projective surgery, counting regions of the boxed threshold arrangement, deformations of threshold arrangements and a statistic for labeled threshold graphs.

In machine learning work was done on handwriting recognition and image classification using persistent homology techniques, and deep learning models on audio data, applications of deep learning models on NLP, computer vision, face recognition algorithms.

In mathematical fluid mechanics work was done on the motion of a rigid body in compressible fluid with Navier slip conditions, Jost solutions to 2D Euler equations and stability properties of fluid models with moisture.

Physics

In the area of Classical General Relativity, the research was focussed on

- gravitational wave data analysis: finding methods to directly detect the signatures of the recoil in the gravitational waveform and its feasibility; how well can one measure the recoil directly in the 3G era; analysing LIGO-Virgo data from 3rd observing run for testing the blackhole nature of the astrophysical compact objects; studying the systematics in gravitational wave parameter estimation due to blackhole mimickers; intermediate mass black holes in the LISA band; measurement accuracy of compact objects in eccentric orbit in ground and space based detectors; exploring the science case of the proposed LIGO-India project.

- detectability of binary neutron star in the LISA band; effect of eccentricity of a binary neutron star on the parameter estimation problem; distinguishing the formation channel of double neutron stars using eccentricity of the system.

- multiband tests of general relativity: Using gravitational waves and space-based and ground-based third generation detectors, Hubble-Lemaitre constant measurement using dark sirens, gravitational radiation fluxes across cosmological horizon; detection of exoplanets around double white dwarfs; finding methods to directly detect the signatures of gravitational recoil from the ringdown waveform; working on the method of testing BBH nature of detected events in LIGO; searching for new techniques to put constraints on neutron star equation of state by combining LIGO and NICER observations; gravitational and electromagnetic radiation fluxes across cosmological horizon; Parametrised tests of general relativity using multiband gravitational wave observations; applying singular value decomposition in testing general relativity using gravitational waves; probing extra-dimensions using gravitational wave source count distribution; prospects of detecting gravitational recoil using future gravitational wave experiments; finding limits on the escape velocities of star clusters that catalyse hierarchical growth of black holes; direct estimation of kick velocity of binary black holes using LIGO data; astrophysical implications of kick velocity measurements.

In the area of Quantum Field Theory and String Theory, the research was focussed on

- the quantum Rajeev-Ranken model and its connection to an anharmonic oscillator; on the classical and quantum three rotor problems; on perturbations of a vortex sheet; on problems in nonlinear dynamics.

- spectral statistics in the quantum three-rotor problem and working on a problem related to the infra-red divergence of the quantum scattering matrix.

- spin-dependence on scattering from soft graviton theorem: finding asymptotic symmetries using timelike infinity; proving classical soft theorems for spinning particles;

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study the behavior of supertranslation vectors near time-like infinity; on soft classical radiation from probe Maxwell field in R-N black hole; proving classical soft theorems from scattering amplitudes.

- exploring PP wave geometries in abelian and non-Abelian T-dual supergravity background, and timelike infinity, twisted twinning hair removal and black hole bound state metamorphosis for CHL models.

- constructing black hole hair using; generalised Garfinkle-Vachaspasi transform technique.

- 2-dim dilaton gravity and holography; cosmological singularities and entanglement and quantum extremal surfaces; extending black hole hair removal proposal for T4 models; braneworld black holes; gravitational and electromagnetic radiation fluxes across cosmological horizon and generalization; the behaviour of extremal surfaces in spacetimes with cosmological singularities; near-extremal BTZ dynamics; exploring pp-wave geometry in Abelian and non-Abelian T-dual supergravity backgrounds; exploring poisson-lie T-duality for string background; properties of the operator product expansion of celestial CFT.

- cosmological singularities via compactifications to 2-dimensional dilaton gravity; de Sitter space and entanglement; horizon hair from an inversion symmetry; black hole hair removal for type IIB theory on T4, timelike infinity,

In the area of Quantum Entanglement, the research was focussed on

- finding the statistics-parameter dependence of the von Neumann entropy in a class of one-dimensional anyon models; finding distribution function for anyons, and hence measures to quantify entanglement.

Research was also carried out in some miscellaneous area viz. developing onine teaching resources for a course to be taught to the new batch of students; working on Proofs project of online Physics sources, on a book on Classical Mechanics, on automation of evaluation of examination papers for large classes and on stochastic quantization.

10 Publications

Journal Articles

Computer Science

J1 V. Arvind, Abhranil Chatterjee, Rajit Datta, and Partha Mukhopadhyay: *On Explicit Branching Programs for the Rectangular Determinant and Permanent Polynomials*, Chic. J. Theor. Comput. Sci. 2020.

J2 David Fernández-Duque, H.P. van Ditmarsch, Vaishnavi Sundararajan and S.P. Suresh: *Who holds the best card? Secure communication of optimal secret bits*, to appear in The Australasian Journal of Combinatorics.

Maths

J3 D L Gonçalves, P Sankaran and P Wong: *Twisted conjugacy in free products*, Communications in Algebra. `DOI:10.1080/00927872.2020.1751848.`

J4 D L Gonçalves, P Sankaran and P Wong: *Twisted conjugacy in fundamental groups of geometric three-manifolds*, to appear in Topology and its Applications.

J5 Tushar Parulekar and Sharad Sane: *Some results on the Ryser Design conjecture-III*, Journal of Algebraic Combinatorics, Special issue in honor of K.T.Arasu `DOI:10.1007/s10801-020-00952-5`

J6 Anurag Singh: *Bounded degree complexes of forests*, Discrete Mathematics, Vol 343, Issue 10.

J7 S.Senthamarai Kannan and Pinakinath Saha: *Rigidity of Bott-Samelson-Demazure-Hansen variety in type F_4 and G_2*, Proceedings of the Indian Academy Sciences, 130 (2020)

J8 Clare D'Cruz and Mousumi Mandal: *Symbolic blowup algebras and invariants associated to certain monomial curves in P3* , Communications in Algebra, Volume 48, 2020 - Issue 9.

J9 Sharad Sane: *Reminiscences of a heritage: Professor Sharadchandra Shankar Shrikhande,*, The Mathematical Consortium Bulletin (July 2020).

J10 Rajiv Sambasivan, Sourish Das and Sujit Sahu: *A Bayesian perspective of statistical machine learning for big data*, Computational Statistics, Volume 35, 2020.

J11 Anbu Arjunan, R. Srinivasan and S. Sundar: *E-semigroups over closed convex cones* , J. Operator Theory, Volume 84, Issue 2, 2020.

J12 Krishna Hanumanthu and Nabanita Ray: *Weyl and Zariski chambers on projective surfaces*, Forum Mathematicum 32 (2020), No. 4, 1027–1037.

J13 Lucja Farnik, Krishna Hanumanthu, Jack Huizenga, David Schmitz and Tomasz Szemberg: *Rationality of Seshadri constants on general blow ups of P^2*, Journal of Pure and Applied Algebra 224 (2020), no. 8, 106345.

J14 Anirban Chakraborti , Kiran Sharma , Hirdesh K Pharasi , K Shuvo Bakar , Sourish Das and Thomas H Seligman: *Emerging spectra characterization of catastrophic instabilities in complex systems*, New Journal of Physics, Vol 22.
https://iopscience.iop.org/article/10.1088/1367-2630/ab90d4/pdf

J15 Sourish Das and Rituparna Sen: *Sparse Portfolio selection via Bayesian Multiple testing*, Sankhya-B. DOI:10.1007/s13571-020-00240-zxa

J16 Sharad Sane: *Doing Combinatorics with passion: Life of Professor Sharadchandra Shankar Shrikhande*, Indian Journal of Discrete Mathematics, Volume 5/2, December 2019, pages: 111-118.

J17 Abhay G. Bhatt, Sourish Das and Rajeeva L Karandikar: *Normalization of marks in multi-session examinations* , Current Science, 118, 2020.

J18 Indranil Biswas, Krishna Hanumanthu and D. S. Nagaraj: *Positivity of vector bundles on homogeneous varieties*, International Journal of Mathematics, 31 (2020), no. 12, 2050097, 11 pp.

J19 Priyavrat Deshpande and Anurag Singh: *Higher Independence Complexes of graphs and their homotopy types*, Journal of the Ramanujan Mathematical Society, 36, No.1 (2021) 53-71.

J20 Shuchita Goyal and Rekha Santhanam: *(Lack of) Model Structures on the Category of Graphs* , Applied Categorical Structures, DOI:10.1007/s10485-021-09630-4

J21 M. Brion and S. Senthamarai Kannan: *Minimal rational curves on generalized Bott–Samelson varieties.* , Compos. Math. 157 (2021), no.1, 122-153.

J22 Sharad Sane: *S.S.Shrikhande: The Euler spoiler*, Resonance, Volume 26/2, pages 167-176.

J23 Tanya Kaushal Srivastava : *Pathologies of the Hilbert scheme of points of a supersingular Enriques surface*, Bulletin des Sciences Mathématiques Volume 167, March 2021, 102957.

J24 Tanya Kaushal Srivastava: *Lifting automorphisms on Abelian varieties as derived autoequivalences*, Arch. Math. (2021). DOI:10.1007/s00013-020-01564-y

J25 Krishna Hanumanthu and Aditya Subramaniam: *Bounded negativity and Harbourne constants on ruled surfaces,*, Manuscripta Mathematica, 164(3), 431-454.

J26 Rajeeva L Karandikar: *Mathematics and Elections*, Proc Indian Natn Sci Acad 86 No. 4 December 2020 pp. 1461-1479.

J27 Sanoli Gun and Jyothsnaa Sivaraman: *On existence of Euclidean ideal classes in real cubic and quadratic fields with cyclic class groups.*, Michigan Math J., vol 69(2).

J28 A.V. Jayanthan and S Selvaraja: *Upper bounds for the regularity of powers of edge ideals of graphs*, Journal Of Algebra, 574 (2021), 184–205.

J29 Clare D'Cruz: *Resurgence and Castelnuovo-Mumford Regularity of Certain Monomial Curves in A3*, Acta Vietnamita, `DOI:10.1007/s40306-020-00383-1`

J30 Avijit Nath and Parameswaran Sankaran : *A note on equivariant cobordism of generalized Dold manifolds*, Topology and its Applications, Volume 293.

J31 Patrice Philippon and Purusottam Rath: *A note on trace of powers of algebraic numbers*, to appear in Journal of Number Theory.

J32 Vikraman Balaji: *Torsors on semistable curves and degenerations*, to appear in Proceedings of the Indian Academy of Sciences.

J33 Bithika Chatterjee, Shekhar Mande and Rajeeva L Karandikar: *The mortality due to COVID-19 in different nations is associated with the demographic character of nations and the prevalence of autoimmunity*, to appear in Current Science.

J34 Krishna Hanumanthu and Brian Harbourne: *Real and complex supersolvable line arrangements in the projective plane*, to appear in Journal of Algebraic Combinatorics.

J35 Sarka Necasova, Mythily Ramaswamy, Anja Schlomerkemper and Arnab Roy.: *Self propelled motion of a body in a density dependent fluid*, to appear in Mathematical Modelling of Natural Phenomena.

J36 Suprajo Das: *An inequality in mixed multiplicities*, to appear in J ournal of Commutative algebra.

J37 Suprajo Das: *Epsilon multiplicity for graded algebras*, to appear in Journal of Pure and Applied Algebra.

J38 Shuchita Goyal, Samir Shukla and Anurag Singh: *Homotopy Type of Independence Complexes of Certain Families of Graphs*, to appear in Contribution to Discrete Mathematics.

J39 Priyavrat Deshpande, Krishna Menon and Anurag Singh: *Counting regions of the boxed threshold arrangement*, to appear in Journal of Integer Sequences.

J40 S.Senthamarai Kannan, Arpita Nayek and Pinakinath Saha: *Torus quotients of Schubert varieties in the Grassmannian $G_{2,n}$*, to appear in Indian Journal of Pure and Applied Mathematics.

J41 Sharad Sane: *Product of circularly arranged numbers with the least number of questions asked*, to appear in The Bulletin of the Australian Mathematics Society.

J42 Jyothsnaa Sivaraman: *Primitive roots for Pjateckii Sapiro primes*, to appear in J. Th. Nombres Bordeaux.

J43 Shibi Vasudevan: *Instability of unidirectional flows for the 2D Navier-Stokes equations and related alpha models*, to appear in Journal of Mathematical Fluid Mechanics,

Physics

J44 G S Krishnaswami and H Senapati: *Ergodicity, mixing and recurrence in the three rotor problem*, Chaos 30(4), 043112 (2020).

J45 Shilpa Kastha, M Saleem and K G Arun: *Imprints of the redshift evolution of double neutron star merger rate on the signal-to-noise ratio distribution*, Monthly Notices of the Royal Astronomical Society, Volume 496, Issue 1, July 2020, Pages 523–531.

J46 K. Narayan: *On de Sitter future-past extremal surfaces and the "entanglement wedge"*, Phys.Rev.D 101 (2020) 8, 086014, `arXiv:2002.11950` [hep-th]

J47 A. Gupta, S. Datta, S. Kastha, S. Borhanian, K. G. Arun, B. S. Sathayprakash: *Multiparameter Tests of General Relativity Using Multiband Gravitational-Wave Observations*, Phys. Rev. Lett. 125, 201101.

J48 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*, Phys. Rev. D, Volume: 103, Page: 024036, Year: 2021.

J49 A. Gupta, D. Gerosa, K. G. Arun, E. Berti, and B.S. Sathyaprakash: *Black holes in the low mass gap: Implications for gravitational wave observations*, Phys. Rev. D 101, 103036 (2020).

J50 LIGO and Virgo collaboration including K G Arun: *GW190814: Gravitational Waves from the Coalescence of a 23 Mo Black Hole with a 2.6 Mo Compact Object*, Astrophysical Journal Letters, 896, L44 (2020).

J51 P. B. Aneesh, Sumanta Chakraborty, Sk Jahanur Hoque and Amitabh Virmani: *First law of black hole mechanics with fermions*, Classical Quantum Gravity, Volume 37, Number 20.

J52 Karan Fernandes, Kedar S. Kolekar, K. Narayan and Sourav Roy,: *Schwarzschild de Sitter and extremal surfaces*, Eur.Phys.J. C 80, 866 (2020), `arXiv:1910.11788` [hep-th].

J53 A. Manu, K. Narayan and Partha Paul: *Cosmological singularities, entanglement and quantum extremal surfaces*, `arXiv:2012.07351` [hep-th], to appear in J.High Energy Phys.

J54 Ritabrata Bhattacharya, K. Narayan and Partha Paul: *Cosmological singularities and 2-dimensional dilaton gravity*, J.High Energy Phys, 2008:062, 2020, `arXiv:2006.09470` [hep-th].

J55 S. Borhanian, A. Dhani, A. Gupta, K. G. Arun and B.S. Sathyaprakash: *Dark Sirens to Resolve the Hubble–Lemaître Tension*, Astro. Phys. J. Lett 905 L28.

J56 Govind S Krishnaswami and T R Vishnu: *The idea of a Lax pair - Part I: Conserved quantities for a dynamical system*, Resonance 25(12), 1705-1720 (2020).

J57 Govind S Krishnaswami and T R Vishnu: *The idea of a Lax pair - Part II: Continuum wave equations*, Resonance 26(2), 257-274 (2021).

J58 Karan Fernandes, Debodirna Ghosh and Amitabh Virmani: *Horizon Hair from Inversion Symmetry*, to appear in Classical and Quantum Gravity.

J59 Subhroneel Chakrabarti, Suresh Govindarajan, P Shanmugapriya, Yogesh K Srivastava and Amitabh Virmani.: *Black hole hair removal in N = 4 CHL Models*, Journal of High Energy Physics - JHEP02(2021)125.

J60 Soumen Roy, Anand Sengupta and K. G. Arun: *Unveiling the spectrum of inspiralling binary black holes*, Phys. Rev. D 103, 064012.

J61 Amitabh Virmani: *No Shadow of a Doubt (book review)*, to appear in Resonance: Journal of Science Education.

J62 LIGO and Virgo collaboration including K. G. Arun: *GW190521: A Binary Black Hole Merger with a Total Mass of 150 Msun*, Phys. Rev. Lett. 125, 101102 (2020) (to appear).

J63 LIGO and Virgo collaboration including K. G. Arun: *Properties and astrophysical implications of the 150 Msun binary black hole merger GW190521*, Astrophys. J. Lett. 900, L13 (2020) (to appear).

J64 LIGO and Virgo collaboration including K. G. Arun: *GW190412: Observation of a binary-black-hole coalescence with asymmetric masses*, Physical Review D 102, 043015 (2020) (to appear).

Proceedings Articles

Computer Science

C65 Hugo Gimbert, Soumyajit Paul and B Srivathsan: *A bridge between polynomial optimization and games with imperfect recall*, 19th International Conference on Autonomous Agents and Multi-Agent Systems 2020, pages 456 - 464.

C66 Samir Datta, Chetan Gupta, Rahul Jain, Vimal Raj Sharma and Raghunath Tewari: *Randomized and Symmetric Catalytic Computation*, Springer Lecture Notes in Computer Science, CSR 2020, volume 12159, pages 211–223.

C67 Geevarghese Philip, Rani M. R. and Subashini R.: *On Computing the Hamiltonian Index of Graphs*, Computer Science – Theory and Applications. CSR 2020. Lecture Notes in Computer Science, vol 12159. Springer.

C68 Lars Jaffke, Paloma T. Lim and Geevarghese Philip: *Structural Parameterizations of Clique Coloring*, 45th International Symposium on Mathematical Foundations of Computer Science (MFCS 2020). Pages 49:1–49:15. `DOI:10.4230/LIPIcs.MFCS.2020.49`.

C69 Daniel Lokshtanov, Pranabendu Misra, Fahad Panolan, Geevarghese Philip and Saket Saurabh: *A (2 + ε)-Factor Approximation Algorithm for Split Vertex Deletion*, 47th International Colloquium on Automata, Languages, and Programming (ICALP 2020). Pages 80:1–80:16. `DOI:10.4230/LIPIcs.ICALP.2020.80`

C70 Julien Baste, Michael R. Fellows, Lars Jaffke, Tomáš Masařík, Mateus de Oliveira Oliveira, Geevarghese Philip and Frances A. Rosamond: *Diversity of Solutions: An Exploration Through the Lens of Fixed-Parameter Tractability Theory*, Proceedings of the Twenty-Ninth International Joint Conference on Artificial Intelligence. Main track. Pages 1119-1125. `DOI:10.24963/ijcai.2020/`

C71 Prem Krishnaa, Girija Limaye, Meghana Nasre and Prajakta Nimbhorkar: *Envy-freeness and Relaxed Stability: Hardness and Approximation Algorithms* , 13th International Symposium (SAGT 2020), Lecture Notes in Computer Science, 12283, Springer, pp 193-208.

C72 Samir Datta, Pankaj Kumar, Anish Mukherjee, Anuj Tawari, Nils Vortmeier and Thomas Zeume: *Dynamic Complexity of Reachability: How Many Changes Can We Handle?*, ICALP 2020, series LIPIcs, Vol 168, pages 122:1–122:19, Schloss Dagstuhl - Leibniz-Zentrum für Informatik.

C73 V. Arvind, Abhranil Chatterjee, Rajit Datta and Partha Mukhopadhyay: *A Special Case of Rational Identity Testing and the Brešar-Klep Theorem*, MFCS 2020, LIPIcs, volume 170, pages 10:1–10:14, Schloss Dagstuhl - Leibniz-Zentrum für Informatik.

C74 C. Aiswarya: *On Network Topologies and the Decidability of Reachability Problem (invited paper)*, NETYS 2020, Lecture Notes in Computer Science, Vol 12129, Pages 3-10, Springer, 2020. `DOI:10.1007/978-3-030-67087-0_1`.

C75 Fedor V. Fomin, Petr A. Golovach, Lars Jaffke, Geevarghese Philip and Danil Sagunov: *Diverse Pairs of Matchings*, 31st International Symposium on Algorithms and Computation (ISAAC 2020). Pages 26:1–26:12. `DOI:10.4230/LIPIcs.ISAAC.2020.26`

C76 Fedor V. Fomin, Petr A. Golovach, Fahad Panolan, Geevarghese Philip and Saket Saurabh: *Diverse Collections in Matroids and Graphs*, Proceedings of the 38th International Symposium on Theoretical Aspects of Computer Science, STACS 2021, LIPIcs, Volume 187, Schloss Dagstuhl - Leibniz-Zentrum fuer Informatik.

C77 M. Praveen: *What you must remember when transforming data words*, 40th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2020), Leibniz International Proceedings in Informatics (LIPICS) vol.182.

C78 Paul Gastin, Sayan Mukherjee and B Srivathsan: *Reachability for updatable timed automata made faster and more effective*, Foundations of Software Technology and Theoretical Computer Science (FSTTCS), LIPIcs, Vol 182, pp 47:1 – 47:17, Schloss Dagstuhl - Leibniz-Zentrum für Informatik.

C79 Parosh Aziz Abdulla, Mohamed Faouzi Atig, Ahmed Bouajjani, K. Narayan Kumar and Prakash Saivasan: *Deciding reachability under persistent x86-TSO*, Proceedings of the ACM on Programming Languages (POPL 2021), ACM Press, Pages 1–32.

C80 Snigdha Athaiya, Raghavan Komondoor and K. Narayan Kumar: *Data Flow Analysis of Asynchronous Systems using Infinite Abstract Domains*, Proceedings of the 30th European Symposium in Programming, ESOP 2021, Springer LNCS .

C81 C. Aiswarya and Paul Gastin: *Weighted Tiling Systems for Graphs: Evaluation Complexity.*, FSTTCS 2020, LIPIcs, vol 182, pages 34:1–34:17, Schloss Dagstuhl–Leibniz-Zentrum für Informatik, 2020. `DOI:0.4230/LIPIcs.FSTTCS.2020.34`

C82 Pranjal Dutta, Nitin Saxena and Thomas Thierauf: *A Largish Sum-of-Squares Implies Circuit Hardness and Derandomization*, 12th Innovations in Theoretical Computer Science (ITCS 2021), LIPICS Vol. 185, pp. 23:1–23:21.

C83 Sheikh Shakil Akhtar, Sandip Das and Harmender Gahlawat: *Cops and Robber on Butterflies and Solid Grids*, Algorithms and Discrete Applied Mathematics, CALDAM 2021. Lecture Notes in Computer Science 12601, Springer.

C84 Aadityan Ganesh, Prajakta Nimbhorkar, Geevarghese and Vishwa Prakash HV: *Disjoint stable matchings in linear time*, to appear in International Workshop on Graph-Theoretic Concepts in Computer Science (WG 2021).

C85 Govind S. Sankar, Anand Louis, Meghana Nasre and Prajakta Nimbhorkar *Matchings with group fairness constraints: Online and offline algorithms*, to appear in 30th International Joint Conference on Artificial Intelligence (IJCAI 2021).

C86 Pranjal Dutta: *Real tau-Conjecture for sum-of-squares: A unified approach to lower bound and derandomization*, to appear in The 16th International Computer Science Symposium in Russia (CSR 2021).

C87 Arkadev Chattopadhyay, Rajit Datta and Partha Mukhopadhyay: *Lower Bounds for Monotone Arithmetic Circuits Via Communication Complexity*, to appear in STOC 2021.

C88 Samir Datta, Anuj Tawari and Yadu Vasudev: *Dynamic Complexity of Expansion*, to appear in CSR 2021.

Collection Articles

Maths

C89 Sabine El Khoury, Manoj Kummini and Hema Srinivasan: *An upper bound for the first Hilbert coefficient of Gorenstein algebras and modules*, to appear in Wiegands Festschrift.

C90 Rajeeva L Karandikar and B. V. Rao: *Stochastic-Integrals-and-Two-Filtrations*, to appear in Séminaire de Probabilités, Springer-Verlag.

Preprints

Computer Science

P91 Pranjal Dutta, Nitin Saxena and Thomas Thierauf: *A Largish Sum-of-Squares Implies Circuit Hardness and Derandomization.*

P92 V. Arvind, Abhranil Chatterjee, Rajit Datta and Partha Mukhopadhyay: *A Special Case of Rational Identity Testing and Bresar-Klep Theorem* .

P93 P Abdulla, M F Atig, A Bouajjani, K Narayan Kumar and P Saivasan: *Deciding Reachability under Persistent x86-TSO.*

P94 Eric Allender, Archit Chauhan and Samir Datta: *Depth-First Search in Directed Graphs, Revisited.*

P95 Prajakta Nimbhorkar, Geevarghese Philip and Vishwa Prakash HV: *Disjoint Stable Matchings in Linear Time.*

P96 Samir Datta, Anuj Tawari and Yadu Vasudev: *Dynamic Complexity of Expansion.*

P97 V. Arvind, Abhranil Chatterjee, Rajit Datta and Partha Mukhopadhyay: *Equivalence Testing of Automata over Partially Commutative Monoids.*

P98 Sandesh Kamath, Amit Deshpande and K V Subrahmanyam.: *How do SGD parameters in natural training affect adversarial robustness* .

P99 Arkadev Chattopadhyay, Rajit Datta and Partha Mukhopadhyay: *Lower Bounds for Monotone Arithmetic Circuits Via Communication Complexity.*

P100 Pranjal Dutta, Nitin Saxena and Thomas Thierauf: *Lower bounds on the sum of 25th-powers of univariates lead to complete derandomization of PIT.*

P101 Arkadev Chattopadhyay, Rajit Datta and Partha Mukhopadhyay: *Negations Provide Strongly Exponential Savings.*

P102 C. Aiswarya: *On Network Topologies and Decidability of Reachability Problem.*

P103 Sandesh Kamath, Amit Deshpande and K V Subrahmanyam: *On Universarsalized Adversarial and Invariant Perturbations.*

P104 Bharat Adsul, Milind Sohoni and K V Subrahmanyam: *Projective limits of stable points.*

P105 R Ramanujam, Vaishnavi Sundararajan and S P Suresh: *Protocol insecurity with communicated assertions.*

P106 Samir Datta, Chetan Gupta, Rahul Jain, Anish Mukherjee, Vimal Raj Sharma and Raghunath Tewari: *Reachability and Matching in Single Crossing Minor Free Graphs.*

P107 Paul Gastin, Sayan Mukherjee and B Srivathsan: *Reachability in updatable timed automata made faster and more effective.*

P108 Venkatesh Vinayakarao, Devika Sondhi, Sumit Keswani, Rahul Purandare and Anita Sarma: *Replacements and Replaceables: Making the Case for Code Variants.*

P109 Lars Jaffke, Paloma T. Lima and Geevarghese Philip: *Structural Parameterizations of Clique Coloring.*

P110 Rupak Majumdar, Madhavan Mukund, Felix Stutz and Damien Zufferey: *Tractable Verification with Multiparty Session Types.*

P111 C. Aiswarya and Paul Gastin: *Weighted Tiling Systems for Graphs: Evaluation complexity.*

P112 M. Praveen: *What You Must Remember When Transforming Datawords.*

P113 S. Hitarth and M. Praveen: *Window Expressions for Stream Data Processing.*

Maths

P114 Chaitanya Ambi: *A Partial Converse of Bott's Theorem on Compact Lie Groups.*

P115 S.Senthamarai Kannan and Pinakinath Saha: *A characterisation of minuscule fundamental weights in simply laced root systems.*

P116 Priyavrat Deshpande, Krishna Menon and Anurag Singh: *A combinatorial statistic for labeled threshold graphs.*

P117 Keshab Chandra Bakshi, Ved Gupta: *A few remarks on Pimsner-Popa bases and regular subfactors of depth 2.*

P118 Navnath Daundkar and Priyavrat Deshpande: *On aspherical chain spaces.*

P119 Suprajo Das: *Epsilon multiplicity for Noetherian graded algebras.*

P120 Anurag Singh: *Higher matching complexes of complete graphs and complete bipartite graphs.*

P121 A.J. Parameswaran and Amith Shastri K: *Jacobians, Anti-affine groups and torsion points. .*

P122 Keshab Chandra Bakshi and Ved Prakash Gupta: *Lattice of intermediate subalgebras.*

P123 Chaitanya Ambi: *Noetherian Pro-p Groups Have Finite Rank.*

P124 Manoj Kummini and Mandira Mondal: *On Hilbert ideals for a class of p-groups in characteristic p.*

P125 V. Balaji and Y. Pandey: *On a wonderful Bruhat-Tits group scheme.*

P126 V. Balaji and Y. Pandey: *On homomorphisms of $\pi_1(\mathbb{P}^1 - \mathcal{R})$ into compact semisimple groups.*

P127 Indranil Biswas, Krishna Hanumanthu and D. S. Nagaraj: *Positivity of vector bundles on homogeneous varieties.*

P128 Sourish Das: *Prediction of COVID-19 Disease Progression in India : Under the Effect of National Lockdown.*

P129 Sharad Sane: *Product of circularly arranged numbers with the least number of questions asked.*

P130 S. Mehrotra and J. Pine: *Rational curves on the Seshadri compactification.*

P131 Indranil Biswas, Jyoti Basgupta, Krishna Hanumanthu and Bivas Khan: *Seshadri constants on Bott towers.*

P132 V. Balaji and Y. Pandey: *Stable parahoric torsors on the punctured projective line..*

P133 R L Karandikar and B V Rao: *Stochastic integration and two filtrations.*

P134 Navnath Daundkar and Priyavrat Deshpande: *The moment polytope of the abelian polygon space.*

P135 Shuchita Goyal, Samir Shukla and Anurag Singh: *Topology of Clique Complexes of Line Graphs.*

P136 S.Senthamarai Kannan, Arpita Nayek and Pinakinath Saha.: *Torus quotients of Schubert varieties in the Grassmannian $G_{2,n}$.*

P137 Parameswaran Sankaran and Oorna Mitra: *Twisted Conjugacy in General Linear Groups over Polynomial Algebras over Finite Fields.*

P138 Anurag Singh: *Vertex decomposability of complexes associated to forests.*

Physics

P139 A. K. Kapoor: *A New Approach to SQM of Axial Vector Field Theory.*

P140 G. S. Krishnaswami and T.R. Vishnu: *An introduction to Lax pairs and the zero curvature representation.*

P141 Suraji Kalita, T.R. Govindarajan and Banibrata Mukhopadhyay: *Application of non-commutative squashed fuzzy sphere in white dwarf.*

P142 Subhroneel Chakrabarti, Suresh Govindarajan, P Shanmugapriya, Yogesh K. Srivastavaand Amitabh Virmani: *Black Hole Hair Removal For N=4 CHL Models.*

P143 A Manu, K Narayan and Partha Paul: *Cosmological Singularities, Entanglement and Quantum Extremal Surfaces.*

P144 Ritabrata Bhattacharya, K. Narayan and Partha Paul: *Cosmological singularities and 2-dimensional dilaton gravity.*

P145 S. Borhanian, A. Dhani, A. Gupta, K. G. Arun and B. S. Sathyaprakash: *Dark Sirens to Resolve the Hubble-Lemaître Tension.*

P146 Divyajyoti, Preet Baxi, Chandra K Mishra, K. G. Arun: *Detectability of gravitational higher order modes in the 3G era.*

P147 LIGO/Virgo collaboration including K. G. Arun as co-author: *GWTC-2: Compact Binary Coalescences Observed by LIGO and Virgo During the First Half of the Third Observing Run.*

P148 LIGO/Virgo collaboration including K. G. Arun as co-author: *Population Properties of Compact Objects from the Second LIGO-Virgo Gravitational-Wave Transient Catalog.*

P149 Karan Fernandes, Debodirna Ghosh and Amitabh Virmani: *Horizon Hair from Inversion Symmetry.*

P150 Himalaya Senapati: *Instabilities and chaos in the classical three-body and three-rotor problems.*

P151 A. Gupta, S. Datta, S. Kastha, S. Borhanian, K. G Arun and B.S. Sathyaprakash: *Multiparameter tests of general relativity using multiband gravitational-wave observations.*

P152 K. Narayan: *On aspects of 2-dim dilaton gravity, dimensional reduction and holography.*

P153 Govind S Krishnaswami and T R Vishnu: *Quantum Rajeev-Ranken model as an anharmonic oscillator.*

P154 A. K. Kapoor: *SQM of Anomalous U(1) Axial Vector Gauge Theory.*

P155 Manu A, Debodirna Ghosh, Alok Laddha and Athira P V: *Soft Radiation from Scattering Amplitudes Revisited.*

P156 Radhika Vinze, Anuradha Misra, T R Govindarajan and P Ramadevi: *Stuckelberg SUSY QED and Infrared Problem.*

P157 LIGO/Virgo collaboration including K.G. Arun as co-author: *Tests of General Relativity with Binary Black Holes from the second LIGO-Virgo Gravitational-Wave Transient Catalog.*

P158 S. Datta, A. Gupta, S. Kastha, K.G. Arun and B.S. Sathyaprakash: *Tests of general relativity using multiband observations of intermediate mass binary black hole mergers.*

P159 G. S. Krishnaswami and S. Phatak: *The Added Mass Effect and the Higgs Mechanism.*

Ph.D. Thesis

T1 Abhishek Bharadwaj: On Non-Vanishing and Linear Independence of Special Values of Dirichlet series (June 2020).

T2 Pratik Roy: Smooth and Oscillating Configurations in String Theory (June 2020).

T3 Pinakinath Saha: Automorphism Groups of Schubert Varieties and Rigidity of Bott-Samelson-Demazure-Hansen varieties (June 2020).

T4 Kuldeep Saha: On Some Embedding Problems of Closed Oriented Manifolds in the Smooth and Contact Category (June 2020).

T5 Anbu Arjunan: E_0-Semigroups over Closed Convex Cones (July 2020).

T6 S.P. Murgan: E_0-Semigroups and Product Systems (July 2020).

T7 Sonakshi Sachdev: Conservative Regularization of Neutral Fluids and Plasmas (July 2020).

T8 Himalaya Senapati: Instabilities and Chaos in the Classical Three-Body and Three-Rotor problems (July 2020).

T9 Kedar S. Kolekar: Aspects of Holography: Mainly nAdS2 Holography from Dimensional Reduction and Non-Relativistic Holography for hvLif Theories (August 2020).

T10 Sachin Phatak: Field Theoretic Viewpoints on Certain Fluid Mechanical Phenomena (October 2020).

T11 K. Sandesh Kamath: Robustness of Neural Network Models (November 2020).

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 co-operation 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 2020, the twentythird batch of students was admitted to the undergraduate programme. At the end of the first semester, 38 students opted for B.Sc. in Mathematics and Computer Science. The second year B.Sc. class has 55 students in Mathematics and Computer Science and the third year B.Sc. class has 20 students. Out of the 22 students of the 2017 batch who took their degrees at the convocation in July 2020, several have been placed in very prestigious institutions.

- Ashutosh Roy Choudhury
  PhD Mathematics, Tata Institute of Fundamental Research, Mumbai.

- Debjit Paria
  MSc Computer Science, Chennai Mathematical Institute.

- Devang Agarwal
  MSc Mathematics, University of British Columbia, Vancouver, Canada.

- Dhruv Nevatia
  MSc Computer Science, Chennai Mathematical Institute.

- Diganta Mukhopadhyay
  MSc Computer Science, Chennai Mathematical Institute.

- Ekanshdeep Gupta
  PhD Computer Science, Courant Institute, New York University, USA.

- Siddharth Gurumurthy
  MSc in Mathematics, University of Western Ontario, Canada.

- Indraneel Pratap Mukhopadhyaya
  MSc in Applied Statistics and Informatics, Indian Institute of Technology, Bombay.

- Kapil Shenvi Pause
  MSc Computer Science, Chennai Mathematical Institute.

- Kartik Sunaad R

- Kavinesh R

- Kushal Vijay Padole
  MSc Applied statistics and Informatics, Indian Institute of Technology, Bombay.

- S V Aswannth
  MSc Computer Science, Chennai Mathematical Institute.

- Saptarsi Ghosal
  M.Stat, Indian Statistical Institute.

- Sayantan Chakraborty
  MSc Mathematics, Chennai Mathematical Institute.

- Areeb Shah Mohammed
  MSc Mathematics, Universitat Regensburg, Germany.

- Shubham Saha
  PhD Mathematics, University of California San Diego, USA.

- Dianthe Basak
  MSc Mathematics, Chennai Mathematical Institute.

- Arya Vadnere
  PhD Mathematics, University of Buffalo, SUNY, USA.

- Writabrata Bhattacharya
  MSc Computer Science, Chennai Mathematical Institute.

- Arpan Biswas
  MSc Data Science, Chennai Mathematical Institute.

- Parthiv Chakrabarty

B.Sc. (Hons.) Mathematics and Physics

Of the 47 students admitted to the undergraduate programme in 2020, 9 students opted for B.Sc. in Mathematics and Physics as the end of the first semester. The second year class has 6 students. The third year class has 2 students. Out of the 6 students of the 2017 batch who took their degrees at the convocation in July 2020, several have been placed in very prestigious institutions.

- Abhishek Hegde K R
  PhD Physics, University of Illinois, Urbana Champaign.

- Deepak M S
  MSc in Mathematics, Chennai Mathematical Institute.

- Devesh Rajpal
  MSc Mathematics, Sorbonne University, Paris, France.

- Immanuel Jeremy Christen Miranda

- Akshay Sakanaveeti
  M.Stat, Indian Statistical Institute, Kolkata.

- Ujjwal Kumar Sana

M.Sc. Mathematics

In 2020, 7 students have joined the programme. There are 3 students in the second year of the programme. 11 students who joined the programme in 2018 have completed the programme successfully.

- Anant Singh

- Anusha Bhattacharya

- Sahil Kulshrestha
  PhD Computer Science, Chennai Mathematical Institute.

- Madhuparna Pal

- Sourav Ghosh

- Ritaman Ghosh
  PhD Mathematics, Indian Statistical Institute, Bengaluru.

- Soham Chakraborty

- Sayantan Roychowdhury

- Rahul Hirwani
  PhD Mathematics, Northeastern University, USA.

- Neelarnab Raha
  PhD Mathematics, Pennsylvania State University, USA.

- Srijan Ghosh
  PhD Mathematics, Stony Brook University, NY, USA.

M.Sc. Computer Science

In 2020, 19 students have joined the programme. There are 18 students in the second year of the programme. 23 students who joined the programme in 2018 have completed the programme successfully.

- Mugdha Uday Khedkar
  PhD Computer Science, Secure Software Engineering Group, Paderborn University, Germany.

- Swarnadeep Bhar
  Software Engineer, Temenos India.

- Srinidhi N
  PhD Computer Science, Chennai Mathematical Institute.

- Samarth Sadashiv Chaturvedi

- Namrata
  Phd Computer Science, University of Warwick, UK.

- Ananth Krishna Duggirala

- Asif Khan
  PhD Computer Science, Chennai Mathematical Institute.

- Mrudula Balachander
  PhD Computer Science, Universite Libre de Bruxelles, Belgium.

- Pratiksha Mondal

- Bhishmaraj Selvamani
  Software Engineer, Google, Hyderabad.

- Vishwa Prakash H V
  PhD Computer Science, Chennai Mathematical Institute.

- Rohit Singh
  Solution Consultant, Sahaj Software Solutions, Bengaluru.

- Sagarika Shahane

- Abhiroop Sanyal

- Siddharth Mitra
  PhD Computer Science, Yale University, USA.

- Ankita Sarkar
  PhD Computer Science, Dartmouth College, Hanover, USA.

- Subhayan Saha
  PhD Computer Science, Ecole Normale Superieure de Lyon, France.

- Ranjani Gowri Sundaram

- Ashwin
  PhD Computer Science, LSV, Ecole Normale Superieure Paris-Saclay, France.

- Biswadeep Sen
  Research Assistant, National University of Singapore, Singapore.

- Akshatha
  Systems Engineer, TCS Research and Innovation, TRDDC, Pune.

- Akshay Anil Naik

- Devendra Reddy

M.Sc. Data Science

In 2020, third batch of 46 students joined the programme. There are 38 students in the second year of the programme. 25 students who joined the programme in 2018 have completed the programme successfully.

- Arkaprava Sinha
  Post Graduate Trainee, Larsen and Toubro Infotech, Navi Mumbai.

- Abhishek Rawat
  Associate Software Engineer, Legato Health Technologies, Hyderabad.

- Subhasish Basak
  PhD Applied Mathematics, Universite Paris Saclay, France.

- Sreya K K

- Nikhil Vishwanath Belure
  Legato Health Technologies, LLP, Hyderabad.

- Malhar Bhartendu Dave

- Krishna V

- Aishwarya R
  PhD Program, Hasso Plattner Institute, Potsdam, Germany.

- Akhil Naravi

- Pushkar Sathe
  Data Scientist, Netcore Solutions Private Limited.

- Purnendu Ghosh
  Data Engineer, Temenos India, Chennai.

- Rohan Khaitan
  Data Scientist, HP PPS India Operations Private Limited, Bengaluru.

- Sankalp Sinha
  Software Engineer, Temenos India, Bengaluru.

- Appu Mathews Madathil

- Aishee Dasgupta

- Ankush Karmarkar
  Analyst, Morgan Stanley, Mumbai.

- Abhinav Faujdar

- Afrad Basheer
  PhD Computer Science, Centre for Quantum Software and Information, University of Technology, Sydney.

- Anirban Bose
  Software Engineer, Temenos India, Chennai.

- Aditya Parson
  Quantitative Analyst, Dolat Capital.

- Ishaan Singh
  Software Engineer, Temenos India, Chennai.

- Sahil Khandelwal

- Trina De
  Post Graduate Trainee, Larsen & Toubro Infotech, Navi Mumbai.

- Suchitra Jayaprakash
  AlgoLabs, Chennai.

- Aritra Banerjee
  Data Scientist, R&D, Hewlett Packard Inc., Bengaluru.

Convocation

In the 18th Annual Convocation of CMI, Degrees were awarded to 101 successful candidates at various levels. Of these, 28 were B.Sc. candidates, 61 were M.Sc. candidates and 12 were a Ph.D. candidates.

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

- Swaraj Bose did internship at Accenture Digital under Ashok Sankpal Pranav and Prateek B. Shukla on "Prediction of future shortfall to customers (supply-chain domain)" during May - June 2020.

- Shubhrajit Bhattacharya

    - did Reading project on algebraic number theory at Stat-Math unit, Indian Statistical Institute, Bangalore (Online) under Professor B. Sury on "Algebraic Number Theory" during May - July 2020.

    - did International Conference on Number Theory and Discrete Mathematics (IC-NTDM 2020) (Online) organized by Rajagiri School of Engineering and Technology (RSET) to mark the hundredth year of passing away of Srinivasa Ramanujan on "Number Theory and Discrete Mathematics" in December 2020.

    - did Workshop on Dualities in Topology and Algebra (DTA 2021) (Online), organized by ICTS-TIFR. on "Duality theorems that arise in higher categories, commutative algebra, algebraic geometry and algebraic topology" in February 2021.

- Subhadutta Mahapatra did industrial internship at Dvara E-Dairy under Balaji Lakshmananan on "Computer Vision application" during May - July 2020 and did industry project during August - December 2020.

- Pranay Agrawal did internship remotely from LSV, ENS Paris-saclay under Alain Finkel and Philippe Schnobelen on "Lossy Channel Systems" during May - July 2020.

- Arka Karmakar did internship at IISc Bangalore [done online from home] under Vamsi Pritham Pingali on "Riemann Surfaces" during May - July 2020.

- Nilanjan Debnath did internship

T1 at Coriolis Technologies (Pune) (Work from home) under Sudhir Kumar on "Natural Language Processing" during May - July 2020.

T2 at DeLab Research (Trivandrum) (Work from home) under Pranav Ashok on "Energy Forecasting using Artificial Neural Networks" during February - March 2021.

- Soumodev Mal did internship remotely at IMSc under Prakash Saivasan, IMSc and C. Aiswarya, CMI on "Studied about Regular Separability" during April - July 2020.

- Kushagra Chatterjee did internship at National University of Singapore (Online) under Diptarka Chakraborty on "Fault Tolerant Networks, which comes under Graph Algorithms" during May 2020 - February 2021.

- Pratap Chandra Das

    T1 did Data Science Summer Internship at IBM Research under Giriprasad Sridhara on "Extraction of microservices from monolithic architectures" during May - July 2020.

    T2 did Industry Project (Elective) at IBM Research underUtkarsh Desai on "Understanding source code using Deep Neural Networks" during August - November 2020.

- Satya Prakash Nayak did internship at Max Planck Institute for Software Systems, Germany (online) under Daniel Neider and Martin Zimmermann on "Adaptive Strategies for rLTL Games" during July - December 2020.

- Ipsita Ghosh did internship

    T1 at Hopstack (via Algolab), California under K. V. Subrahmanyam on "Analysis of Location information of workers from their smartphone sensors using Deep Learning models" during June - August 2020.

    T2 at Haber under Varun Thakre on "Used Bayesian Optimisation and Deep Learning to build solutions for manufacturing" during August - November 2020.

- Sricharan AR did internship at TIFR (online) under Umang Bhaskar on "Fair Division (Algorithmic Game Theory)" during May - August 2020.

- Debangshu Bhattacharya did internship at Credit Suisse on "Model Risk Management" during May - July 2020.

- Nachiket Dravid at Fortiate under Amit Godbole "EMI propensity modelling" during January - March 2021.

- Senjuti Dutta did internsip at PROMYS Bridge Math Program (as a junior counsellor) under Marjory Baruch on "Graph Theory" and under Kiran Kedlaya on "Beyond Pick's Theorem (Exact topic being- Ehrhart-Equivalence, Equidecomposability, and Unimodular Equivalence of Integral Polytopes)" during July - August 2020.

- Arghadeep Ghosh did internship at University of Bordeaux under Anca Muscholl and Diego Figueira on "A new model for distributed stream processing and on distributed transducers" during May - July 2020.

- Ashish Kumar Sinha did internship at HP Labs under Niranjan Damera Venkata on "Time-to-event prediction using Deep Recurrent Neural Network" during June - November 2020.

- Kushal Motwani did internsip

  T1 at Credit Suisse, Mumbai (Online) under Anirban Dutta on "Model Risk Management" during May - July 2020.

  T2 at Algolabs, Chennai (Online) under Sourish Das on "Audio Classification" during November 2020 - March 2021.

- Aadityan Ganesh did internship

  T1 at IIT Kanpur under Swaprava Nath on "Fair assignment of ride requests to drivers- algorithmic game theory" during May - July 2020.

  T2 at CMI under Prajakta Nimbhorkar "Stable Matching and related problems- algorithms" duirng October 2020 - March 2021.

- Vruddhi Satra did internship at Coriolis Technologies Pvt.Ltd. under Sudhir Kumar on "Identifying images containing sensitive information" during May to July 2020.

- Soundarya Devi did internship at Condé Nast on "Spire modeling with video features" during May - July 2020, January - March 2021.

- Ashwani Anand did internship at Max Planck Institute for Software Systems, Germany (Remote) under Georg Zetzsche on "Downward closures with respect to refinements of subword order" during July 2020 - March 2021.

Interaction with graduate students from Ecole Normale Supérieure

Chennai Mathematical Institute has an agreement with the Ecole Normale Supérieure in Paris, France, one of the leading institutions in the world for teaching and research in Mathematics. This agreement provides for regular exchange visits by academic members of CMI and ENS, Paris. This includes, in particular, exchanges of visits by undergraduate students between the two institutions.

Every year, the top three students passing out from the B.Sc. Mathematics programme spend 8 weeks at the ENS, where they work on research projects with the ENS faculty. In May–June 2020, none visited the ENS because of covid situtation.

Interaction with graduate students from Ecole Polytechnique

Chennai Mathematical Institute has an agreement with the Ecole Polytechnique in Paris, France, one of the leading institutions in the world for teaching and research in Physics.

Every year, the top three students passing out from the B.Sc. Mathematics programme spend 8 weeks at the ENS, where they work on research projects with the ENS faculty.

13   Undergraduate/Graduate Courses

August – December 2020

Advanced Algorithms	:	Samir Datta
Algebraic Geometry I	:	Rupam Karmakar
Algebra III	:	Upendra Kulkarni
Design & Analysis of Algorithms	:	Prajakta Nimbhorkar/Philip Geevarghese
Advanced Machine Learning	:	Madhavan Mukund/Sourish Das
Analytic Number Theory	:	Priyamvad Srivastav
Analysis III	:	S Ramasubramanian
Calculus	:	T R Ramadas
Commutative Algebra	:	Mandira Mondal
Commutative Algebra Seminar	:	Speaker
Coding Theory	:	Sharad Sane
Classical Mechanics	:	Govind Krishnaswami
Intro to Diophantine Approximation	:	Purusottam Rath
Data Mining & Machine Learning	:	Madhavan Mukund
Differential Topology	:	Priyavrat Deshpande
Electrodynamics	:	Alok Laddha
Envirement Course	:	Speaker/Movie
Fuchsian groups, vector bundles & moduli	:	V Balaji
German I	:	Pavithra Ravishankar
Gravitational Waves	:	K G Arun
Hilbert spaces & linear operators	:	Keshab Bakshi
Information Retrieval	:	V Venkatesh
Mathematical Logic	:	M Praveen
Model Checking & Systems Verification	:	M K Srivas
Model Theory	:	Manoj Kummini/S P Suresh
Online Optimization	:	K V Subrahmanyam
Optimization Techniques	:	Sujatha Babu
Partial Differential Equations	:	Mythily Ramaswamy
Parameterized & Exact Algorithms	:	Philip Geevarghese
Proofs & Types	:	S P Suresh
Intro to Quantum Computing	:	Partha Mukhopadhyay
Quantum Mechanics I	:	H S Mani
Quantum Mechanics	:	V V Sreedhar
Semisimple Lie Algebras	:	Arpita Nayek
Constraint (SMT) Solving & Deep Neural Networks	:	M K Srivas
Stochastic Processes I	:	B V Rao
Statistical Mechanics	:	G Date
Intro to String Theory	:	K Narayan

Theory of Wavelets	:	M Sundari
Timed Automata	:	B Srivathsan
Theory of Computation	:	Aiswarya C/Narayan Kumar
Intro to Topological Combinatorics	:	Shuchita Goyal
Thermal Physics	:	Amitabh Virmani
Time Series Analysis	:	V Swaminathan
Values Through Literature	:	M Usha

December 2020 – March 2021

Algebraic Automata Theory	:	Amaldev Manuel
Abelian Varieties	:	Pramathanath Sastry
Algebraic Geometry II	:	Suprajo Das
Advaned Information Retrieval	:	V Venkatesh
Algebra I	:	T R Ramadas
Algebra IV	:	Krishna Hanumanthu
Algebraic Groups	:	Senthamarai Kannan
Analysis I	:	Purusottam Rath
Bayesian Data Analysis	:	Sourish Das
Complex Analysis	:	Manoj Kummini
Classical Mechanics I	:	A K Kapoor
Complex Manifolds	:	Parameswaran Sankaran
Completely Positive Maps & Applications	:	Nirupama Mallick
Complexity Theory I	:	Partha Mukhopadhyay
Introduction to Cryptography	:	Rajeeva Karandikar
Computer Vision	:	Kavita Sutar
Differential Equations	:	Pramathanath Sastry
Discrete Mathematics	:	B Srivathsan
Economics	:	Malathi Velamuri
Enumerative Combinatorics	:	Anurag Singh
English	:	Usha Mahadevan
Financial Models Using Python	:	Mousum Dutta
Geometry of Algebraic Curves	:	Suratno Basu
Graduate Algebra I	:	Clare D'Cruz
Graduate Analysis I	:	R Srinivasan
Game Theory	:	Sujatha Babu
Graph Theory	:	Sharad Sane
Graduate Topology I	:	V Balaji

Gravitational Wave Physics	:	K G Arun
Homological Algebra	:	Clare D'Cruz
Intersection Theory	:	Sayanta Mandal
Infinite State Verification	:	K Narayan Kumar/Prakash Saivasan
Interactive Theorem Proving	:	S P Suresh/M K Srivas
Logic, Automata, Games	:	K Narayan Kumar/M Praveen
Linear Algebra & its Applications	:	Kavita Sutar
Mathematical Logic	:	K Narayan Kumar
Linear Optimization	:	B Srivathsan/Prajakta Nimbhorkar
Intro to Manifolds	:	Sukhendu Mehrotra
Mathematical Methods-Analysis	:	S Ramasubramanian
Multivariate Statistics	:	Shibasish Dasgupta
Natural Language Processing	:	Ramaseshan Ramachandran
Operator Algebras & Spectral Theor	:	Sruthymurali
Optics	:	H S Mani
Open Quantum Systems	:	V V Sreedhar
Probability & Statistics with R	:	R V Ramamoorthi
Programming & Data Structures with Python	:	Madhavan Mukund
Programming Language Concepts	:	S P Suresh/M Praveen
Functional Programming in Haskell	:	S P Suresh
Quantum Field Theory	:	G Date
Quantum Mechanics II	:	Alok Laddha
RDBMS, SQL & Visualization	:	V Venkatesh
Topics in Representation Theory	:	Upendra Kulkarni
Reinforcement Learning	:	K V Subrahmanyam
Stochastic Processes II	:	B V Rao
The Art of Short Fiction	:	M Usha
To be announced	:	Abhishek T Bharadwaj
Topics in Commutative Algebra	:	Sudeshna Roy
Topological Data Analysis	:	Priyavrat Deshpande
Theoretical Foundations of CS	:	Geevarghese Philip
Theory of Computation	:	C Aiswarya
Topology	:	Krishna Hanumanthu
Topics in String Theory	:	K Narayan

January – April 2021

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Multivariate Statistics	:	Shibasish Dasgupta

Natural Language Processing	:	Ramaseshan Ramachandran
Operator Algebras & Spectral Theory	:	Sruthymurali
Optics	:	H S Mani
Open Quantum Systems [Mar-Apr]	:	V V Sreedhar
Probability & Statistics with R	:	R V Ramamoorthi
Programming & Data Structures with Python	:	Madhavan Mukund
Programming Language Concepts	:	S P Suresh/M Praveen
Functional Programming in Haskell	:	S P Suresh
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Topics in Representation Theory	:	Upendra Kulkarni
Reinforcement Learning	:	K V Subrahmanyam
Reachability & Matching;Algorithms & Complexity	:	Samir Datta
Resolution of Singularities	:	Sayanta Mandal
Stochastic Processes II	:	B V Rao
The Art of Short Fiction	:	M Usha
Topics in Commutative Algebra	:	Sudeshna Roy
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Theoretical Foundations of CS	:	Geevarghese Philip
Theory of Computation	:	C Aiswarya
Topology	:	Krishna Hanumanthu
Topics in String Theory	:	K Narayan

14   Special Lectures

- Keshab Chandra Bakshi: Lattice of intermediate subalgebras (November 2020).

- Mandira Mondal: On Hilbert ideals for a class of p-groups in characteristic p (November 2020).

- Suratno Basu: System of Hodge bundles and generalised Opers on smooth projective varieties (December 2020).

- Anurag Singh: Graph complexes: At the intersection of algebra, topology and combinatorics (December 2020).

- Anup Dixit: On families of L-functions (December 2020).

- Suprajo Das: Epsilon multiplicity of graded algebras (December 2020).

- Abhishek T Bharadwaj: On special values of Dirichlet series with periodic coefficients (December 2020).

- Arpita Nayek Torus quotients of Schubert varieties in the Grassmannian $G_{2,n}$ (December 2020).

- Sudeshna Roy: Graded components of local cohomology modules II (December 2020).

- Rupam Karmakar: CMI Mathematics Seminar: positive cones of cycles on products of projective bundles over curves (January 2021).

- Sayanta Mandal: CMI Mathematics Seminar: Non-globally generated stable bundles on curves (February 2021).

- Shibi Vasudevan: CMI Mathematics Seminar: Continued fractions, Fredholm determinants and unstable eigenvalues of ideal fluids (February 2021).

- Chaitanya Ambi: CMI Mathematics Seminar: Filling Radius and Volume of Riemannian Manifolds (February 2021).

- Tanya Kaushal: CMI Mathematics Seminar: (Not) Irreducible Symplectic Varieties in Characteristic 2 (February 2021).

- Shuchita Goyal: CMI Mathematics Seminar: Tidiness of planar polygonal spaces (March 2021).

- Amith Shastri K: CMI Mathematics Seminar: Jacobians, anti-affine groups and torsion points (March 2021).

15 Data Science Colloquium Series

The Data Science colloquium at CMI is a platform for the industry representatives to talk about their work in the fields of data science, machine learning and artificial intelligence and also explain how these niche technologies are used to solve real life problems. The colloquium series started in August 2019.

- Jazeem Basheer, ClusterDev (co-founder), Kochi: Building better typing experience for Indian languages (October 2020).

- Bhramar Mukherjee, University of Michigan: Predictions, Role of Interventions and the Crisis of Virus in India: A Data Science Call to Arms (January 2021).

- Rajeeva L Karandikar, Chennai Mathematical Institute: Role of statistics in the era of BigData, Analytics, Data Science (January 2021).

- Mousum Dutta, Founder, Spotle.ai.: Deep Learning Algorithms for Natural Language Processing and its Applications (February 2021).

- Tanujit Chakraborty, IIIT Delhi: Hellinger net: A consistent statistical learning model for imbalanced pattern classification (February 2021).

- Balaji Raman, at Cogitaas, AVA: Marketing - Yet Another Playground for Data Scientists (March 2021).

16 Workshops/Schools/Conferences

CMI Webinar series on Recent Connections to GCT and Progress in GCT, April–July, 2020

- Anna Seigal: Torus Actions and Maximum Likelihood Estimation.

- Phillip Reichenbach: Matrix Normal Models and Invariant Theory.

- Kathlén Kohn: Gaussian Group models-I.

- Carlos Améndola: Gaussian Group models-II.

- Christian Ikenmeyer: Implementing geometric complexity theory: On the separation of orbit closures via symmetries.

- Cole Franks: Rigorous Guarantees for Tyler's M-estimator via quantum expansion.

- Tasuku Soma: Information geometry of operator scaling.

- Michael Walter: Towards a theory of non-commutative optimization: geodesic first and second order methods for moment maps and polytopes.

- Jeroen Zuiddam: Geometric rank of tensors.

- Joseph Landsberg: The complexity of matrix multiplication: history and recent progress.

- Anuj Dawar: A Lower Bound for Symmetric Circuits for the Permanent.

- Visu Makam: Maximum Likelihood estimation for matrix normal models via quiver representations.

CMI Online Seminar Series, May–July, 2020

- Ananth Shankar (MIT): A finiteness criterion for 2-dimensional representations of surface groups.

- Chandrasekhar Raju (École Polytechnique Fédérale Laussane): Connections between the Circle method, trace formula and bounds for the Subconvexity problem.

- Akash Sengupta (Columbia University): Geometric invariants and geometric consistency of Manin's conjecture.

- Mohan Swaminathan (Princeton University): A concrete approach to virtual classes in genus 0 Gromov–Witten theory.

- Akashdeep Dey (Princeton University): A comparison of the Almgren-Pitts and the Allen-Cahn min-max theory.

- Alapan Mukhopadhyay (University of Michigan, Ann Arbour): Singularities in Positive Characteristics.

- Arnab Saha (IIT Gandhinagar): p-adic Hodge theory and delta geometry.

- Siddhi Pathak (Pennsylvania State University),: Arithmetic nature of special values of L-functions.

- Arul Shankar (University of Toronto): Squarefree sieves in arithmetic statistics.

- Abhishek Oswal (University of Toronto): A non-archimedean definable Chow theorem.

- Baskar Balasubramnyam (IISER Pune): Construction of p-adic L-functions.

- Padmavathi Srinivasan (University of Georgia): Topological invariants in arithmetic geometry.

- Ved Datar (IISc): (Inverse)-Hessian type equations and positivity in complex algebraic geometry.

- Swarnava Mukhopadhyay (TIFR Bombay): Graph potentials and Moduli spaces of vector bundles of curves.

- Yajnaseni Dutta (University of Bonn): Positivity of direct image sheaves.

- Nivedita Bhaskhar (University of Southern California): Brauer p-dimensions of complete discretely valued fields.

- Chiranjib Mukherjee (University of Münster): The Kardar-Parisi-Zhang equation in $d \geq 3$ and the Gaussian free field.

- Agnid Banerjee (TIFR CAM Bangalore): The structure of the regular and the singular set of the free boundary in the obstacle problem for fractional heat equation.

- Ronno Das (University of Chicago): Noncollinear points in the projective plane.

- Utsav Choudhury (ISI Kolkata): Unstable motivic homotopy theory and few commutative algebra problems.

CMI NASI Online Outreach Lectures for Schools, 2020, September–November, 2020

- Dr. K Viswanathan: The Periodic Table — A Masterpiece in Systematization.

- Prof. Rama S Verma, Department of Biotechnology, IIT Madras: Clean Water.

- Dr. C Aiswarya, Chennai Mathematical Institute: Logical Reasoning through Puzzles.

- Dr. Shailesh Shirali, Director, Sahyadri School (KFI), Pune: Euler's Polyhedron Theorem and Some Applications.

- Prof Jim Libby, IIT Madras: Searching for Beauty: Finding one in a Billion with the CMS Experiment at the Large Hadron Collider.

- Dr. Sushan Konar, Former Scientist, NCRA Pune: The Sound of Music.

- Prof. Rama S Verma, Department of Biotechnology, IIT Madras: Bioplastics.

ReLaX Workshop on Games (February 2021) (Online)

The workshop was organized by H. Gimbert (CNRS, LaBRI, Univ. Bordeaux), R. Ramanujam (IMSc, Chennai) and B. Srivathsan (CMI, Chennai) .

Keynote sessions:

- Véronique Bruyère (Univ. Mons, Mons) – First talk (survey): Synthesis of Nash equilibria and subgame perfect equilibria in games played on graphs Slides Second talk: Nash equilibria and subgame perfect equilibria in reachability games.

- T. Parthasarathy (CMI, Chennai) - First talk: A survey on stochastic games Second talk: Finite algorithm for some classes of stochastic games.

- Jérôme Renault (TSE, Toulouse) – Long-term value in stochastic games.

- Arunava Sen (ISI, Delhi) – Implementation in undominated Strategies with Bounded Mechanisms.

- Sitabhra Sinha (IMSC, Chennai) – The temptation of Mr Spock: Solution frameworks for non-cooperative games among rational agents.

- Tristan Tomala (HEC, Paris) – Bayesian Games, Information Design and Persuasion.

Technical sessions:

- John Augustine (IIT-Madras, Chennai) - Game Theoretic Challenges in Distributed Trust.

- Dietmar Berwanger (LSV, Paris Saclay) – Automatic Information Structures.

- Umang Bhaskar (TIFR, Mumbai) – Optimal Bounds on the Price of Fairness for Indivisible Goods.

- Sujata Ghosh (ISI Chennai) – On game equivalences: Algebraic and logical perspectives.

- Valentin Goranko (Stockholm University) – The temporal logic of coalitional goal assignments in concurrent multi-player games (joint work with Sebastian Enqvist).

- Sushmita Gupta (IMSc Chennai) – To fix a tournament: A parameterized complexity perspective.

- Deepak Khemani (IIT-Madras, Chennai) – Contract Bridge: Par and Beyond.

- Maël Le Treust (ETIS,Cergy) – Persuasion with limited communication capacity (joint work with Tristan Tomala, HEC Paris).

- Neeldhara Misra (IIT, Gandhinagar) – Party Nominations.

- Youssouf Oualhadj (Université Paris-Est Créteil Val de Marne) - Games Where You Can Play Optimally with Finite Memory.

- Rohit Parikh (CUNY) - The Sorites paradox, Fuzzy Logic, and Wittgenstein's Language Games.

- Sunil Simon (IIT Kanpur) – On externalities in one-sided markets.

CMI Arts Initiative

The objective of the CMI Arts Initiative is to provide a space for students, professionals and anybody else keenly interested in the humanities and arts to interact and learn from experts in these areas. The CMI Arts Initiative is coordinated by K. Srilata, K.V. Subrahmanyam, and Madhavan Mukund.

- D W Gibson, Author. Gave a talk on "The Changing Nature of Work, Globalization & Borders in the 21st Century" (Online Talks and Readings 2021) (February 2021).

- Anne Tannam and Fiona Bolger Poet. Gave a talk on "Summing Up" (Online Talks and Readings 2021) (March 2021).

17 Conferences, Visits and External Lectures

A K Kapoor

- Gave a set of online lecture on Group Theory lectures for Kerala University refresher program.

- Gave an online course on quantm field theory.

Asif Khan

- Audited Reachability and Matching algorithms and complexity course at CMI.

- Attended FSTTCS 2020 matrix rigidity workshop.

Amitabh Virmani

- Attended online conference on black hole microstructure.

- Gave online seminar at IACS Kolkata titled QNMs of the D1-D5 system.

V Balaji

- Visited ICTS, Bangalore in February 2020 and gave talks.

- Visited and gave a talk in the AIM Workshop in California in January 2021.

Bhamidi V Rao

- Visited Osmania University, Department of Statistics, Hyderabad in September 2020 (virtual) and gave talks.

- Visited Indian Statistical Institute, Kolkata in September 2020 (Virtual) and gave talks.

- Visited West Bengal State University, Barasat in September 2020 (virtual) and gave talks.

- Visited Ganit Sora, Math club Guwahati in September 2020 (Virtual) and gave talks.

- Visited Sri Venkateswara University, Tirupati in September 2020 (Virtual) and gave talks.

- Visited IISER Bhopal (virtual) in December 2020 and gave talks.

Chaitanya Ambi

- Gave a talk on "Fourier series".

- Gave a talk on "Gromov's conjecture".

- Gave a talk on "Lusin's theorem".

Clare D'cruz

- Visited VIT, Chennai (Via Zoom) Symbolic Powers, Resurgence, Waldschmidt Constant and Castelnuovo-Mumford Regularity, International Conference on Research Trends in Mathematics, VIT in August 2020 and gave talks.

Govind Krishnaswami

- Visited Dept. of Nuclear Physics, University of Madras, STPIP-2020 in July 2020 and gave talks.

- Visited Chennai Strings Meeting, IMSc, Chennai in December 2020 and gave talks.

- Visited Beneath a Tree, Bengaluru in February 2021.

Geevarghese Philip

- Presented a paper at ICALP 2020.

- Presented work at STACS 2021 (online).

H S Mani

- Gave two talks for Indian association of physics chapter on "electrostatics" in July 2020.

- Conducted several online lectures for CMI, NASI from October to December 2020.

- Gave a lecture on "measurement of distances in astronomy".

Jyothsnaa Sivaraman

- Attended the online number theory conference held at IMSc, in March 2021.

- Delivered a talk in the Queen's university number theory seminar in March 2021.

- Participated in Women in Numbers 5, 2021.

Keshab Chandra Bakshi

- Gave an invited talk at 35th annual conference Ramanujan Mathematical Society.

- Gave an invited talk at Webinars on Operator Theory and Operator Algebra in March 2021 on "On a question of Vaughan Jones".

K G Arun

- Gave an invited talk at a workshop held in IIT Gandhinagar (remotely) on "Tests of GR using GW observations".

Krishna Hanumanthu

- Gave a virtual algebraic geometry seminar titled "Seshadri constants and rationality questions" at IIT-Bombay, in June 2020

- Gave a virtual talk in the Algebra and Number theory seminar at University of Maryland, in September 2020, titled "Some results on Seshadri constants".

- Gave a talk titled "Bounded negativity and Harbourne constants for algebraic surfaces" at Indo-Japan Web-Workshop on Vector Bundles and Related Topics, in February 2021.

Madhavan Mukund

- Visited SSN College of Engg, Workshop on Guidelines for administering open book exams in June 2020 and gave talks.

- Visited IOI Training Camp (online) in June-August 2020.

- Visited 16th International Bebras Task Workshop (online) in May 2020.

- Visited Bharati Vidyapeeth's College of Engineering for Women, Pune in September 2020 and gave talks.

- Visited Crescent Institute of Science and Technology, Chennai in September 2020 and gave talks.

- Visited Manipal Academy of Higher Education, Manipal in September 2020 and gave talks.

- Visited SRM University, Chennai in July 2020 and gave talks.

- Visited Pimpri Chinchwad College of Engineering, Pune in February 2021 and gave talks.

- Visited SRM University, Chennai in January 2021 and gave talks.

Mandira Mondal

- Delivered a talk in Virtual Commutative Algebra seminar.

Sukhendu Mehrotra

- Gave a talk entitled "Stability conditions on K3 surfaces" in August 2020 at IITB.

Manoj Kummini

- Gave two talks in the Virtual Commutative Algebra Seminar organized at IIT-Bombay.

- Gave an online talk at IISER Thiruvananthapuram.

- Gave talk in Online Topological Groups Seminar, University of Hawaii, USA.

Usha Mahadevan

- Visited Airports Authority of India in November and gave talks.

- Visited Airports Authority Of India in February 2021.

Narayan K

- Visited Chennai Strings Meeting (online), talk on "2-dim dilaton gravity, holography, cosmological singularities and quantum extremal surfaces" in December 2020.

Oorna Mitra

- Gave talk at IIT Bombay in September 2020.

Pankaj Saini

- Attended online 31st IAGRG workshop.

Priyavrat Deshpande

- Delivered a talk on combinatorics in department seminar of M.O.P.V. College, in Chennai.

- Delivered an online talk for students of BVM school, Chennai.

- Delivered a talk in IISER Bhopal mathematics symposium in March 2021.

- Gave an online talk in March 2021 for the students of RSM college, Latur, Maharshtra.

Pranjal Dutta

- Gave a (virtual) talk on " A Largish Sum-of-Squares Implies Circuit Hardness and Derandomization" at tMeet (Theory Seminar), Indian Institute of Technology, Madras.

- Gave a webinar at IITK on "Lower bounds on the sum of 25th-powers of univariates lead to complete derandomization of PIT".

Rajeeva Karandikar

- Gave lectures at conferences.

- Gave online lectures at various universities and institutions.

Sahil Mhaskar

- Attended Gandalf 2020.

- Attended Highlights 2020.

Sayan Mukherjee

- Attended the online summer school move in June 2020.

- Presented paper during FSTTCS 2020.

Sayantani Datta

- Visited IIT-Chennai in February 2020 and gave talks.

- Visited ICTS, Bangalore in August 2020 and gave talks.

- Visited LISA symposium XIII in September 2020 and gave talks.

- Visited IAGRG, IIT-Gandhinagar in December 2020.

Shanmugapriya P

- Visited IMSc (Chennai Strings Meeting) in December 2020 and gave talks.

- Visited CERN Winter School on Supergravity, Strings and Gauge Theory 2021 (online) in February 2021.

Sourav Roychowdhury

- Visited Institute of Mathematical Sciences (IMSc) in @Chennai Strings Meetings 2020 (virtually) and gave talks.

Sourish Das

- Gave invited lecture at Pfizer on the Covid19 forecast.

B Srivathsan

- Gave a talk at a meeting of a French ANR project TickTac.

- Gave a talk at a working group seminar at LSV, ENS Paris-Saclay.

Sharad Sane

- Gave a talk on "Stirling Numbers" in the preparatory School for the CIMPA school (on Interpolation Formulae) at Ruia College, Mumbai, in December, 2020.

- Webinar participation as a Resource person: In the Memory of Professor S.S.Shrikhande, Mathematics Department, Mumbai University, in May 2020.

Sundari Maddala

- Participated in Analysis and Probability Research Group seminars since August 2020.

- Attended NCM workshop on Harmonic analysis from in December 2020.

T R Govindarajan

- Gave lectures on Trends in Physics, Particle Physics in May 2020 at SRV School, Trichy, for teachers.

Venkatesh Vinayakarao

- Visited IBM Research in July 2020.

- Visited SSN Institutions in August 2020 and gave talks.

18   Other Professional Activities

A K Kapoor

- Wrote a chapter of a book to be published by Springer Verlag as part of their series "Springer Briefs".

- Worked on computer assisted evaluation.

Amitabh Virmani

- Contributed to the work of the Indian Association of Physics Teachers.

- Edited a volume of "GERG" titled the Fuzzball Paradigm.

- Helped with setting up some national level question-papers for Indian Association of Physics Teachers.

- Member of VVN thesis award committee for IAGRG.

V Balaji

- Gave a course of lectures for a part of the audience from the AIM Workshop on the details of my work on "Torsors on semistable curves"

- Gave an invited talk at Roma I on my work with Y. Pandey on Wonderful Bruhat-Tits group schemes.

- Started to work with a student on questions related to degenerations of parabolic moduli spaces.

Clare D'cruz

- Wrote reviews for Math Reviews.

- Wrote abstracts for Math-Reviews and Math Zentralblatt.

Govind Krishnaswami

- Did editorial board work for Resonance journal.

- Refereed papers for Resonance journal.

- Reviewed IIT Kanpur PhD thesis.

- Reviewing a book.

- Supervised summer intern Shivangi Dhiman on mechanics and geometry.

- Supervised summer project of Ankit Yadav on dynamical systems.

- Wrote a book on classical mechanics.

Himalay Senapati

- Classification of vectorization identities.

- Complex network-based measure of chaos.

H S Mani

- Conducted a three day workshop at christ church college, kanpur on elements of quantum information in March 2021.

- Wrote a book.

Keshab Chandra Bakshi

- Gave a talk at CMI on lattices of intermediate subalgebras.

K G Arun

- Chair of the editorial team of the testing general relativity paper by LIGO collaboration.

- Coorganizer of ICTS summer school on gravitational wave astronomy.

- Referee for Physical review Letters.

- Scientific organizing committee of astronomical society of India meeeting.

K Narayan Kumar

- Chair, Steering Committee, FSTTCS.

- Deputy Leader, Indian Team to IOI 2020.

- Organizing Committee, Workshop on Research Highlights in Programming Languages (Online).

K V Subrahmanyam

- Organized a GCT webinar.

- Weekly webinar on recent progress in geometric complexity theory.

Madhavan Mukund

- PC member, APLAS 2020.

- Team Leader, IOI 2020.

Mandira Mondal

- Attended CAZoom-Virtually bringing together commutative algebra and related fields, A online seminar held in April 2020.

- Attended online talks in Virtual Commutative Algebra Seminar.

- Attended Virtual Commutative Algebra Seminar, which is being held via Google meet, organised by Prof. J. K. Verma and Prof. A. V. Jayantan.

Mandayam Srivas

- Served as Examiner for PhD Dissertation at IIT Bombay.

Usha Mahadevan

- Conducted aviation English language proficiency tests for ATCOs at AAI, Chennai.

- Coordinated and conducted debates for students, attended and participated in book lovers club.

- Coordinated for CMI magazine.

- Gave feedback as well as edited short stories by students.

- Organised book discussions.

- Prepared content for online course, in English.

- Did translation of Tirukkural in English.

Mythily Ramaswamy

- Evaluated CRG research proposals for the PAC meeting in December 2020, as a core committee member of PAC of SERB.

- Evaluated research proposals for CSIR Mathematical Sciences Research Committee meeting in November 2020.

- Finalized the invited speakers list for a special session in ICM 2022, as a member of an international panel for ICM 2022.

Oorna Mitra

- Worked as a mentor for Online Foundational Course in Mathematics, MTTS in October 2020.

Priyavrat Deshpande

- Organized online dicussion meetings on applications of Borsuk-Ulam theorem.

Pranjal Dutta

- Reviewed subtitles for the videos of the NPTEL course "Arithmetic Circuit Complexity" by Prof. Nitin Saxena.

- Sub-reviewed a journal paper for Journal of Complexity.

M Praveen

- Coordinated corporate career and internship placements for students.

- Reviewed for CONCUR conference.

Shuchita Goyal

- Co-organiser (with anurag singh) of webinar series - catgt.

Sourish Das

- Program committee on StatFin21 conference.

B Srivathsan

- Programme Committee of 18th International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS 2020).

- Acted as PhD examiner of Victor Roussanaly (University of Rennes, France).

- Appointed as Secretary for Indian Association for Research in Computing Science for a second term.

Sharad Sane

- Convened a Symposium on Graph Theory and Combinatorics (in the memory of the late Professor S.S.Shrikhande), Indian Mathematical Society, Annual Meeting at Vellore, in December, 2020.

- Board of Studies meeting (online), Fergusson College, Pune, in March 2021.

- Editorial Board Member, Indian Journal of Pure and Applied Mathematics in March 2021,

- Referee work on a paper submitted to the European Journal of Combinatorics (ongoing).

Sudeshna Roy

- Gave a talk on Graded components of local cohomology modules II, in the CMI-seminar, in December 2020.

Sundari Maddala

- Life member of Ramanujan Mathematical Society.

Tanya Kaushal

- Examiner for a Master's thesis.

- Gave a Talk at CMI AG seminar on "(Not) Irreducible Symplectic Varieties in Characteristic 2".

Venkatesh Vinayakarao

- Gae a talk at Qualcomm on "Why should software developers care for mathematics?".

- Gave a lecture on Information Retrieval at the NPTEL special lecture series.

- Session Chair for 3rd International Conference on Computational Intelligence in Data Science.

19 Other Online Seminars

- Paramjit Singh, Humboldt University of Berlin. Gave a talk on "Transversality and symmetry for pseudoholomorphic covers" (August 2020).

- Gerard Berry, College de France. Gave a talk on "Math and Informatics, ever more fruitful interactions" (November 2020).

- Deborshee Sen, Postdoctoral Associate, SAMSI, and Department of Statistical Science, Duke University, USA. Gave a talk on "Scalable Monte Carlo algorithms for Bayesian inference" (November 2020).

- Nithin Varma, Univ of Haifa. Gave a talk on "Algorithms for Massive Datasets: Efficiency and Corruption-Resilience" (December 2020).

- Pranabendu Misra, Max-Planck Institute for Informatics, Saarbrucken, Germany. Gave a talk on "An optimal approximation algorithm for Feedback Vertex Set in Tournaments" (December 2020).

- Srimathy Srinivasan, University of Colorado, Boulder. Gave a talk on "Finiteness theorems on algebraic groups with good reduction" (December 2020).

- Ramya C., TIFR. Gave a talk on "Algebraic Complexity Theory: A gripping tale of two polynomials" (January 2021).

- Uma Girish, Princeton University (USA). Gave a talk on "Quantum Logspace Algorithm for Powering Matrices with Bounded Norm" (January 2021).

- Ratul Mahanta, HRI. Gave a talk on "Introductory lecture on WZW models" and "Modular Averages for WZW Correlators, and $N \leftrightarrow k$ Correspondence" (February 2021).

- Madhusudhan Raman, TIFR. Gave a talk on "Virasoro Algebra, Representation Theory, and Conformal Blocks" and "Zamolodchikov Recursion and Modular Symmetry" (March 2021).