Chennai Mathematical Institute

Annual Report

April 2019–March 2020

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1 Preface

Chennai Mathematical Institute (CMI) is a deemed university with a difference. For the past two decades, CMI has attracted best students wishing to pursue mathematics to the high quality undergraduate and postgraduate programmes at CMI.

CMI specialises in Mathematics, Computer Science and Physics. CMI faculty are active researchers, comparable to the best in leading institutions in the country. The focus areas of research in mathematics includes algebraic geometry, commutative algebra, number theory, and operator algebras, representation theory and topology. In computer science the focus areas are automata theory, concurrent systems, verification, algorithms, computational complexity and machine learning. Focus areas in physics are theoretical and mathematical physics, gravitational astronomy and string theory.

Many CMI researchers are experts in their subject areas and several senior faculty members are members of national and international academic societies and bodies dealing with policies.

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 Sciences. In addition, CMI offers PhD programmes in Mathematics, Computer Science and Physics.

The BSc and MSc programmes in Mathematics, Physics and Computer Science at CMI have always had a strong research focus. An overwhelming majority of CMI students go on to join PhD programme at the best institutions across the world, including Caltech, Harvard, MIT, University of California, Berkely, Stanford, Yale, Carnegie-Mellon, Cornell, Urbana-Champaign Illinois, John Hopkins, NYU and Princeton in USA, Oxford in UK, ENS Paris in France, the Max Planck Institutes and Humboldt University in Germany as well as the IITs, IISERs, IMSc, ISI and TIFR in India, not to mention CMI itself. The MSc Data Science programme enables the students to take up the much sought after jobs in industry in the emerging area of analytics and data science.

CMI has made significant contributions to India's scientific manpower. CMI graduates are now faculty members at institutions such as ISI, IITs, IISERs, IIMs, IMSc and CMI, as well as researchers in organizations such as Microsoft Research India. During the last decade, CMI students have taken up careers in sectors such as finance, insurance and data analytics that require a strong background in mathematics, statistics and computing. Over the last decade, mathematics has come to the centerstage due to availability of huge chunks of data and cheap computing power at our finger tips. This has led to the excitement around BigData, Analytics, Machine learning. We hope to make a bigger impact in this area too.

CMI has received support from the Government, primarily through the Department of Atomic Energy. CMI has also received funding from the UGC and DST. One of CMI's unique features is that many private sources have also contributed generously to its growth.

During the year CMI faculty and students continued to make their mark on the mathema-

tical scene in the country. As the year came to an end, we faced the global pandemic. We hope to deal with it as best as possible and continue to make our mark in years to come.

Rajeeva L. Karandikar
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    Professor, Azim Premji University, Bangalore

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    Distinguished Professor, Chennai Mathematical Institute, Chennai

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    Director-Emeritus, Chennai Mathematical Institute, Chennai

14. K.V. Subrahmanyam
    Professor, Chennai Mathematical Institute, Chennai

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    Professor, Indian Institute of Technology Bombay, Mumbai

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Computer Science

1. K.V. Subrahmanyam (CMI), Chair
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5. K. Narayan Kumar (CMI)
6. V. Vinay (LimberLink, Bangalore)
7. V. Balaji (CMI, Chair, Board of Studies in Mathematics)

Physics

1. V.V. Sreedhar (CMI), Chair
2. K.G. Arun (CMI)
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Undergraduate Studies

1. Pramathanath Sastry (CMI), Chair
2. V. Balaji (CMI)
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	Pramathanath Sastry
	S. Senthamarai Kannan
	Shiva Shankar (Until December 2019)
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Associate Professors	
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Arpita Nayak
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Biplab Paul (Until November 2019)
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Kumari Saloni (Until December 2019)
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Adjunct Professors

Manindra Agrawal
T. R. Govindarajan
Ramesh Hariharan
R. Jagannathan
S. Kesavan
V. Lakshmibai
Ashok Kumar Kapoor
H. S. Mani

Neeraj Kayal
Raghav Kulkarni
Usha Mahadevan
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S. Ramanan
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R. Sridharan
K. Srilata
Mandayam Srivas
S Ramasubramanian (Until April 2019)
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V. Swaminathan
A. Thyagaraja
V. Vinay

Research Scholars

Aashish Satyajith
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Abhijeet Ghanwat
Abhishek T Bharadwaj
Aditya N K Subramaniam
Adwitee Roy
Aishik Chattopadhyay
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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.

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.

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.

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.

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.

Shiva Shankar

Shiva Shankar received his B.Tech. (Electrical Engineering) from the Indian Institute of Technology, Delhi (1978) and his Ph.D. from SUNY, Stony Brook (1983).

He has been an Assistant Professor, at the Department of Applied Mathematics, SUNY, Stony Brook (1983–84), a Visiting Fellow at the School of Mathematics, Tata Institute of Fundamental Research, Bangalore (1984–88), an Associate Professor at the Department of Electrical Engineering, Indian Institute of Technology, Bombay (1988–2000).

Visiting Positions include Institute of Mathematical Sciences, Chennai, and at Mathematics Institute, University of Groningen.

His research interests are Partial Differential Equations, Mechanics and Control Theory.

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.

Sourav Chakraborty

Sourav Chakraborty received his B.Sc. from Chennai Mathematical Institute (2003), M.S. from University of Chicago (2005) and Ph.D. from University of Chicago (2008).

He has been a Post-doctoral researcher at Technion, Israel (2008-2009) and a Post-doctoral researcher at CWI, Amsterdam (2009-10).

His research interests are Complexity and Algorithms

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.

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.

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.

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

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.

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.

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.

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.

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.

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.

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.

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.

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) anda Visiting Fellow at the Chennai Mathematical Institute (2012-15).

His research interest are: Topology, Combinatorics and Algebra.

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.

Vijay Ravikumar

Vijay Ravikumar received his BA in Mathematics from Amherst College, Amherst MA (2006), Ph.D. in Mathematics from Rutgers University, New Brunswick NJ (2013).

He has been a Graduate Coordinator for the DIMACS REU program (2007-08), a Teaching Assistant at Rutgers University (2007-13), a Postdoctoral Fellow at TIFR, Mumbai (2013-14) and a Postdoctoral Fellow at CMI, Chennai (2015-16).

His research interests are: Quantitative methods for improving sustainability and Bioinformatics and population genetics.

8 Achievements

- CMI team (Sreejata Bhattacharyya, Rajat De, Debjit Paria) qualified for ACM ICPC World Finals, May 2019.

9 Research Activities

Computer Science

In Computer Science work was carried in several areas as summarized below.

In program analysis and program verification work was done on developing techniques to help scale formal methods to large software through abstractions, invariant generation and modular decomposition, extending strategy iteration to recursive functions, disjunctive invariants generation via max-strategy iteration, modular techniques for safety verification and on verification of actor like programming languages.

In the analysis of timed systems work was done on active learning for event clock automata, adding time constraints to negotiation systems, better algorithms to check reachability in timed automata in the presence of diagonal constraints, obtaining good independence relations between actions of networks of some subclasses of timed automata, on partial order reduction techniques for networks of timed automata, investigating automata learning algorithms for a specification formalism called Expressive Decision Tables, and on the correctness of local-time semantics for networks of timed systems.

In the area of automata,logics and distributed systems work done includes studying temporal logic of repeating values with a translation to automata, synthesis problem for the temporal logic of repeating values, on a distributed automata model for capturing context-sensitive languages, on the decidability of distributed asynchronous games, verifying flat FIFO systems by simulating them using counter systems, reachability in flat counter systems, distributed graph automata for defining graph languages, establishing complexity results on imperfect information games of finite duration, on separability and expressive completeness for logics over partial ordered structures, on verifying automata augmented with channels, analysis of message sequence charts, on decision problems for some extensions of vector addition systems, verification of Read-Write Memory having weaker memory models using bad-patterns technique, robustness of asynchronous programs with respect to weak memory models, formal models for speculation and other complex behaviour in replicated datatypes, verification problem for multilevel consistency in replicated data-stores, distributed games with causal memory strategies, synthesis problems for negotiation systems and on the expressive power of distributed graph automata.

On the theory of databases work was done on query preserving watermarking schemes for locally tree-like databases some non-regular tree languages, on verification of database driven systems with data and qualitative languages defined by quantitative automata, verification of database driven systems and on data driven program analysis.

In the area of computer security work was done on quantifying information flow in protocols using discrete notion of information for Russian card type of problems, on solving the derivability and active intruder problem for Dolev-Yao enhanced with existentially quantified assertions and on the active intruder problem with unbounded nonces.

In geometric and algebraic complexity theory work was done on permanents/Hamiltonian permanents of low rank matrices, computing permanents/Hamiltonian permanents of low rank matrices modulo small primes, polynomial identity testing over non-commutative rings and its variants and lower bound for restricted arithmetic circuits.

In algorithms work was done on improved upper bounds to O[log n] time in a CREW (Concurrent Read Exclusive Write Random Access machine) machine model for problems like planar s-t reachability, planar breadth first search, planar depth first search (undirected), edit distance, parallel complexity of recursive planar separators, dynamic complexity of planar problems, variations on the quasi NC algorithm for bipartite perfect matching, dynamic complexity of approximation, finding faster exact exponential and FPT algorithms for 3-path vertex cover, improving known FPT algorithms for edge Hamiltonian path, improving the known FPT algorithm for minimum fill-in parameterized by vertex cover number, improving the approximation algorithm for finding a large subset of points in general position, finding a WQO-based algorithm for point-line cover, exact exponential-time algorithms for algebraic problems, parameterized complexity of permanent and its variants, on matchings in the presence of one-sided preferences and lower quotas, finding popular matchings in many-to-one setting when ties are allowed, exploring Primal-Dual based approach to find maximum envy-free matchings and designing an approximation algorithm for a matching with minimum blocking pairs in the hospital-residents problem with both upper and lower quotas on hospitals.

Work was also done on image processing for drone imagery, on SO(2) equivariant classifiers and trying to build a theory explaining empirical results obtained earlier on universal attacks for equivariant classifiers.

Mathematics

Work continued in the following areas: algebraic geometry, commutative algebra, (geometric) representation theory, number theory, combinatorics, algebraic and differential topology, operator theory, and probability and statistics.

Algebraic geometry:

- *Linear systems:* Seshadri constants and positivity of linear systems on algebraic surfaces of general type and Grassmann bundles over curves, Symbolic powers, bounded negativity and Harbourne constants on algebraic surfaces. Containment, regularity and Waldschmidt constant,
- Minimal rational curves in Bott-Samelson-Demazure-Hansen varieties,
- *Derived categories:* moduli of point objects in the derived category of the intersection of two quadrics, towards the Torelli theorem for the moduli of bundles on a curve by derived techniques,

- A conjecture of Narasimhan on the existence of a semi orthogonal decomposition of a given form of the derived category of the moduli of bundles on a curve,
- A Torelli-type theorem for the derived category of an elliptic surface following work of Rajan and Subramanian,
- A Hodge/Galois theoretic criterion for derived equivalences of genus 1 fibered surfaces,
- Vector bundles and Torsors: construction of a flat degeneration of the moduli space of semistable G-torsors when the smooth curve degenerates to an irreducible nodal curve, to give an intrinsic definition of (semi)stability for a G-torsor on an *irreducible nodal curve*,
- Towards a solution of two longstanding questions in the field of torsors on singular curves,
- Poincare polynomial of Gieseker's degeneration, Torelli theorem, degeneration of moduli of SL_2 bundles,
- Residues and duality: general transitivity relations for duality functors for maps of formal scheme, transitivity relations as applied to smooth maps of formal schemes and establishing residue formulas for such maps.

Commutative algebra:

- Solving a conjecture of Ryo Takahashi,
- Invariants of finite groups in positive characteristics, finite group actions in positive characteristics and flat families of Gorenstein rings, free resolutions of Gorenstein rings,
- On Boij's conjecture on the minimal free resolution of generic Gorenstein rings,
- Integral closure of ideals and annihilators of Koszul homology,
- The Hilbert function of local Artinian complete intersections in co-dimension 3, on a family of Gorenstein K-algebras,
- Cohen-Macaulayness of Rees algebras, on the Buchsbaumness of associated graded rings of filtration,
- The almost minimal value of the second normal Hilbert coefficient,
- Hilbert-Kunz density function and related invariants on projective toric set up,
- Itoh's conjecture on the vanishing of third normal Hilbert coefficient.

(Geometric) Representation theory:

- Schubert Calculus on the full flag variety G/B (in types A, B, C, and D),
- The 'B-side' of tue mirror symmetry of the Grassmannian,
- The GIT quotient of minimal Schubert varieties admitting semi-stable points in the Grassmannian $G(r, n)$ for the action of a maximal torus in $SL(n, C)$,
- The automorphism group of Schubert varieties and Bott-Samelson-Demazure-Hansen varieties for the Kac-Moody groups,
- Connections between Chari-Loktev bases for local Weyl modules in type A with the other known bases given in terms of the so called alcove paths,
- The stability of Feigin-Makedonskyi bases for local Weyl modules in type A,
- Tangent bundle on BSDH varieties in Kac-Moody set up,
- Rigidity of Bott-Samelson-Demazure-Hansen for F_4 and G_2,
- Finding a PBW filtered bases for local Weyl modules of the current algebra.

Number theory:

- The inter-relation between an open question of Hardy in 1919 and another question of Mahler,
- Multiple zeta values and multiple Apery-like sums,
- Linear independence and valuation criteria of certain algebraic numbers in connection to infinite series,
- Extension a work of Corvaja and Zannier on distribution of certain exponential sequences mod 1,
- On a p-adic analogue of a theorem of Baker Birch and Wirsing,
- Representations of the p-adic groups and applications to automorphic forms and Geometric Langlands program.

Operator Theory:

- The classification problem of CCR flows,
- Multi-parameter generalization for E_0-semigroups and Quantum Gaussian states.

Combinatorics:

- Ryser Design Conjecture.

Differential and Algebraic Topology:

- Defining a discrete Morse Function on the quotient space obtained from the action of Z_2 on cyclopermutohedron, with a view to the computation homology groups,
- Computing the homotopy type of intervals in the dual of face poset of cyclopermutohedron,
- Configuration spaces of graphs and polygonal linkages,
- Computation of curvature of polygon spaces,
- A problem related to asphericity of polygon spaces,
- Construction of a discrete Morse function on the set of all bi-cyclically ordered partitions,
- A problem related to the generators of unoriented Goldman Lie algebra,
- Embedding problems of smooth and contact manifolds,
- Linear independence of length functions on Teichmuller space associated to simple closed curves,
- Computations of topological complexity.

Probability and Statistics:

- Martingales, some questions in stochastic calculus,
- Questions related to enlargement of filtration in the theory of stochastic integrals,
- Modeling risk and return with Dirichlet process prior,
- Regularization and variable selection with Copula Prior
- Sparse portfolio selection via Bayesian multiple testing,
- Goodness of fit tests for stationary sequence of discrete random variables using empirical probability generating functions,
- Understanding Sea Ice Melting via Functional Data Analysis,
- Characterization of catastrophic instabilities.

Physics

Research in Physics at the Chennai Mathematical Institute during the year 2019-2020 is summarised below.

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

- developing a method to extract the physical nature and parameters of gamma ray burst (GRB) jets using the coincident observations of gravitational waves (GW) and gamma rays, and exploring the differences in the galactic environments in which short and long GRB explosions occur,
- implementing a Bayesian algorithm to test the binary black hole nature of the LIGO-Virgo gravitational wave events, studying the unique signatures of black hole horizons, studying the effect of orbital eccentricity in the parameter estimation, measuring the redshift evolution parameters of binary neutron stars, and testing the multipole structure of compact binaries,
- performing parameter estimation analysis for various gravitational wave detectors and a space-based detector, studying stealth biases accompanied in the GW parameter estimation by virtue of the differences in the underlying signal and the assumed signal model, devising a new figure of merit to compare the performances of third generation gravitational wave detectors,
- devising new methods to test the true nature of gravity and presence of exotic compact objects using gravitational wave observations of LIGO, testing multipole structure of post-Newtonian theory.

In the area of Nonlinear Dynamics, the research was focussed on

- studying perturbations of a regularized vortex sheet and a conservative regularization of gas dynamics, modelling shocks, generalizing single-field KdV equation to multi-field density, velocity and pressure equations using density-gradient energy,
- examining the relation between the added mass effect and the Higgs mechanism,
- periodic solutions and their stability and chaos in the classical three-rotor problem and its quantum generalization,
- the integrability, phase space structure, action-angle variables, and information ellipsoid volume analysis using Fisher matrix of a mechanical reduction of a dual to the two-dimensional principal chiral model.

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

- on a problem related to the Faddeev-Kulish states of Yang Mills theory, the relation between the classical and the quantum BCJ double copy,
- understanding the relationship between positive geometry and scattering amplitudes, understanding modern techniques in computation of scattering amplitudes in generic quantum field theories, understanding infrared issues in gauge theories and gravity, classical derivation of classical soft theorem, dressed states and asymptotic symmetries in YM theory, locating Stokes polytopes in the worldsheet,
- factorization problem in AdS/CFT, finding the two-point correlation function of extreme BTZ black holes, generalised Garfinkle-Vachaspati transform with dilaton, quasinormal modes of supersymmetric three-charge microstates, conserved charges in asymptotically de Sitter spacetimes, BMS at timeline infinity and event horizon, supertranslations.
- AdS2 dilaton gravity theories arising from dimensional reduction of higher dimensional theories, investigating certain N-level generalizations of ghost-spins and their entanglement properties, renormalization group flows and c-functions, de Sitter gravity and topics in black hole physics,
- D-branes in string theory and their possible bound states and the spectral flows which carry one state to another, preliminary studies on timelike Liouville theory and supercritical strings, problems related to de Sitter charges, study of null energy conditions intrinsically, understanding the computation of correlation functions of twist operators in D1-D5 CFT,

In the area of Quantum Entanglement research was focussed on

- studying the dependence of the von Neumann entropy on the statistics parameter of one-dimensional anyons,
- calculating pair correlation functions of one-dimensional anyons,
- effects of quantum channels on quantum Fourier Transform,
- thermal rectification using coupled cavity-atom system, extension of Jaynes-Cummings model to two-level systems in external gravitational field,

Research was also carried out in some miscellaneous areas viz.

- phenomenological implications of renormalizability of axial vector gauge theory,
- exact solution of some reflection and transmission problems using quantum Hamilton-Jacobi formalism,
- investigation of shape invariance in higher dimensions and field theory.

10 Publications

Journal Articles

Computer Science

J1 Partha Mukhopadhyay and Suryajith Chillara: *Depth-4 Lower Bounds, Determinantal Complexity: A Unified Approach*, Computational Complexity, Vol. 28, No.4 (2019) 545–572.

J2 Govind R, Paul Gastin and Amaldev Manuel: *Logics for Reversible Regular Languages and Semigroups with Involution*, to appear in Developments in Language Theory 2019.

J3 F. Herbreteau, B. Srivathsan, T.T. Tran and I. Walukiewicz: *Why liveness for timed automata is hard, and what we can do about it?*, to appear in ACM ToCL.

J4 Samir Datta, Anish Mukherjee, Thomas Schwentick, Nils Vortmeier and Thomas Zeume: *A Strategy for Dynamic Programs: Start over and Muddle through*, Logical Methods in Computer Science 15(2) (2019).

J5 Geevarghese Philip, Varun Rajan, Saket Saurabh and Prafullkumar Tale: *Subset Feedback Vertex Set in Chordal and Split Graphs* Algorithmica, Vol 81, Issue 9, pp 3586-3629 (https://link.springer.com/article/10.1007%2Fs00453-019-00590-9).

J6 Arnab Bhattacharyya, Ashutosh Gupta, Lakshmanan Kuppusamy, Somya Mani and ANkit Shukla, Mandayam Srivas and Mukund Thattai: *A Formal Methods Approach to Predicting New Features of the Eukaryotic Vesicle Traffic System*, to appear in Acta Informatica.

J7 R Ramanujam, Vaishnavi Sundararajan and S P Suresh: *The complexity of disjunction in intuitionistic logic*, to appear in Journal of Logic and Computation,
DOI: https://doi.org/10.1093/logcom/exaa018.

J8 F Herbreteau, B Srivathsan, T.T Tran and I Walukiewicz: *Why liveness for timed automata is hard and what we can do about it*, ACM Transactions on Computational Logic, Volume 21, Issue 3.

Maths

J9 Krishna Hanumanthu, Indranil Biswas, D. S. Nagaraj and Peter E. Newstead" *Seshadri constants and Grassmann bundles over curves*, to appear in the journal Annales de l'Institut Fourier.

J10 Parangama Sarkar: *Rees' theorem for filtrations, multiplicity function and reduction criteria^î* Journal of pure and applied algebra (https://doi.org/10.1016/j.jpaa.2019.06.010).

J11 R Srinivasan, Tiju Cherian and B.V. Rajarama Bhat: *Infinite mode quantum Gaussian states*, Reviews in Mathematical Physics Vol. 31, No. 0 (2019) 1950030 DOI: 10.1142/S0129055X19500302.

J12 S. Senthamarai Kannan and Pinakinath Saha: *Rigidity of Bott-Samelswon-Demazure-Hansen variety for F_4 and G_2*, Proceedings of Indian Academy Sciences, Vol. 130, no.19 (2020).

J13 Purusottam Rath and Abhishek Bharadwaj: *On a question of Baker over arbitrary number fields*, to appear in Mathematika.

J14 Keshab Chandra Bakshi and Ved Prakash Gupta: *A note on irreducible quadrilaterals of II_1 factors*, International journal of Mathematics, Vol 30, 2019.

J15 Sarjick Bakshi, Senthamarai Kannan and K V Subrahmanyam: *Torus Quotients of Richardson varieties in the Grassmannian*, to appear in Communications in Algebra.

J16 Rajeeva Karandikar, Sourish Das and Abhay Bhatt: *Normalization of Marks in Multi-Session Examinations* to appear in Current Science.

J17 Abhishek T Bharadwaj: *A short note on generalised Euler-Briggs constants*, to appear in International Journal of Number Theory.

J18 Clare D'Cruz: *Resurgence and Castelnuovo-Mumford regularity of certain monomial curves in A^3*, to appear in Acta Mathematica Vietnamica.

J19 Clare D'Cruz and Shreedevi Masuti: *Symbolic blowup algebras and invariants of certain monomial curves in an affine space,* , Communications in Algebra, Volume 48 Issue 3.

J20 Clare D'Cruz and Mousumi Mandal: *Symbolic blowup algebras and invariants associated to certain monomial curves in P^3*, to appear in Comm. Alg.

J21 Rajiv Sambasivam, Sourish Das and Sujit Sahu: *A Bayesian perspective of statistical machine learning for big data.*, to appear in Computational Statistics.

J22 Krishna Hanumanthu and Aditya Subramaniam: *Bounded negativity and Harbourne constants*, to appear in Manuscripta Mathematica.

J23 Ian M. Aberbach and Parangama Sarkar: *Frobenius Betti numbers and syzygies of finite length modules*, to appear in Proc. Amer. Math. Soc.

J24 Nirupama Mallick and K. Sumesh: *On a generalization of Andos dilation theorem*, to appear in Acta Scientiarum Mathematicarum.

J25 Arpita Nayek, Santosha Kumar Pattanayak and Shivang Jindal: *Projective normality of torus quotients of flag varieties*, to appear in Journal of Pure and Applied Algebra.

J26 B. V. Rajarama Bhat, Robin Hillier, Nirupama Mallick and Vijaya Kumar U: *Roots of completely positive maps*, Linear Algebra and its Applications, Vol. 587 (2020) 143–165.

J27 Tushar Parulekar and Sharad Sane: *Some Results on the Ryser Design conejcture*, Journal of Combinatorial Designs 2020 pages 349-357, https://doi.org/10.1002/jcd.21699

J28 Tushar Parulekar and Sharad Sane: *Some Results on the Ryser Design conejcture-II*, Linear and Multilinear Algebra DOI: 10.1080/03081087.2019.1710104.

J29 Tushar Parulekar and Sharad Sane: *Some Results on the Ryser Design conejcture-III*, to appear in Journal of Algebraic Combinatorics.

J30 Sharad Sane: *Survey Paper with title: "Equiangular lines in the real space R^d"* , Proceedings of the Conference in honour of S.H.Kulkarni, IIT Madras (SHKFEST2018), Published in the Journal of Analysis, February, 2020. https://doi.org/10.1007/s41478-020-00227-z.

J31 D L Gonçalves and P Sankaran, P Wong: *Twisted conjugacy in free products*, to appear in Communications in Algebra.

J32 Arpita Nayek and Santosha Kumar Pattanayak: *Torus quotient of Richardson varieties in Orthogonal and Symplectic Grassmannians*, Journal of Algebra and Its Applications (2020) 2050186 (24 pages) DOI: 10.1142/S0219498820501868.

Physics

J33 Subhroneel Chakrabarti, Deepali Mishra, Yogesh K. Srivastava and Amitabh Virmani: *Generalised Garfinkle-Vachaspati Transform With Dilaton* Class. Quant. Grav. 36 (2018) no.12, 125008.

J34 K.G. Arun: *Tests of General Relativity with GW170817*, LIGO Scientific Collaboration and Virgo Collaborations, to appear in Physical Review Letters. (Member of the paper writing team on behalf of the collaboration) in June 2019.

J35 A.K. Kapoor: *Stochastic quantization of axial vector gauge theories with fermions*, to appear in Modern Physics Letters https://doi.org/10.1142/S0217732319501761.

J36 Dileep P. Jatkar, Kedar S. Kolekar and K. Narayan: *N-level ghost-spins and entanglement*, Physical Review D, Volume 99, Issue 10, page 106003-1 to 106003-19, arXiv id:-arXiv: 1812.07925 [hep-th].

J37 Aneesh P B, S.J. Hoque, and A. Virmani: *Conserved charges in asymptotically de Sitter spacetimes*, Classical and Quantum Gravity, Volume 36, Number 20 DOI: 10.1088/1361-6382/ab3be7.

J38 Shilpa Kastha, Anuradha Gupta, K.G. Arun, B.S. Sathyaprakash and Chris Van Den Broeck: *Testing the multipole structure and conservative dynamics of compact binaries using gravitational wave observations: The spinning case*, Phys. Rev. D 100, 044007, 2019.

J39 G.S. Krishnaswami and T. R. Vishnu: *Invariant tori, action-angle variables and phase space structure of the Rajeev-Ranken model*, J. Math. Phys. 60, 082902 (2019) [arXiv:1906.03141].

J40 T.R. Govindarajan and Nikhil Kalyanapuram: *Stueckelberg Bosons as an Ultralight Dark Matter Candidate*, arXiv:1902.08768, Modern Phys Letts (2019).

J41 Athira P V and A. Manu: *Classical double copy from color kinematics duality: A proof in the soft limit*, Physical Review D, Vol. 101, No. 4 (2020) 046014.

J42 S. Borhanian, K.G. Arun, H. Pfeiffer and B. S. Sathyaprakash: *Comparison of post-Newtonian mode amplitudes with numerical relativity simulations of binary black holes*, Class. Quantum Grav. 37 065006 (2020).

J43 T.R. Govindarajan and Sumanta Chakraborty: *Embedding into flat spacetime and black hole thermodynamics* , Mod. Phys. Lett. A 34, 2050013 (2019).

J44 Govind S Krishnaswami and Himalaya Senapati: *Ergodicity, mixing and recurrence in the three rotor problem*, To appear in Chaos 30(4), 2020 (to appear).

J45 LIGO and Virgo collaboration including K. G. Arun: *GW190425: Observation of a Compact Binary Coalescence with Total Mass 3.4Mo*, to appear in Astrophysical Journal.

J46 A.H. Anupam and Athira P V: *Generalised coherent states in QCD from asymptotic symmetries*, Phys. Rev. D, Vol. 101, No. 6 (2020) 066010.

J47 Govind S Krishnaswami, Sachin S Phatak, Sonakshi Sachdev and A Thyagaraja: *Nonlinear dispersive regularization of inviscid gas dynamics*, AIP Advances, 10(2), 025303 (2020).

J48 K. Narayan: *On de Sitter future-past extremal surfaces and the "entanglement wedge"*, to appear in Phys. Rev. D, arXiv:2002.11950 [hep-th].

J49 M. Saleem, L. Resmi, K.G. Arun and S. Mohan: *On the Energetics of a Possible Relativistic Jet Associated with the Binary Neutron Star Merger Candidate S190425z*, Astrophysical Journal 891, 130 (2020).

J50 Muhammed Saleem: *Prospects of joint detections of neutron star mergers and short-GRBs with Gaussian structured jets*, Monthly Notices of the Royal Astronomical Society, Vol. 493, No. 2 (2020) 1633-–1639.

J51 H.S. Mani, Ramadas N and V. V. Sreedhar: *Quantum Entanglement in One-Dimensional Anyons*, Phys. Rev A 101, 022314.

J52 Subramanya Hegde, Bindusar Sahoo, and Aravindhan Srinivasan: *Relaxed hypermultiplet in four dimensional N = 2 conformal supergravity*, Physical Review D, Vol. 101, No. 6 (2020) 066012.

J53 Govind S Krishnaswami and Sachin S Phatak: *The Added Mass Effect and the Higgs Mechanism: How accelerated bodies and elementary particles can gain inertia*, Resonance 25(2), 191 (2020).

Conference Papers

Computer Science

C54 Kavitha Gopal, Meghana Nasre, Prajakta Nimbhorkar and T Pradeep Reddy: *Many-to-one Popular Matchings with Two-sided Preferences and One-sided Ties*, to appear in COCOON 2019.

C55 Meghana Nasre, Prajakta Nimbhorkar and Nada Pulath: *Classified Rank-Maximal Matchings and Popular Matchings – Algorithms and Hardness*, to appear in WG 2019.

C56 M. Praveen and Alain Finkel: *Verification of Flat FIFO Systems*, CONCUR 2019 (The 30th International Conference on Concurrency Theory), Amsterdam, the Netherlands, August 26-31, 2019.

C57 Partha Mukhopadhyay, V. Arvind, Abhranil Chatterjee and Rajit Datta: *Efficient Black-box Identity Testing for Free Group Algebras*, Schloss Dagstuhl - Leibniz-Zentrum für Informatik, LIPIcs, Vol. 145, 57:1–57:16 (2019).

C58 A Baskar, R Ramanujam and S P Suresh: *Dolev-Yao theory with associative blindpair operators* to appear in CIAA 2019, Kosice, Slovakia, July 2019.

C59 Geevarghese Philip, Varun Rajan, Saket Saurabh and Prafullkumar Tale: *Subset Feedback Vertex Set in Chordal and Split Graphs*, Published in the Proceedings of the 11th International Conference on Algorithms and Complexity, CIAC 2019. Part of LNCS volume 11485, Available online at: https://link.springer.com/chapter/10.1007%2F978-3-030-17402-6_30.

C60 Govind R, Frederic Herbreteau, B Srivathsan and Igor Walukiewicz: *Revisiting local-time semantics for networks of timed automata*, CONCUR 2019: 16:1 - 16:15.

C61 Sandesh Kamath, Amit Deshpande and K V Subrahmanyam: *On adversarial robustness of Small versus Large batch training*, poster presented at ICML 2019 Workshop on Understanding and Improving Generalization in Deep Learning, Long Beach, California, June 2019.

C62 Sandesh Kamath, Amit Deshpande and K V Subrahmanyam: *Better generalisation with adaptive adversarial training*, poster presented at ICML 2019 Workshop on Understanding and Improving Generalization in Deep Learning, Long Beach, California, June 2019.

C63 Paul Gastin, Sayan Mukherjee and B Srivathsan: *Fast Algorithms for Handling Diagonal Constraints in Timed Automata*, CAV 2019: 41 - 59.

C64 Parosh Aziz Abdulla, C. Aiswarya, Mohamed Faouzi Atig and Marco Montali: *Reachability in Database-driven Systems with Numerical Attributes under Recency Bounding*, Proceedings of the 38th ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems (PODS) 2019: 335-352

C65 M. Praveen and Agnishom Chattopadhyay: *Query Preserving Watermarking Schemes for Locally Treelike Databases*, to appear in FSTTCS 2019 (39th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science), December 11–13, 2019, Indian Institute of Technology Bombay.

C66 Partha Mukhopadhyay, V. Arvind, Abhranil Chatterjee and Rajit Datta: *On Explicit Branching Programs for Rectangular Determinant and Permanent Polynomials*, Schloss Dagstuhl - Leibniz-Zentrum für Informatik, LIPIcs, Vol. 149, 38:1–38:13 (2019).

C67 Partha Mukhopadhyay, V. Arvind, Abhranil Chatterjee and Rajit Datta: *Fast Exact Algorithms using Hadamard Product of Polynomials*, to appear in FSTTCS 2019.

C68 Muthuvel Murugan and K V Subrahmanyam: *SO(2)-equivariance in Neural networks using Fourier nonlinearity*, poster presented at the British Machine Vision conference, 2019.

C69 Prajakta Nimbhorkar, Kavitha Gopal, Meghana Nasre and T. Pradeep Reddy: *Many-to-one Popular Matchings with Two-Sided Preferences and One-Sided Ties*, COCOON 2019, Springer Lecture Notes in Computer Science, Vol. 11653 (2019) 193–205.

C70 S.P. Suresh, A Baskar and R Ramanujam: *Dolev-Yao theory with associative blindpair operators*, CIAA 2019, Kosice, Slovakia, July 22–25, 2019.

C71 Daniel Lokshtanov, Pranabendu Misra, Joydeep Mukherjee, Fahad Panolan, Geevarghese Philip and Saket Saurabh: *2-Approximating Feedback Vertex Set in Tournaments*, Proceedings of the 2020 ACM-SIAM Symposium on Discrete Algorithms, SODA 2020, 1010–1018.

C72 H Gimbert, S Paul and B Srivathsan: *A Bridge between polynomial optimization and games with imperfect recall*, to appear in AAMAS 2020 (Conference on Autonomous Agents and Multi-Agent Systems).

C73 Ahmed Bouajjani, Constantin Enea, Madhavan Mukund, Gautham Shenoy R. and S.P. Suresh:: *Formalizing and Checking Multilevel Consistency*, VMCAI 2020, Springer LNCS 11990, 379-400.

C74 Geevarghese Philip, Rani M. R. and Subashini R.: *On Computing the Hamiltonian Index of Graphs*, to appear in the 15th International Computer Science Symposium in Russia (CSR 2020).

C75 Samir Datta, Chetan Gupta, Rahul Jain, Vimal Raj Sharma, Raghunath Tewari: *Randomized and Symmetric Catalytic Computation*, to appear in CSR 2020.

Humanities

C76 Usha Mahadevan: *Upanishadic message in Sri Aurobindos Vasavadutta* to appear in ELTAI (English Language Teachers Association of India) Golden Jubilee conference scheduled in October, at New Delhi.

Collection Articles

Computer Science

C77 Madhavan Mukund, Gautham Shenoy R., S. P. Suresh: *Bounded Version Vectors using Mazurkiewicz Traces*, to appear in Advanced Computing and Systems for Security: Volume Eleven.

Maths

C78 Clare D'Cruz: *Symbolic powers, set-theoretic complete intersection and certain invariants*, to appear in Telangana Academy of Sciences.

Book Chapters

Computer Science

B79 Jean Goubault-Larrecq, S. Halfon, Prateek Karandikar, K. Narayan Kumar and Philippe Schnoebelen: The Ideal Approach to Computing Closed Subsets in Well-Quasi-Orderings. in *Well-Quasi Orders in Computation, Logic, Language and Reasoning*, Springer Trends in Logic, Vol 53, Pages 55–107, 2020.

Preprints

Computer Science

P80 Prem Krishnaa, Girija Limaye, Meghana Nasre and Prajakta Nimbhorkar: Maximum-Size Envy-Free Matchings.

P81 M. Praveen and Agnishom Chattopadhyay: Query Preserving Watermarking Schemes for Locally Treelike Databases.

P82 Partha Mukhopadhyay, V. Arvind, Abhranil Chatterjee, and Rajit Datta: On Explicit Branching Programs for the Rectangular Determinant and related Polynomials.

P83 Frederic Herbreteau, R Keerthan, B Srivathsan, R Venkatesh and Sagar Verma: Formal Semantics for Expressive Decision Tables.

P84 Snigdha Athaiya, Raghavan Komondoor and K. Narayan Kumar: Data Flow Analysis of Asynchronous Systems using Infinite Abstract Domains.

P85 Sandesh Kamath, Amit Deshpande and K V Subrahmanyam: Universal adversarial attacks using very few test samples.

P86 Vikraman Arvind, Abhranil Chatterjee, Rajit Datta and Partha Mukhopadhyay: *Multiplicity Equivalence Testing of Automata over Partially Commutative Monoids.*.

P87 Daniel Lokshtanov, Pranabendu Misra, Fahad Panolan, Geevarghese Philip and Saket Saurabh: *A (2 + ϵ)-factor Approximation Algorithm for Split Vertex Deletion.*

P88 Fedor Fomin, Petr Golovach, Lars Jaffke, Geevarghese Philip and Danil Sagunov: *Diverse Pairs of Matchings.*

P89 Pranjal Dutta, Nitin Saxena and Thomas Thierauf: *Lower bounds on the sum of 25th-powers of univariates lead to complete derandomization of PIT.*

P90 V. Arvind, Abhranil Chatterjee, Rajit Datta and Partha Mukhopadhyay: *Multiplicity Equivalence Testing of Automata over Partially Commutative Monoids.*

P91 C. Aiswarya and Paul Gastin: *Weighted Tiling Automata: Evaluation Complexity.*

P92 M. Praveen: *What you must remember when transforming data words.*

Maths

P93 Purusottam Rath, Ajit Bhand and Sanoli Gun: A note on lower bounds of heights of non-zero Fourier-coefficients of Hilbert cusp forms.

P94 Keshab Chandra Bakshi and Ved Prakash Gupta: On orthogonal systems, two-sided bases and regular subfactors.

P95 Keshab Chandra Bakshi and Vijay Kodiyalam: Commuting square and planar subalgebras.

P96 Krishna Hanumanthu and Indranil Biswas: An ampleness criterion for line bundles on abelian varieties.

P97 B.V. Rao: Marginal Sufficiency.

P98 Praveen Kumar Roy: Seshadri constants on surfaces of general type.

P99 Pramathanath Sastry and Suresh Nayak: Grothendieck Duality and Transitivity I: Formal Schemes (Available at http://in.arxiv.org/abs/1903.01779).

P100 Pramathanath Sastry: Grothendieck Duality and Transitivity II: Traces and Residues via Verdier's isomorphism (Available at http://in.arxiv.org/abs/1903.01783).

P101 Clare D'Cruz: Resurgence and Castelnuovo-Mumford regularity of certain monomial curves in $\mathbb{A}^3$, arXiv:1904.05797

P102 Clare D'Cruz and Mousumi Mandal: Symbolic blowup algebras and invariants associated to certain monomial curves in $\mathbb{P}^3$, arXiv:1904.00556.

P103 Priyavrat Deshpande, N. Manikandan and A. Singh: On the topology of bi-cyclopermutohedra.

P104 Sharad Sane and Tushar Parulekar: On the Ryser Design conjecture-I.

P105 Sharad Sane and Tushar Parulekar: On the Ryser Design conjecture-II.

P106 M. Badra, D. Mitra, M. Ramaswamy and J-P Raymond: Stabilizability of time periodic evolution equations by finite dimensional controls.

P107 Krishna Hanumanthu and Brian Harbourne: Real and complex supersolvable line arrangements in the projective plane.

P108 Krishna Hanumanthu, Marcin Dumnicki, Luja Farnik, Grzegorz Malara, Tomasz Szemberg, Justyna Szpond, and Halszka Tutaj-Gasinska: Negative curves on special rational surfaces.

P109 Michel Brion and S. Senthamarai Kannan: Minimal rational curves on generalized Bott-Samelson varieties.

P110 Michel Brion and S. Senthamarai Kannan: Some combinatorial aspects of generalised Bott-Samelson varieties.

P111 R. Srinivasan: CCR flows and CAR flows over convex cones.

P112 Sourish Das, Bharathi Manjula. K and Jehadeesan R: Causal Impact of Web Browsing and Other Factors on Research Publications.

P113 Priyavrat Deshpande, Anurag Singh and Naageswaran M.: Higher independence complexes and their homotopy types.

P114 Pramathanath Sastry: Differential operators on Cousin complexes.

P115 Kumari Saloni: The Buchsbaumness of the associated graded rings of filtrations.

P116 Mandira Mondal: *β-density function on projective toric varieties.*

P117 Shuchita Goya and Rekha Santhanam: *(Lack of) Model structures on the category of graphs.*

P118 P. Philippon and Purusottam Rath: *A note on traces of powers of algebraic numbers.*

P119 Sabine El Khoury, Manoj Kummini and Hema Srinivasan: *An upper bound for the higher Hilbert coefficients of Gorenstein algebras and modules.*

P120 Priyavrat Deshpande, Samir Shukla and Anurag Singh: *Distance r-domination number and r-independence complexes of graphs.*

P121 Avijit Nath and Parameswaran Sankaran: *Equivariant cobordism of generalized Dold manifolds.*

P122 Priyavrat Deshpande and Anurag Singh: *Higher Independence Complexes of graphs and their homotopy types.*

P123 Shuchita Goya and Rekha Santhanam: *Lovasz' original lower bound: Getting tighter bounds and Reducing computational complexity.*

P124 V. Balaji: *Torsors on semistable curves and the problem of degenerations..*

P125 P Sankaran and P Wong: *Twisted conjugacy and commesurabiltiy invariance .*

P126 O Mitra and P Sankaran: *Twisted conjugacy classes in general and special linear groups over polynomial algebras over finite fields..*

P127 Daciberg Gonçalves, Parameswaran Sankaran and Peter Wong: *Twisted conjugacy in geometric 3-manifolds.*

Physics

P128 Shilpa Kastha, Anuradha Gupta, K.G. Arun, B.S. Sathyaprakash and Chris Van Den Broeck: Testing the multipole structure and conservative dynamics of compact binaries using gravitational wave observations: The spinning case, arXiv:1905.07277.

P129 M. Saleem, L. Resmi, K. G. Arun and S. Mohan: On the energetics of a possible relativistic jet associated with the binary neutron star merger candidate S190425z, arXiv:1905.00337.

P130 K.G. Arun: Extreme Gravity and Fundamental Physics, arXiv:1903.09221.

P131 G.S. Krishnaswami and T. R. Vishnu: Invariant tori, action-angle variables and phase space structure of the Rajeev-Ranken model, arXiv:1906.03141 (7 June 2019).

P132 G. S. Krishnaswami and H. Senapati: Classical three rotor problem: periodic solutions, stability and chaos, arXiv:1811.05807 (14 May 2019).

P133 Muhammed Saleem: Multimessenger detections of binary neutron star mergers and their inclination angle distributions (https://arxiv.org/abs/1905.00314).

P134 Muhammed Saleem: On the energetics of a possible relativistic jet associated with the binary neutron star merger candidate S190425z (https://arxiv.org/abs/1905.00337).

P135 K. Narayan: de Sitter entropy as entanglement, arXiv:1904.01223 [hep-th], awarded "Honorable Mention", May 2019, in the Gravity Research Foundation 2019 Competition for Essays in Gravitation.

P136 R. Parthasarathy: Issues of Confinement in QCD.

P137 B. Chakrabarty, D. Ghosh, and A. Virmani: Quasinormal modes of supersymmetric microstate geometries from the D1-D5 CFT, arXiv:1908.01461 [hep-th].

P138 N. V. Krishnendu, M. Saleem, A. Samajdar, K. G. Arun, W. Del Pozzo and Chandra Kant Mishra: Constraints on the binary black hole nature of GW151226 and GW170608 from the measurement of spin-induced quadrupole moments, arXiv: 1908.02247.

P139 Anuradha Gupta, Davide Gerosa, K. G. Arun, Emanuele Berti and B. S. Sathyaprakash: Black holes in the low mass gap: Implications for gravitational wave observations, arXiv: 1909.05804.

P140 G. S. Krishnaswami and T. R. Vishnu: Finding conserved quantities for a dynamical system: The idea of a Lax pair.

P141 S. Roychowdhury and P. K. Tripathy: The non-Abelian T-dual of Klebanov-Witten Background and its Penrose Limits, arXiv:1907.01904 [hep-th].

P142 T.R. Govindarajan and Rakesh Tibrewala: Asymptotic symmetries from edge states.

P143 Muhammed Saleem C: Constraints on the binary black hole nature of GW151226 and GW170608 from the measurement of spin-induced quadrupole moments (https://arxiv.org/abs/1908.02247).

P144 Vivek Lohani, Nishant Abhangi, Sitikantha Das and Amitabh Virmani: *A Jarring Bullet.*

P145 K. Narayan: *On de Sitter future-past extremal surfaces and the "entanglement wedge".*

P146 Govind Krishnaswami andVishnu T R: *The idea of a Lax pair - Conserved quantities for a dynamical system.*

P147 Govind Krishnaswami and Vishnu T R: *The idea of a Lax pair - Continuum wave equations.*

P148 Govind S Krishnaswami and T R Vishnu: *The idea of a Lax pair - Part I: Conserved quantities for a dynamical system.*

P149 Govind S Krishnaswami and T R Vishnu: *The idea of a Lax pair - Part II: Continuum wave equations.*

Ph.D. Thesis

T1 Rajiv Sambasivan: Some Computational Approaches for Machine Learning on Big Datasets (July 2019).

T2 Sourav Das: On Generalised Parabolic Hitchin Pairs (July 2019).

T3 Anish Mukherjee: Static and Dynamic Complexity of Reachability, Matching and Related Problems (August 2019).

T4 Praveen Kumar Roy: Seshadri constants on algebraic surfaces (December 2019).

T5 Krishnendu N.V: Testing the binary black hole nature of compact binary mergers using gravitational-wave observations (December 2019).

T6 Debangshu Mukherjee: Aspects of entanglement and hydrodynamics in hyperscaling violating Lifshitz(hvLif) theories (January 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 cooperation with the Institute of Mathematical Sciences (IMSc), Chennai. These programmes tap the teaching talent available at the elite research institutes of the country, which are normally outside the university system. Students are thus exposed to lectures by active researchers who bring a very different perspective to the teaching.

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

In 2019, the twentysecond batch of students was admitted to the undergraduate programme. At the end of the first semester, 58 opted for B.Sc. in Mathematics and Computer Science. The second year B.Sc. class has 20 students in Mathematics and Computer Science and the third year B.Sc. class has 25 students. Out of the 26 students of the 2016 batch who took their degrees at the convocation in July 2019, several have been placed in very prestigious institutions.

- Agnishom Chattopadhyay
  PhD in Computer Science, Rice University, USA
- Amit Behera
  MSc in Computer Science, Ben-Gurion University, Israel
- Aparna Shankar
  PhD in Computer Science, TIFR, Mumbai
- Ashwani Anand
  MSc in Computer Science, CMI

- C V Sriram
  MSc in Mathematics, CMI
- Debam Biswas
  MSc in Mathematics, ALGANT (University of Regensburg, Germany)
- Deeparaj Bhat
  PhD in Mathematics, MIT, USA
- Kanekar Rahul Raphael Amlesh
  MSc in Mathematics, ISI, Bangalore
- Kelkar Dhruva Rasesh
  MSc in Mathematics, ALGANT (University of Duisburg-Essen, Germany)
- Kishlaya Jaiswal
  MSc in Computer Science, CMI
- Krishnendu Bhowmick
  MS in Advanced Combinatorics, MIPT, Russia
- Mohammad Saif Anwer
  M Stat, ISI, Delhi
- Nivedita Ganesh
  MS in Computing, Entrepreneurship and Innovation, New York University, USA
- Parasuram Venkatesh
- Rajat De
  MSc in Computer Science, CMI
- Raut Aditya Arun
  PhD in Algorithms, Combinatorics and Optimization, Carnegie-Mellon University, USA
- S Viswanathan
- Sandeep S
  PhD in Mathematics, TIFR, Mumbai
- Satya Prakash Nayak
  MSc in Computer Science, CMI
- Sreejata Kishore Bhattacharya
  MSc in Computer Science, CMI

- Sricharan A R
  MSc in Computer Science, CMI
- Subham Jaiswal
  MSc in Computer Science, CMI
- Swaminath M
- Zubin Duggal
  MSc in Computer Science, CMI
- Kousik K
  Credt Suisse
- Rao Shrisha Shripathi
  MSc in Computer Science, CMI

B.Sc. (Hons.) Mathematics and Physics

Of the 64 students admitted to the undergraduate programme in 2019, 6 students opted for B.Sc. in Mathematics and Physics as the end of the first semester. The second year class has 2 students. The third year class has 6 students. Out of the 2 students of the 2016 batch who took their degrees at the convocation in July 2019, several have been placed in very prestigious institutions.

- Gayathri S
  PGDM, XLRI, Jamshedpur
- Nikhil Kalyanapuram
  PhD in Physics, Perimeter Institute, University of Waterloo, Canada

M.Sc. Mathematics

In 2019, 3 students have joined the programme. There are 11 students in the second year of the programme. 7 students who joined the programme in 2016 have completed the programme successfully.

- Arghya Datta
- Naageswaran M
- Paramjit Singh
  PhD in Mathematics, Berlin Mathematicsl School, Germany

- Raiean Banerjee
- Sambit Senapati
  PhD in Mathematics, University of Illinois at Urbana-Champaign, USA
- Sridhar V
  PhD in Mathematics, University of Michigan, Ann Arbor, USA
- Utsabraj Sarkar

M.Sc. Computer Science

In 2019, 19 students have joined the programme. There are 20 students in the second year of the programme. 14 students who joined the programme in 2017 have completed the programme successfully.

- Balasubramanian A R
  PhD in Computer Science, Technical University of Munich, Germnany
- Aashish Satyajith
  PhD in Computer Science, CMI
- Arijit Shaw
  Research Intern, National University of Singapore
- Bhargav C S
  PhD in Computer Science, IIT Kanpur
- Jeetsagar Ghorai
- Kush Grover
  PhD in Computer Science, Technical University of Munich, Germnany
- Mirza Ahad Baig
  PhD in Computer Science, IST, Austria
- Pankaj Kumar
  PhD Applied Mathematics, Charles University, Prague, Czech Republic
- Rajarshi Roy
  PhD in Computer Science, Max Planck Institute for Software Systems, Germany
- Ritam Raha
  PhD in Computer Science, University of Antwerp, Belgium
- Souvik Parial
  PhD in Mathematics, IIT Guwahati

- Thejaswini K S
  PhD in Computer Science, University of Warwick, UK
- Utsab Ghosal
- Vasudha Sharma
  Indian Army (Combined Defence Service)

M.Sc. Applications of Mathematics

4 students who joined the programme in 2017 have completed the programme successfully.

- Koustav Chakraborty
- Nitish Mahato
  Data Scientist, Ford India, Chennai
- Sohail Hossain
- Suriya Selvarajan

M.Sc. Data Science

In 2019, second batch of 39 students joined the programme. There are 25 students in the second year of the programme.

Convocation

The 17th Annual Convocation of CMI was held on 29 July 2019. Degrees were awarded to 58 successful candidates at various levels. Of these, 28 were B.Sc. candidates, 26 were M.Sc. candidates and 4 were a Ph.D. candidate. Prof. K. VijayRaghavan, F.R.S., Principal Scientific Adviser, Government of India was the Chief Guest and delivered the convoation address.

For the B.Sc. programmes, the CMI Gold Medal of Excellence was awarded to Deeparaj Bhat in Mathematics and Computer Science and Nikhil Kalyanapuram in Mathematics and Physics for their outstanding performance at the undergraduate level. For the M.Sc. programmes, the CMI Gold Medal of Excellence was awarded to Sridhar V & Sambit Senapati in Mathematics and Balasubramanian A R in Computer Science.

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

- Abhishek Rawat did internship at Coriolis Technologies Pvt. Ltd.,Pune under Sudhir Kumar on "Big Data Tools (like Apache Spark)" during May – July 2019.
- Saptarsi Ghosal did internship at IIsc Bangalore under Manjunath Krishnapur on "Random Walks on Electric Networks" during May – July 2019.
- Abhishek Hegde K R did internship at IIT Bombay under P Ramadevi on "Quantum groups and Conformal Field Theory" during May – July 2019.
- Sridhar Venkatesh did internship at Australian National University under James Borger & Anand Deopurkar on "Local fields & Moduli of Curves" during May – July 2019 under the program "Future Research Talent Award".
- Agnishom Chattopadhyay did internship at LaBRI, Bordeaux under Anca Muscholl & Filip Mazowiecki on "Weighted Automata / Streaming String Transducers" during May - July 2019.
- Thejaswini K S did internship at Laboratoire SpÈcification et VÈrification (LSV), Cachan, France under Paul Gastin & Stephan Schwoon on "Distributed Synthesis" during February – June 2019.
- Mirza Ahad Baig did internship at LabRI, University of Bordeaux, France under Corentin Travers on "k-Set Agreement in Asynchronous Shared Memory Systems" during May – July 2019.
- Namrata did internship at LIP6, Sorbonne University, Paris. under Vincent Viallat Cohen-Addad on "Algorithmic Fairness" during May - July 2019.
- Aishwary R did internship at Skylark Drones, Bangalore under Mugilan T R on "Crop detection and counting" during May – July 2019.

- Ashwani Anand did internship at Laboratoire Bordelais de Recherche en Informatique, Bordeaux, France under Jérôme Leroux & NathanaÎl Fijalkow on "Complexity of games with multiple objectives with universal graphs" during May – July 2019.

- Satya Prakash Nayak did internship at Aix-Marseille University, Marseille, France under Jean Marc Talbot on "Minimization of visibly pushdown automata" during May – July 2019.

- Deeparaj Bhat did internship at ENS, Paris under Nicolas Tholozan on "Higgs Bundles and Non-Abelian Hodge Correspondence" during May – June 2019.

- Dia did internship at cole polytechnique fÉdÉrale de Lausanne, Lausanne, Switzerland under Subhadeep Banik, LASEC group on "Optimisation of ring arithmetic in cryptographic protocols" during May – July 2019.

- Ekanshdeep Gupta did internship at Laboratoire SpÉcification et VÉrification (LSV), ENS Paris-Saclay, Paris under Alain Finkel on "Characterization of well-structured counter machines" during May – july 2019.

- Arkaprava Sinha did internship at Teradata, Hyderabad under Vijayasaradhi Gannavaram on "Topic Modeling, Clickstream Analysis" during May – July 2019.

- Rohit Singh did internship at Intellect Design Arena SIPCOT IT PARK on "OCR (Optical Character Recognition) by DeepLearning" during May – August 2019.

- Anant

  – did summer reading course at Chennai Mathematics Institute, Chennai, under Sukhendu Mehrotra on "Commutative Algebra" (read the book "Introduction to Commutative Algebra" by M.F. Atiyah and I.G. MacDonald), "Algebraic Curve Theory" (read the book "Algebraic Curves: An Introduction to Algebraic Geometry" by W. Fulton) and "Riemann Surfaces" (read the book "Algebraic Curves and Riemann Surfaces" by R. Miranda) during June – July 2019.

  – did summer reading course at Indian Institute of Science, Bangalore, under Apoorva Khare, on "Representation Theory" (read the book "Introduction to Representation Theory" by P. Etingof et al) during May 2019.

  – was Instructor, Team-Selection-Test designer and grader, at the International Mathematical Olympiad Training Camp, 2019, conducted at Homi Bhabha Center for Science Education, Mumbai, during April – May 2019. Worked as an instructor of the Indian Team participated in the International Mathematical Olympiad, 2019, held at Bath, United Kingdom, in July 2019.

- Arya Vadnere did internship at IIT Kanpur under Bidyut Sanki on "Hyperbolic geometry" for a period of one month.

- Devang Agarwal did internship at ISI Kolkata under Ritabrata Munshi in number theory as part of the Indian Academy of Sciences Summer Research Fellowship (SRF) programme during June – July 2019.

- Purnendu Ghosh did internship at at Noida, Uttar Pradesh under Adarsh Jain (CDS of Octro Inc.) on "To Create a poker Bot using Reinforcement Learning" during May – July 2019.

- Aritra Banerjee did internship at LatentView Analytics, Chennai under Ganesh Sankaralingam on "Online Experimentation, A/B testing" during May – July 2019.

- S V Aswannth did internship at

  - Computer Science and Automata Dept., IISc under Vijay Natrajan on "Symmetry Detection and Visualization" during May – July 2019.
  - Mathematics Dept., IISc under Ved Datar on "Introduction to Differential topology, Gauss Bonnet theorem" during May – July 2019.

- Subhasish Basak did internship at Laboratoire des Signaux et Systemes (L2S UMR8506), Ecole CentraleSupelec, Universite Paris-Saclay. Gif-sur-Yvette, France under Emmanuel Vazquez on "Reviewing Python toolboxes implementing Gaussian Process regression" during May – July 2019.

- Deepak M S did internship at Centre for Excellence in Basic Sciences (UM - DAE CEBS) , University of Mumbai under Balwant Singh on "Commutative algebra" during May – July 2019.

- Pushkar Sathe did internship at Ford Motors, Chennai under Prabhanjan Tattar (Manager, Ford Motors) on "Confidence intervals for complex parameters estimated through simulation and re-sampling techniques", "Data processing for Segmentation Analysis, inclusive of variable creation and multiple data sources", "Code Standardization for Dynamic Fitting of System of Equations Model" and "SAAR Modeling For Converting the Annual Sales Volume into Monthly Sales" during May – July 2019.

- Parthiv Chakrabarty did internship at Kolkata under T Parthasarathy on "Game Theory" during June – July 2019.

- Nikhil V did internship at Temenos-Banglore under Durga Prakash on "Fraud detection in Banking".

- Amit Behera did internship at Tata Institute of Fundamental Research, Mumbai, India. under Jaikumar Radhakrishnan on "Quantum Computing and Quantum Information Theory" during May – July 2019.

- Rohan Khaitan did internship at Intellect Design Arina, Chennai under Kishore Kumar Uthirapathy on "Named Entity Recognition" during May - August 2019.

- Siddharth G did internship at IIT Kanpur under Amit Kuber on "Model Categories" during June – July 2019.
- Ananth Krishna Duggirala did internship at IMSc, Chennai under Venkatesh Raman on "Algorithms" during May – June 2019.
- Sarvesh Sunil Bandhaokar did internship at Skylark Drones Pvt. Ltd., Bangalore under Mughilan Thiru Ramasamy & Kavita Sutar on "Machine Learning".
- Aditya Prakash did internship at Chennai Mathematical Institute underK V Subrahmanyam on "Young Tableaux in connection with symmetric functions and representations of symmetric groups, general linear groups and quantum groups" during June – July 2019.
- Devesh Rajpal did internship at IISc, Bangaluru underHarish Seshadri on "Riemannian Geometry" during June – July 2019.
- Sankalp did internship at Temenos Banglore under Durga Prakash Devarakonda "on Explainable AI and currently working on Payment repair Module" during May – July 2019.
- Anirban Bose did internship at Genesys, Chennai on "Optimization" during May – July 2019.
- Afrad Muhamed Basheer did internship at Genesys Telecom Labs, Chennai on "Optimization/ Integer Programming" during May – July 2019.
- Shrisha Rao did internship at Department of Computer Science, University of Warwick under Dmitry Chistikov & Ranko Lazic on "Bounds on Positive Integral Solutions of Linear Diophantine Systems using Steinitz's Lemma" during June – July 2019.
- Ashwin Bhaskar did internship at Dept. of Informatics and Mathematics, Technical University of Munich, Germany under Jan Kretinsky, on "Verified Model Checkers - Isabelle generated code for MEC decomposition" during May – July 2019.
- Krishna did internship at Firm Risk Management-Division of Morgan Stanley Mumbai in the stress testing and Portfolio risk team on "Automation of Credit Value Adjustment Model" during May – July 2019.
- Trina De did internship at Morgan Stanley Advantage Services(Mumbai), Firm Risk Management Division Mumbai under Arijit Das (Vice President, Model Risk Management) on "Validating performance of Market Risk Valuation Model and development of web-based application on Dash for model and variable testing" during May – July 2019.
- Ameya Kamat did internship at Quadratyx, Hyderabad on "Machine learning, Data Science" during May – July 2019.

- Sagarika did internship at Temenos India under Durga Prakash, SVP, Temenos on "AI model to automate Payments in Banking software" during May – July 2019.
- Ankita Sarkar did internship at ISI Kolkata under Sourav Chakraborty on "'Online Algorithms" during May – July 2019.
- Dhruv Nevatia did internship at IIT Goa under Amaldev Manuel on "Algebraic Automata Theory - Varieties of Reversible Regular Languages" during June – July 2019.

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 2019, Deeparaj Bhat visited the ENS.

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 r'esearch projects with the ENS faculty.

13 Undergraduate/Graduate Courses

August – November 2019

Advanced Algorithms	:	Prajakta Nimbhorkar
Algebraic Surfaces II	:	Krishna Hanumanthu
Algebraic Geometry I	:	Krishanu Dan
Algebra I	:	Purusottam Rath
Algebra III	:	Clare D'Cruz
Algebra IV	:	V Balaji
Algebraic Curves	:	Biswajit Rajaguru
Design & Analysis of Algorithms	:	Samir Datta
Advanced Machine Learning	:	Madhavan Mukund/Sourish Das
Analysis I	:	M Sundari
Analysis III	:	R Srinivasan
Calculus	:	Sukhendu Mehrotra
Commutative Algebra II	:	Manoj Kummini
Commutative Algebra	:	Parangama Sarkar
C*-algebras and W*-algebras	:	Keshab Chandra Bakshi
Classical Mechanics	:	T R Govindarajan
Classical Mechanics I	:	A K Kapoor
Concurrency Theory	:	Madhavan Mukund/Aiswarya Cyriac
Convex optimization	:	K V Subrahmanyam
Complexity Theory II	:	Partha Mukhopadhyay
Coding Theory	:	Sharad Sane
Discrete Mathematics	:	B Srivathsan
Data Mining & Machine Learning	:	Madhavan Mukund
DS Seminar	:	Speaker
Electrodynamics	:	R Parthasarathy
English	:	Usha Mahadevan
Enviroment Course	:	Speaker/Movie
Graduate Algebra I	:	Upendra Kulkarni
Graduate Analysis I	:	T R Ramadas
German	:	Pavithra Ravishankar
Geometric Group Theory	:	Arpan Kabiraj
Games on Graphs II	:	B Srivathsan
Graduate Topology I	:	Shiva Shankar
Gravitational Waves	:	K G Arun

Information Retrieval	:	V Venkatesh
Laboratory 1	:	K G M Nair
Lie Algebra	:	Senthamarai Kannan
Linear Algebra	:	Kavita Sutar
Mathematical Logic	:	M Praveen
Intro to Manifolds	:	Parameswaran Sankaran
Marxism and the Contemporary World	:	Viren Murthy
Mathematical Methods-Analysis	:	Kavita Sutar
Mathematical Physics	:	Alok Laddha
Optimization Techniques	:	T Parthasarathy
Proofs and Types	:	S P Suresh
Intro to PDE	:	Mythily Ramaswamy
Programming & Data Structures with Python	:	K Narayan Kumar
Intro to Programming (Haskell)	:	S P Suresh
Probability & Statistics With R	:	Rajeeva Karandikar
Quantum Mechanics I	:	G Rajasekaran
Quantum Mechanics	:	V V Sreedhar
Rigid Analytic Geometry	:	Pramathanath Sastry
Regression & Classification	:	Sourish Das
Representation Theory of Finite Groups	:	Mandira Mondal
RDBMS, SQL, & Visualization(Oct-Nov,2 credits)	:	Sourish Das/V Venkatesh
SMT for Synthesis	:	M Srivas
Stochastic Processes I	:	B V Rao
Statistical Mechanics	:	H S Mani
Topological Data Analysis	:	Priyavrat Deshpande/Sourish Das
Theoretical Foundations of Computer Science	:	K V Subrahmanyam
Theory of Computation	:	Aiswarya Cyriac
Thermal Physics	:	Govind Krishnaswami
Time Series Analysis	:	V Swaminathan
Values Through Literature	:	Usha Mahadevan

January - April 2020

Algebraic Geometry II	:	Suratno Basu
Algebra II	:	Clare D'Cruz
Design & Analysis of Algorithms	:	Geevarghese Philip
Analysis II	:	Pramathnath Sastry
Advanced Programming	:	Samir Datta
Bayesian Data Analysis	:	Sourish Das
Big Data with Hadoop	:	Venkatesh V
Black Hole Dynamics from QFT	:	Alok Laddha
Complex Analysis	:	Manoj Kummini
Classical Mechanics II	:	Alok Laddha
Complex Analysis	:	Priyavrat Deshpande
Completely Positive & Bounded Maps	:	Nirupama Mallick
Complexity Theory I	:	Partha Mukhopadhyay
Compact Riemann Surfaces	:	V Balaji
CS Seminar	:	Speaker
Computer Vision	:	Rukmini Vijaykumar
Data Science Colloquium	:	Speaker
Differential Equations	:	Dishant Pancholi
Discrete Mathematics	:	K V Subrahmanyam
Data Mining & Machine Learning	:	Madhavan Mukund
Economics	:	Krishanu Pradhan
Enumerative Combinatorics	:	Anurag Singh
Etale cohomology & the Weil Conjectures	:	Sukhendu Mehrotra
Electrodynamics I	:	R Parthasarathy
Environment Course	:	Speaker/Movie
Graduate Algebra II	:	Senthamarai Kannan
Graduate Analysis II	:	M Sundari
German II	:	Pavithra Ravishankar
Game Theory	:	T Parthasarathy
General Relativity	:	Amitabh Virmani
Graph Theory	:	Sharad Sane
Graduate Topology II	:	Parameswaran Sankaran
Gravitational Wave Astrophysics	:	K G Arun
Gravitational Wave Data Analysis	:	Saleem Muhammed
Interactive Theorem Prover in Coq	:	S P Suresh/M K Srivas
Linear Algebra & its Applications	:	Kavita Sutar
Laboratory	:	K G M Nair
Logic, Automata, Games	:	C Aiswarya/M Praveen
Linear Optimization	:	B Srivathsan
Mathematical Methods	:	T R Govindarajan

Model Checking & Systems Verification	:	M K Srivas
Mathematical Finance	:	V Swaminathan
Modular Invariant Theory	:	Manoj Kummini
Introduction to Modular Forms	:	Purusottam Rath
Multivariate Statistics	:	Shibasish Dasgupta
Natural Language Processing	:	Ramaseshan Ramachandran
Optics	:	H S Mani
Professional Development	:	Usha Mahadevan/V Raghu
Programming Language Concepts	:	S P Suresh/M Praveen
Probability Theory	:	Rajeeva Karandikar
Quantum Computation & Quantum Information	:	R Srinivasan
Quantum Field Theory	:	A K Kapoor
Quantum Mechanics II	:	G Rajasekaran
Renormalization Group & Conformal Field Th	:	K Narayan
Reinforcement Learning	:	K V Subrahmanyam
Stochastic Processes II	:	B V Rao
Topics in Algorithms	:	Prajakta Nimbhorkar
The Art of Short Fiction	:	M Usha
Topics in Nonlinear Dynamics	:	Govind Krishnaswami
Topology	:	Krishna Hanumanthu
Weighted Automata	:	C Aiswarya

14 Special Lectures

- V. Swaminathan: Summer School on Mathematical Finance" (6 talks) (May – June 2019).
- Rajeeva L. Karandikar: Option pricing to Summer school students (April – June 2019).
- B.V. Rao: Hear Measure, Compact Groups, Peter-Weyl Theorem (April – June 2019).
- S.P. Suresh: Interactive Theorem Proving: Part 2 (April 2019).
- S.P. Suresh: Set Theory: Reading course (April 2019).
- G. Philip: Randomized FPT Algorithms (reading course) (April 2019).
- Rajeeva L. Karandikar: Making sense of Opinion polls (April 2019).
- Pritthijit Biswas: Research Methodology Seminar: Cartan Hadamard Theorem & Synge's Theorem (April 2019).
- Aishik Chattopadhyay: Research Methodology Seminar: Riemann Roch theorem for nonsingular curves (April 2019).
- Sonakshi Sachdev: KdV-type nonlinear dispersive regularization of gas dynamics (April 2019).
- Shubham Ovhal: Research Methodology Seminar: On the Ring of Invariants of Finite Groups generated by pseudo-reflections (April 2019).
- Utsabraj Sarkar: MSc (Mathematics) thesis defence talk: Finite Dimensional Inclusion and Path Algebra (April 2019).
- Arghya Datta: MSc (Mathematics) thesis defence talk: On the Non vanishing of Dirichlet L functions using twisted molifier (April 2019).
- V. Sridhar: MSc (Mathematics) thesis defence talk: GIT and the classification of Semistable Vector Bundles over a Curve (April 2019).
- Raein Banerjee: MSc (Mathematics) thesis defence talk: Forcing and Measurable subsets of R (April 2019).
- Naageswaran M.: MSc (Mathematics) thesis defence talk: Some homology calculations using discrete Morse theory (April 2019).
- Paramjit Singh: MSc (Mathematics) thesis defence talk: J-holomorphic curves and Gromov's nonsqueezing theorem (April 2019).

- Sambit Senapati: MSc (Mathematics) thesis defence talk: Moduli space of spatial polygons (April 2019).
- Aritriya Mukhapadhyay: On Manin Mumford Conjecture (April 2019).
- Aritriya Mukhapadhyay: An Introduction to Bounded Height Conjecture (April 2019).
- P.V. Athira: Coherent States in QCD (April 2019).
- N. Ramadas: Identical particles and quantum entanglement (May 2019).
- Nirmal Kotal: Kunz's theorem (May 2019).
- Madhavan Mukund: NPTEL MOOC on Programming Data Structures and Algorithms using Python (July-September 2019).
- T R Govindarajan: What if photon has a mass? (August 2019).
- Madhavan Mukund: NPTEL MOOC on Design and Analysis of Algorithms (August-October 2019).
- S.P. Suresh: NPTEL Course on Haskell (September-October 2019).
- Siddharth Mitra: On Adaptivity in Information-Constrained Online Learning (September 2019).
- K.V. Subrahmanyam: The Singular tuples of matrices is not a null cone (September 2019).
- T.R. Ramadas: Zariski decomposition on algebraic surfaces (October 2019).
- Pramathanath Sastry: Algebraic Geometry Seminar (two talks): Residues and Duality — abstract and concrete approaches (October 2019).
- Plawan Das: Algebraic Geometry Seminar: The Mordell-Weil Theorem (October 2019).
- Sandesh Kamath: Robustness of Neural Networks (October 2019) & SVD Universal perturbations (November 2019).
- Ekanshdeep Gupta: Well Structured Problem for Presburger Counter Machines (November 2019).
- K.G. Arun: GW190425: Detection of a compact binary coalescence with total mass 3.4 Msun (January 2020).
- Himalaya Senapati: Instabilities, chaos and ergodicity in the three rotor problem (January 2020).

- Sk Jahanur Hoque: A linearized mass loss law: with or without a positive cosmological constant (February 2020).
- Sourav Roychowdhury: Non-Abelian T-dual of Klebanov-Witten Background and its Penrose limits (February 2020).
- Debodirna Ghosh: Quasinormal modes from D1-D5 CFT (March 2020).
- C. Aiswarya: Weighted Tiling Automata on Graphs: Evaluation Complexity (March 2020).

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.

- Sarang Jagdale, Opex Analytics, Pune: Tour of Data Science Technologies and its Applications (August 2019).
- Kaushik Raghavan, FLICQ, Chennai: Discussion with Kaushik on AI and ML (August 2019).
- Srinivas Bhogle, 4Pi: Datum (August 2019).
- Ashok Kalidas, Kantar Analytics, Chennai: Using Artificial Intelligence and Machine Learning to evaluate and improve Advertising: New solutions to Old problems (August 2019).
- Sandipan Ray, ICICI Bank: Application of advanced analytics and machine learning in banking (August 2019).
- Shanmugavel Sankaran, FixNix,Chennai: Prediction models of regulatory Technology world (September 2019).
- Varun Thakre, ICTS, Bengaluru: Topological Data Analysis (TDA) (September 2019).
- Manish Kumar, CRISIL: Automation in Model Development/Model Validation process (September 2019).
- Sawata Sahoo, Gartner: Data Points in High Dimension: A Problem That Still Haunts the Practitioners (October 2019).
- Mahesh Iyer, Sineflex Solutions, Hyderabad: Analytics in Healthcare (October 2019).
- Amit Godbole, Fortiate, Pune: Image based encoding for financial transactions (November 2019).
- R. S. Milton, SSN College: Bayesian Data Analysis (November 2019).
- Hrishikesh Rajpathak, Netcore solutions, Thane: Considerations while designing industrial strength recommendation engine (November 2019).
- Shankar Sivaramakrishnan, Aditya Birla Group: Bayesian Structural Time Series Forecasting (November 2019).

- Kriti Mahajan Center for Advanced Financial Research and Learning (CAFRA promoted by the RBI), Mumbai: Inflation Forecasting in Emerging Markets: A Machine Learning Approach (February 2020).
- Pradeep Vijaykumar, Opex Analytics, Chennai: Demystifying Data Engineering (February 2020).
- Santhoji Katare, Ford Motor Private Limited: Artificial Intelligence in Automotive Product Development (February 2020).
- Snehasis Mukherjee, IIIT Sricity: Recognizing Human Actions at a Distance in Video: From Bag-of-Words to Deep Neural Network Models (March 2020).
- Sanjoy Bose, Sahaj Software, Chennai: The 1,2 & 3s of a data product (March 2020).

16 Workshops/Schools/Conferences

IOI 2019 Training Camp (April -– May 2019)

The Indian team for IOI is selected at the International Olympiad in Informatics Training Camp (IOITC). IOITC-2019 was held over 10 days in Chennai during the period April — May, 2019.

Faculty for IOITC-2019:

- Arjun Arul, Codechef
- Hanit Banga, IIIT Delhi
- Parth Mittal, IIIT Delhi
- Rajas Vanjape, IIIT Hyderabad
- Rajat De, CMI
- Sreejata Bhattacharya, CMI
- Teja Vardhan Reddy, IIT Madras
- Animesh Fatehpuria, Georgia Tech
- Jatin Yadav
- Nalin Bhardwaj
- Praveen Dhinwa, Sharechat
- Sidhant Bansal, NUS
- Swapnil Gupta
- Yash Chandnani, IIT Kanpur

Summer School on Mathematical Finance 2019 (May – June 2019)

Summer School on Mathematical Finance 2019 was Jointly organized by: Chennai Mathematical Institute, Indian Academy of Sciences, Indian National Science Academy and The National Academy of Sciences.

Topics covered are: Probability and statistics, Random walk, Brownian motion, Introduction to workings of financial markets, Financial time series, Derivative pricing, Portfolio optimization and Risk management.

Faculty involved were:

- Rajeeva L Karandikar
  Chennai Mathematical Institute
- Ajay Shah
  National Institute of Public Finance and Policy
- Susan Thomas
  Indira Gandhi Institute of Development Research
- Nalini Ravishankar
  University of Connecticut
- Abhay Bhatt
  Indian Statistical Institute, Delhi
- Rituparna Sen
  Indian Statistical Institute, Chennai
- Sourish Das Chennai Mathematical Institute
- Rajiv Sambasivan
  Chennai Mathematical Institute
- V. Swaminathan
  Chennai Mathematical Institute
- Sushama Bendre Indian Statistical Institute, Chennai

Lecture Programme for students of class XI and XII, in association with National Academy of Sciences, Allahabad (July 2019)

The Chennai Mathematical Institute (CMI) organised a lecture programme for students of class XI and XII in the areas of Mathematics, Computer Science and Physics.

The following lectures were presented:

- S. Sivakumar, Krea University: Insights and imagination in physics.
- T. Subramoniam, Sathyabama Institute of Science and Technology: Animal Development: From DNA to Diversity.
- R. Balasubramanian, NCM, IIT-B: Number theory and Secure communication.
- Satyavani Vemparala, IMSc: What can computer simulations teach us about material properties?
- K.V. Subrahmanyam, CMI: The P vs NP problem.
- Padmashree Arvind Gupta: Fun of doing Science.

Workshop on Hochschild Homology, 2019 (July 2019)

The following lectures were presented in the workshop:

- Krishna Hanumanthu (CMI): Derivations, Kahler differentials, fund. exact sequences
- Sarang Sane (IIT Madras): Definition and basic properties of Hochschild homology
- Sukhendu Mehrotra (CMI): Finite separable algebras and Smooth algebras
- Manoj Kummini (CMI): Hochschild-Whitehead theorem and Converses to the Hochschild-Kostant-Rosenberg theorem
- Suresh Nayak (ISI Bengaluru): Products in Hochschild homology and Hochschild-Kostant-Rosenberg theorem

Statistical Methods in Finance 2019 (December 2019)

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

The StatFin2019 Data Science Workshop aimed to provide participants exposure to the Principles, Techniques and Tools of Data Science including their applications to quantitative finance.

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.

Writers in residence

CMI is proud to host a writers' residency programme in cooperation with Sangam House. Under this programme, CMI supports two international writers each year for a residency of 4–6 weeks.

- **TM Krishna**, a Chennai based Musician and Writer. Writer in residence in October 2019. He also gave a talk titled *Sebastian and Sons* on his forthcoming book of the same name.

- **Panagiotis Gavriiloglou**, a writer, editor, and translator based in Athens, Greece. (He writes under the pseudonym Panagiotis Kechagias.) His first book, the short story collection Final Warning, was published by Antipodes in 2016. His fiction and essays appear regularly, in print and online, both in major daily newspapers and literary journals. His translations include: Prodigals by Greg Jackson (Antipodes, 2017), Solar Bones by Mike McCormack (Antipodes, 2018), So Long, See You Tomorrow by William Maxwell (Gutenberg, forthcoming April 2020), Billy Budd by Herman Melville (Antipodes, forthcoming 2020). Furthermore, he has undertaken a new critical translation of "The Gold-Bug" by Edgar Allan Poe (Gutenberg, forthcoming). Since 2016 he has been the official Greek-to-English translator of Golden Dawn Watch, an initiative by the Hellenic League for Human Rights to monitor and document the trial of Golden Dawn, the infamous Greek neo-Nazi organization. In the past, he has been a resident at Art Omi, Hudson, NY, USA (2015), and at Sangam House, Bangalore, India (2017)

  Panagiotis was a writer in residence at CMI in February 2020. He also gave a talk titled *Crisis and Greek Fiction*.

- **Cindy Lynn Brown**, a Danish/American poet, novelist and literary translator with a degree in literature and creative writing. She has published ten books, a few them collaborations. She is translated into multiple languages and has performed at festivals throughout the world. She is also the organizer of an international poetry festival in the city of Odense, in Denmark. Cindy has experience with and a strong, particular interest in poetic and artistic collaborations and is currently working on a collaborative collection of poetry about refugees with her partner, poet Kenneth Krabat. Her latest collaboration A to B-Z to Fish, 2019 was translated into 13 languages.

  Cindy Lynn Brown was in residence at CMI in February 2020 and also gave a talk at CMI with readings from her poetry, her work method and her previous books.

Endowment Lectures at CMI

- Vidyadhar Kulkarni, Department of Statistics and Operations Research, University of North Carolina, delivered K. Madhava Sarma Memorial Distinguished Lecture on "Stochastic Models of Appointment Scheduling In Healthcare" (November 2019).

- Mahan Mj, TIFR, Mumbai delivered K. Lakshmanan Memorial Distinguished Lecture on "Random Hyperbolic Geometry" (January 2020).

- S.G. Dani, UM-DAE Centre for Excellence in Basic Sciences (CBS), Vidyanagari Campus of the University of Mumbai,Mumbai, delivered R.K. Rubugunday Distinguished Lecture on "Square roots: a historical perspective" (January 2020).

17 Conferences, Visits and External Lectures

Abhishek T Bharadwaj

- Visited Sorbonne Universite, UPMC, in July 2019.
- Visited Kerala School of Mathematics in January 2020 and gave talks.

Aiswarya Cyriac

- Visited Prof Paul Gastin, LSV, ENS Paris-Saclay, France, in June 2019.
- Gave a talk on "Reachability in Database-driven Systems with Numerical Attributes under Recency Bounding" at PODS, and FM Update.
- Visited TRDDC Pune in July 2019.
- Visited IIT Goa in March 2020 and gave talks.

Anurag Singh

- Gave a talk on "Discerte Morse theory and some homology computations" at IIT Kanpur, in May 2019.
- Visited The Fields Institute, Toronto in March 2020.

Archit Chauhan

- Visited IIT Bombay in December 2019.

Athira P V

- Visited TIFR, Mumbai in February 2020 and gave talks.
- Visited IISER Pune in February 2020 and gave talks.

Amitabh Virmani

- Visited TIFR, Department of Theoretical Physics, Mumbai.
- Attended Physics Olympiad team selection camp at HBSCE, TIFR, Mumbai.
- Visited IIIT Allahabad.

- Visited RRI Bangalore and gave a seminar on "Aretakis Instability".
- Visited AEI Potsdam.
- Attended GR22 conference, at Valencia, Spain.
- Visited ICTS, Bengaluru.
- Visited IISER TVM in January 2020 and gave talks.
- Visited IIT Madras in January 2020 and gave talks.
- Visited TIFR, Mumbai in January 2020 and gave talks.
- Visited Homi Bhabha Center for Science Education in February 2020.

V Balaji

- Visited UNC, Chapel-Hill in November 2019 and gave talks.
- Visited Columbia University, New York in November 2019 and gave talks.
- Visited University of Washington, Seattle in December, 2019 and gave talks.

Bhamidi V Rao

- Visited Indian Statistical Institute during April – June 2019 to participate in a workshop "Two random days in Probability and Statistics" and for academic collaboration and gave a talk on "Marginal Sufficiency" and "Sum set Conjecture of Erdos".
- Visited NISER Bhubaneswar, in June 2019 to lecture in "Advanced Instructional School in Stochastic processes" and gave a talk on "Discrete Probability" and "Measure Theoretic Probability".
- Visited NISER, Bhubaneswar in July 2019 and gave a lecture in the workshop on Stochastic Processes (level II).
- Visited St Berchman's College, Changanassery in January and gave talks.
- Visited Central University of Kerala, Kasargod in February and gave talks.
- Visited St Berchman's College, Changanassery in January and gave talks.
- Visited Central University of Kerala, Kasargod in February and gave talks.

Clare D'cruz

- Gave 3 talks at Summer Training Programme in Mathematics 2019, STPIM-2019 at Anna University in June 2019.
- Gave a talk on "Monomial Curves and invariants associated to them" at IWM-2019 held at IIT Bombay, in June 2019.
- Gave a talk on "Invariants associated to monomial curves in P^3 at CAAG 2019, in July 2019.
- Gave a talk on "Monomial Curves and invariants associated to them" at the 34th Annual Conference of the Ramanujam Mathematical Society, in August 2019.

Debodirna Ghosh

- Visited IISER Bhopal in December 2019.

Dharm Veer

- Visited IIT Kharagpur in December 2019.

Govind Krishnaswami

- Attended collaboration meeting with Sachin Phatak at Bengaluru, during May–June 2019.
- Attended Mid-Year-Meeting of the Indian Academy of Sciences at Indian Institute of Science, Bengaluru, in June 2019.
- Attended Editorial Board meeting of Resonance, Journal of Science Education, at Indian Academy of Sciences, Bengaluru, in June 2019.
- Gave lecture on "Introduction to Linear Spaces and Operators in Quantum Mechanics", Lectures on Unravelling Quantum Mechanics at Dwaraka Doss Goverdhan Doss Vaishnav College, Arumbakkam, Chennai, in August 2019.
- Gave courses on "Symmetries in Quantum Mechanics" and "Path integrals in quantum mechanics", Summer school on Quantum Mechanics, at Islamic University of Science and Technology, Awantipora, Pulwama, Jammu and Kashmir, during July – August 2019.
- Visited Indian Academy of Sciences, Bengaluru in January 2020.

- Visited Resonance 25th Year Conference, St Joseph's college, Bengaluru in January 2020.
- Visited Beneath a Tree, Bengaluru, Collaboration with Sachin Phatak in January 2020.
- Visited Workshop on Quantum Mechanics - A Revisit, Farook College Kozhikode, Kerala in February 2020 and gave talks.
- Visited International Conference on Complex Quantum Systems, BARC, Mumbai in March 2020 and gave talks.
- Visited International Conference on Complex Quantum Systems, BARC, Mumbai in March 2020 and gave talks.

Kumari Saloni

- Participated in a workshop in Trento, in July 2019.
- Visited Department of Mathematics, University of Genova, in July 2019 and gave a talk on "Bounding Hilbert coefficients of parameter ideals".

Parangama Sarkar

- Attended the conference on "Thematic Program in Commutative Algebra and its Interaction with Algebraic Geometry" during June 2019, at University of Notre Dame, Indiana.

Pranjal Dutta

- Attended Caleidoscope Complexity Summer School held in Institute Henri Poincare in June 2019.
- Attended and gave talk at Google PhD Fellowship Summit, 2019 in Googleplex, MTV campus in July 2019.
- Visited Dr. Rafael Oliveira at University of Toronto in July 2019.

Himalay Senapati

- Attended Workshop on "Data Analysis and Machine Learning", in May 2019, organized by IISER Tirupati and IUCAA Pune, held at IISER Tirupati.
- Visited ICTS, Bengaluru in January 2020.

B. Ravinder

- Tutor at the Instructional School for Teachers on Representation Theory held at IISER, Thiruvananthapuram during June 2019.

S Senthamarai Kannan

- Gave a talk at University of Pisa, Pisa, Italy, in June 2019.

K G Arun

- Visited Pennsylvania State University, PA, during May–July 2019 and gave a talk on "Parametrized Tests of Post-Newtonian theory using Singular Value Decomposition" in IGC@25 conference.
- Visited Pennsylvania State University during May-July 2019.
- Visited International Center for Theoretical Sciences, TIFR, Bangalore as a co-organizer of the "Future of Gravitational Wave Astronomy" meeting and chair of the panel discussion on "Post-Newtonian modelling of compact binaries" in August 2019.
- Visited Union Christian College, Aulva, Kerala to give a lecture on "Gravitational Waves" in the Introductory School on Astronomy and Astrophysics in August 2019.
- Visited IACS Kolkata in January 2020 and gave talks.
- Gave a talk at National Seminar on Gravitation at Madras Christian college.

Arpan Kabiraj

- Gave a short course on "Introduction to hyperbolic geometry" at Madhava Mathematics Competition Nurture Camp at CMI in June 2019.

Keshab Chandra bakshi

- Visited JNU, Delhi in July 2019 and gave an invited talk on "Orthogonal systems and two-sided Pimsner-Popa bases".
- Visited ISI, Kolkata in July 2019 and gave a talk on "Pimsner-Popa basis and angle between intermediate subfactors".

Kedar Shrikrishna Kolekar

- Participated in the school on "Spring School on Superstring Theory and Related Topics" at The Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy, during March – April 2019.

Krishna Hanumanthu

- Gave a talk on "Bounded negativity problem" at Commutative Algebra and Algebraic Geometry (CAAG 2019) conference, IISER Bhopal, in July 2019.
- Visited Tata Institute of Fundamental Research (TIFR), Mumbai during September 2019 to work with A. J. Parameswaran, Indranil Biswas and Nabanita Ray.
- Visited International Centre for Theoretical Sciences (ICTS), Bengaluru in January 2020.
- Visited International Centre for Theoretical Sciences (ICTS), Bengaluru in February 2020.

Madhavan Mukund

- Visited the Max-Planck Institute for Software Systems (MPI-SWS), Kaiserslautern, Germany to pursue joint research with Rupak Majumdar and Damien Zufferey, in April, 2019.
- Participated in CTiS 2019: 1st Computational Thinking in Schools Conference at Pune, in April, 2019.
- Gave two lectures on "Smart Contracts" and "From Automata to Logic" at the Post-IOI Training Camp Workshop on Topics in Theoretical Computer Science, in May, 2019.
- Attended the Bebras Task Workshop at Balatonkenese, Hungary, in May, 2019.
- Visited LaBRI, Univ Bordeaux, in May 2019 to pursue joint research with Anca Muscholl and Igor Walukiewicz as part of CEFIPRA project IOTTA.
- Visited IRIF, Univ Paris Denis-Diderot, in June 2019 to pursue joint with Ahmed Bouajjani and Constantin Enea.
- Presented four lectures in Anna University sponsored Faculty Development and Training Programme on "Problem Solving and Python Programming" at SSN College of Engineering, in June 2019.

- Keynote address at ACM India workshop on "Assessments in Computer Science and Engineering", University of Pune, in June 2019.
- Delivered a lecture entitled "Model Learning" at the Formal Methods Update Meeting, IIT Hyderabad, in July 2019.
- Delivered a lecture entitled "The Past, Present and Future of AI" at Padma Seshadri Bala Bhavan School, KK Nagar, Chennai, in July 2019.
- Delivered a lecture entitled "AI - From Lab to Marketplace" at L&T Infotech, Mumbai, in August 2019.
- Participated in the International Olympiad in Informatics 2019 in Baku, Azerbaijan, in August 2019.
- Delivered a lecture entitled "The Past, Present and Future of AI" as part of the Popular Science Lecture Series of Tamil Nadu Science Forum, Chennai, in September 2019.
- Delivered a lecture entitled "Efficient Processing of Range Queries" at VIT Chennai, in September 2019.
- Visited the Max-Planck Institute for Software Systems (MPI-SWS), Kaiserslautern, Germany to pursue joint research with Rupak Majumdar and Damien Zufferey, in September, 2019.
- Visited ACM-MSR Academic Research Summit, Goa in January 2020.
- Visited ICT Academy Research Summit 2020, Chennai in February 2020 and gave talks.
- Visited IRISS and ACM India Annual Event, Gandhinagar in February 2020.
- Visited NCASHT 2020, Saveetha School of Engg, Chennai in March 2020 and gave talks.
- Visited Flame University, Pune in March 2020 and gave talks.

Mandira Mondal

- Attended the conference "National Conference on Commutative algebra and Algebraic Geometry" held at IISER Bhopal, in July 2019 and gave a talk in the conference.
- Attended the commutative algebra seminar on test ideals and positive characteristic methods.

H S Mani

- Conducted the out reach programme in V.I.T College Chennai, in April 2019 in astronomy.
- Gave a talk to students in a programme organized by Tamil Nadu Science Forum in May 2019 held at IMSC. Demonstrated on how to make a low cost telescope.
- Gave lectures (two) at I.I.T in May 2019 for school children organized by I.I.T. (RSIC -SP2019).
- Attended on a council meeting of Raman Research Institute in May 2019 as a nominee of the Raman Trust.
- Discussed with Prof Anitha Kurup, Dean NIAS about starting a centre of learning (as done by them in Bangaluru) for school children gifted in mathematics in Chennai. Initiated steps to do so.
- Lectured on Quantum Erasure at V.I.T. College in a programme held by Indian association of Physics Teachers.
- Conducted a two day programme for school children in July 2019.
- Gave three lectures at SPM College for women in Delhi in August 2019 on "Application of geometry and group theory in Physics by examples".
- Visited I.I.T.Tirupati in February 2020 and gave talks.
- Visited IISER Tiruathi in Febuary 2020 and gave talks.
- Visited Central University of Tamil Nadu in January 2020 and gave talks.

A Manu

- Visited Saha Institute for Nuclear Physics in January 2020.

Rajeeva L. Karandikar

- Gave a colloquium talk on "Making sense of Opinion polls" at IIT Madras, in April 2019.
- Gave a talk on "Making sense opinion polls" at Clearing Corporation of India, Mumbai, in April 2019.
- Attended the brainstorming meeting on Data Science organized by DG, CSIR at Infosys campus, Mysore.

- Gave a talk at a special session organized by CSIR on "role of science in the Indian elections", in June 2019 at NPL, Delhi.
- Visited IIT Bombay to deliver P V Sukhatme memorial lecture on "On Connections between Partial Differential Equations and Diffusion Processes", in August 2019.

Mythily Ramaswamy

- Gave two lectures at IIT Madras in QIP short program On "Evolution equations : Theory and Computations" on "Heat equation" and "Wave equation" in August 2019.
- Gave a lecture in the Half-day symposium at IISER Trivandrum on "Control of some fluid models", in August 2019.
- Gave three Lectures at IIT Roorkee West Asian Mathematics School on "Recent Developments and Applications of PDEs : From Theory to Simulations" during August – September 2019. Gave two lectures on "Elliptic equation and Heat equation" and one lecture on "Optimal Control of Elliptic equations" in August 2019.
- Gave a talk on "Thermal fluid stabilization" in September 2019 in the Conference on "Control and Stabilization issues for PDE" at Universite Paul Sabatier, Toulouse, France.

Sahil Mhaskar

- Attended Formal Methods Update in July 2019.

Sukhendu Mehrotra

- Gave a talk entitled "On a question of Schoen" at the conference CAAG 2019 held at IISER Bhopal, in July 2019.
- Attended the workshop "Perfectoid Spaces" held at ICTS, Bangalore, in September 2019.
- Visited ICTS in January 2020.
- Visited ICTS in February 2020.
- Visited HRI in 8-10 March 2020 and gave talks.

Geevarghese Philip

- Visited the Department of Informatics at the University of Bergen, Norway, duirng May – July 2019.

- Visited the Department of Informatics at the University of Bergen, Norway, during May – November 2019.
- Gave a talk titled "Diverse Fixed-Parameter Tractability" at the Parameterized Complexity and Practical Computing Workshop, University of Bergen, in August 2019.

Pritthijit Biswas

- Attended the AIS in Homotopy Theory at ISI Kolkata in May 2019 and gave Research Methodology Talk on "Synge's Theorem (A theorem relating curvature and topology of a Complete Riemannian Manifold)".

Muhammed Saleem

- Visited IIT Madras in January 2019 and gave talks.

Narayan K

- Participted in the Simons Summer Workshop in Mathematics and Physics 2019, on "Cosmology and String Theory", at Simons Center for Geometry and Physics, Stony Brook, USA, in July 2019.
- Visited International Center for Theoretical Physics (ICTP), Trieste, Italy, during September - November 2019.
- Visited International Center for Theoretical Sciences (ICTS), Bangalore in Feb 5-7, 2020 and gave talks.

K. Narayan Kumar

- Visited LaBRI, Univ. of Bordeaux, in May 2019.
- Visited LSV, ENS Paris-Saclay, during May – June 2019.
- Attended the Update Meeting in Formal Methods held in IIT Hyderabad, in July 2019.

Nirmal Kotal

- Visited IIT Kharagpur in December, 2019.

Jagadish Pine

- Visited ICTS in January 2020.
- Visited ICTS in February 2020.

Prajakta Nimbhorkar

- Gave 4 lectures in the MMC nurture camp at CMI, in June 2019.
- Attended ACM-W Summer School on Algorithmic Game Theory at IIT Gandhinagar and gave five talks.

Purusottam Rath

- Gave a series of 4 lectures in an instructional workshop at Hyderabad University.
- Gave two talks in a Teachers' Enrichment Workshop at IMSc, Chennai.

P Sankaran

- Gave a course of three lectures on "Groups and symmetry" at the "Undergraduate Teachers' Refresher Programme" held at Shyama Prasad Mukherjee College for Women, New Delhi.
- Gave a talk on "twisted conjugacy in certain PL-homeomorphism groups of the circle" at the "Topology and representation theory" conference held at ISI Kolkata during August 2019.
- Visited Madurai Kamaraj University in January 2020 and gave talks.
- Visited Indian Institute of Science in February 2020 and gave talks.

Sayan Mukherjee

- Gave a talk in Formal Methods Update Meeting, held at IIT Hyderabad.

Sayantani Datta

- Attended a summer school on "gravitational waves and astronomy " held at ICTS Bangalore, in July 2019.
- Visited IISER Mohali in December 2019 and gave talks.

- Visited IIT Chennai in January 2020 and gave talks.

Shanmugapriya P

- Attended the conference Pressing for Progress, gender equity in physics, in September 2019 at University of Hyderabad.
- Visited Chennai Symposium on Gravitation and Cosmology at IIT Madras in Jan 22-24, 2020.

Sonakshi Sachdev

- Attended a summer school on "The multiple approaches to plasma physics from laboratory to astrophysics" in Les Houches, France, in May 2019. Also competed in the student talks competition in this school. Won second prize. Received a plasma physics book as prize.
- Attended European Mathematical Society School in Applied Mathematics on "Mathematical aspects of fluid flows" in Kacov, Czech Republic, in May 2019 and gave a student talk.
- Visited Indian Plasma Research, Gandhinagar in January2020 and gave talks.
- Visited Indian Institute of Science, Bengaluru in January 2020.

Sourav Roychowdhury

- Attended ST4 at Indian Institute of Science Education and Research, Bhopal (IISER-B), during July 2019.
- Visited Indian Institute of Science Education and Research Bhopal in December 2019 and gave talks.

Sourish Das

- Visited Hindustan Institute of Technology and Sciences in Jan 2020 and gave talks.

Sharad Sane

- Gave Invited 45 minutes talk at an International Conference on Combinatorial Designs and Coding Theory in honour of K.T. Arasu (ArasuFest, supported by the Fiels Institute, Canada) at Kalamata, Greece in August, 2019.

- Visited Cochin University of Science and Technology on 7 January, 2020. Title: Some rummaging through structural graph theory in January, 2020 and gave talks.

K.V. Subrahmanyam

- Visited Microsoft Research Bangalore for a week and gave a talk on "SO(2)-equivariant neural networks using Fourier nonlinearity".

S P Suresh

- Attended the Formal Methods Update Meeting, in July 2019, at IIT Hyderabad.
- Spoke on logical reasoning in security protocols at MSR India Academic Summit. BITS Goa in January 2020.

Govind R

- Visited University of Bordeaux as part of Cotutelle thesis.
- Presented a paper at DLT 2019 at Warsaw.
- Attended CONCUR 2019 at Amsterdam.

T R Govindarajan

- Visited Max Planck Inst for Gravitation Physics, during June – July 2019.
- Gave a talk at AEI, Golm, on "Is Photon Massless?".
- Gave a talk at IMSc, on "Is Photon Massless?".
- Visited IIT Madras, in January 2020 and gave talks.
- Visited IIT, Kanpur in February and gave talks.

R Srinivasan

- Visited ISI, Banglore during February – March 2020 and gave talks.

B. Srivathsan

- Gave a talk on "Revisiting local-time semantics for networks of timed automata" at the conference CONCUR 2019.

- Gave a talk on "Fast Algorithms for Handling Diagonal Constraints in Timed Automata" at the conference CAV 2019.

Usha Mahadevan

- Conducted English Proficiency tests for Aeronautical station Operators at AAI, Meenambakkam.
- Conducted Orientation programme for students of English Literature at Thiruthangal Nadar college, Chennai in July 2019.

Venkatesh Vinayakarao

- Visited SSN Institutions in February 2020 and gave talks.

Vijay Ravikumar

- Gave outreach talks at IMSc, Chennai for high school students.

18 Other Professional Activities

A K Kapoor

- Worked on organizing Physics content on internet as a part of a PROOFS program: "Physics Resources Online Open and Free Source" URL : http://0space.org/users/kapoor.
- Continuing to work on content creation for UG and PG courses.
- Started working on computer assisted evaluation of examiantion papers.

Archit Chauhan

- Teaching Assistant for design and analysis of algorithms course.

Amitabh Virmani

- Editor for General Relativity and Gravitation.

Bhamidi V Rao

- Gave a course on markov chains.

Clare D'cruz

- Refereed paper for Journal of Algebra and Its Applications and Communications in Algebra.
- Wrote review for Mahtematics Zentralbatt.

Dharm Veer

- Gave three lectures on F-pure rings in CMI.

Govind Krishnaswami

- Awarded SERB research grants: Mathematical Research Impact Centric Support (MATRICS) and Core Research Grant (CRG).
- Refereed articles for Journals Chaos, Physica D and Resonance.

- Supervised four PhD students Sachin Phatak, Sonakshi Sachdev, Himalaya Senapati and T R Vishnu.
- Editorial board member and referee for Resonance, Journal of science education.

Himalaya Senapati

- Gave a poster presentation titled 1Instabilities, chaos and ergodicity in the classical three rotor problem' at the workshop based on work joint with Govind Krishnaswami.

Keshab Chandra Bakshi

- Supervised Master's thesis of Mr. Utsabraj Sarkar.

H S Mani

- Asimpriya Mitra of I.I.T. Kharagpur did a summer project on Renormalization group. This is organized by the three academies.
- Attended as a council member, the meeting of the Raman Research Institute council in September 2019.
- Particpating in the outreach programme on Annular solar eclipse which is to occur on 26th December - will be visible in parts of Kerala and Tamil Nadu.
- Projects for school children (N.P.S. School)

K G Arun

- Entrusted with the duty of Review Liaison of the Testing General Relativity sub-group of the LIGO and Virgo Collaboration.

K Narayan Kumar

- Coach at the training camp for the International Olympiad in Informatics.
- Deputy Leader, Indian team to the International Olympiad in Informatics, IOI 2019, Baku, Azerbaijan, August 2019.
- Chair, Steering Committee, The International Conference on Foundations of Software Technology and Theortical Computer Science (FSTTCS).
- Member, Program Committee, 39th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science, Mumbai, December 2019.

- Member, Program Committee, Highlights of Logic, Games and Automata, Warsaw, September 2019.

Mythily Ramaswamy

- As a member of Program Advisory Committee of ICTS, Evaluated research proposals for funding in August 2019.
- As a core committee member of Program Advisory committee of SERB, Evaluated research proposals and monitored ongoing research projects in August 2019.
- Evaluated research proposals for NBHM Research Proposal Committee.

Rajeeva L. Karandikar

- Was a member of the expert team constituted by the Election commission on sampling of EVM machines. Our report was part of the reply by Election commission filed in the Supreme Court.
- Have been named as a committee set up by Supreme Court, with Retd. Justice G Sanghvi as Chairman and with Mr Nandan Nilkeni and Dr Bhatkar as members along with others, to look into possible fraud in an online examination.

B. Srivathsan

- Program Committee of conference MFCS 2019.

Sukhendu Mehrotra

- Organized algebraic geometry seminar.

Pankaj Saini

- Currently working on Formation channels of Black hole - Black Hole binaries and Netron star binaries.
- Working in Gravitational Wave Astrophysics with Prof. K.G. Arun.

Prajakta Nimbhorkar

- Worked as a subreviewer for COCOON 2019, ESA 2019, Fundamenta informaticae.

- Worked as a reviewer for Mathematical Reviews.
- Supervised one student for his MSc thesis.
- Reviewer for Discrete Optimization journal and FSTTCS conference.

Priyavrat Deshpande

- Organized a national level nurture camp for the Madhava Mathematics competition winners in June 2019 at CMI.
- Coordinated the Madhava Mathematics Competition exam for Chennai center in January 2020.
- Coordinated topological complexity discussion seminar.

Parthapratim Mahapatra

- Reading a paper: Parameter estimation of inspiralling compact binaries using 3.5 post-Newtonian gravitational wave phasing: The non-spinning case.
- Worked out paper: Constraints on the astrophysical environment of binaries with gravitational-wave observations.

Pramathanath Sastry

- Deligne-Illusie - new approaches via De RhamWitt
- Gave seminar on Berkovich spaces

Pranjal Dutta

- Teaching Assistant of the NPTEL Course- "Arithmetic Circuit Complexity" by Prof. Nitin Saxena (IIT K)

M Praveen

- Querying graph databases with relational query languages

Purusottam Rath

- Taught an elective on Modular forms this semester.

P Sankaran

- Attended Board of Studies Meeting, Central Univ of Tamil Nadu, Tiruvarur.
- Attended the Publications Meeting, IASc, Bengaluru.

Shanmugapriya P

- Tutor of GR course.

Somnath Dake

- Improved implementation of straightening algorithm.

Sonakshi Sachdev

- Submitted PhD Thesis titled 'Conservative regularization of neutral fluids and plasmas' in March 2020.

Sourish Das

- Organised workshop on Bayesian Data Analysis for the Data Science group of Aditya Birla Group.
- Helped to develop a root cause analysis system for Opscruise, a Calfornia based company in USA.
- Organised Fifth conference on Statistical Methods in Finance StatFin19.
- Reviewed Article for Sankhya.

Sharad Sane

- PhD thesis with title "Ryser Design Conjecture" submitted by Tushar Parulekar at the IIT Bombay in January, 2020

T R Govindarajan

- Editor, Phys Education, Physics Teachers Association.

Upendra Kulkarni

- Gave a talk on Young tableaux in Tessellate 2020

Usha Mahadevan

- Helped interested students with acquisition of soft skills like time management skills and presentation skills.
- Coordinated and conducted book discussions.
- Met students of the Drama Club and discussed certain plays.
- Organised Poetry workshop for CMI students.
- Guided students to bring the next issue of the student magazine.

Venkatesh Vinayakarao

- Taught big data and hadoop.

V Swaminathan

- Attended CSIR meeting during August 2019.
- participated in the NTA-CSIR meeting at CLRI, Chennai between January 18 and 20, 2020
- preparing and uploading the lecture notes for the MSc DS course Mathematical Finance

Vijay Ravikumar

- Gave outreach talks at IMSc for college students.

19 Visitors

- Ashmita Das, IIT Guwahati. Gave a talk on "Unruh-DeWitt detector in presence of multiple scalar fields : A Toy Model" (April 2019).
- Ritabrata Bhattacharya, HRI Allahabad. Gave a talk on "Chaotic Correlation Functions with Complex Fermions" (April 2019).
- Prashant Nalini Vasudevan, Univ. of California Berkeley. Gave a talk on "Average-Case Fine-Grained Hardness, and what to do with it" (April 2019).
- K.N. Raghavan, Institute of Mathematical Sciences, Chennai. Gave a talk on "A study of Kostant-Kumar modules via Littelmann paths" (April 2019).
- Partha Paul IOP Bhubaneshwar. Gave a talk on "Conformal Properties of Soft-Operators" (April 2019).
- Apoorva Khare, Indian Institute of Science, Bangalore. Gave a talk on "Matrix analysis: overview talk" and "PolyMath14: Groups with norms" (April 2019).
- Venkatakrishnan Ramaswamy, NCBS, Bangalore. Gave a talk on "On understanding Neural Circuit Computation" (April 2019).
- Prashant Kocherlakota, TIFR Mumbai. Gave a talk on "Stability in General Relativity using Symplectic Geometry" (May 2019).
- Supurna Sinha, Raman Research Institute, Bangalore. Gave a talk on "A quantum diffusion law" (May 2019).
- Joseph Samuel, Raman Research Institute, Bangalore. Gave a talk on "Lorentzian Geometry of Qubit Entanglement" (May 2019).
- Bidisha Chakrabarty, ICTS, Bangalore. Gave a talk on "Out of Time Ordered Quantum Dissipation" (May 2019).
- Brian Harbourne, University of Nebraska, USA. Gave a talk on "Line arrangements with applications to recent work in algebraic geometry and commutative algebra" (June 2019).
- V. Suresh, Emory University. Gave a talk on "Symbol length in Galois cohomology groups" (July 2019).
- Anup Dixit, Queen's University, Canada. Gave a talk on "A uniqueness result for general Dirichlet series" (July 2019).
- Arun Ravishankar, University of Arizona. Gave a talk on "The Aretakis instability of extremal asymptotically AdS black holes" (July 2019).

- Samir D Mathur, Ohio State University, USA. Gave a talk on "Resolution of the black hole information paradox" (July 2019).
- Akashdeep Dey, Princeton University. Gave a talk on "Compactness of the space of singular, minimal hypersurfaces with bounded volume and Jacobi eigenvalue" and "Recent developments in the variational theory of minimal hypersurfaces" (August 2019).
- Varun Thakre, ICTS, Bengaluru. Gave a talk on "Hypersymplectic manifolds and associated geometries" (August 2019).
- Thejaswini K S, Chennai Mathematical Institute, University of Warwick. Gave a talk on "Parity Games and Register Index" (August 2019).
- Alapan Mukhopadhyay, University of Michigan. Gave a talk on "Reducedness of formally unramified algebras" (August 2019).
- Daniel Grumiller, Institute for Theoretical Physics, TU Wien (Vienna University of Technology). Gave a talk on "Near horizon dynamics of three dimensional black holes" (August 2019).
- Hari Govind V K, University of Waterloo, Canada. Gave a talk on "Interpolating strong induction" (August 2019).
- Prasad Tetali, School of Mathematics and School of Computer Science, Georgia Institute of Technology,USA. Gave a talk on "Finding Cliques with Few Probes" (August 2019).
- Ronno Das, University of Chicago. Gave a series of lectures on "Inclusion-exclusion in topology and (kind(s) of) arithmetic - A user's guide to (étale) cohomology, Topology and arithmetic: some real, imaginary and complex bridges & Points and lines on cubic surfaces" (August 2019).
- Suryajith Chillara, IIT Bombay. Gave a talk on "Complexity of Computing Polynomials of Bounded Individual Degree" (September 2019).
- Madhusudhanan Kalaichelvan. Gave a talk on "Temple Conservation - An Indian Way" (September 2019).
- Shibashis Guha, ULB, Brussels. Gave a talk on "Formal Methods in Network Games" (September 2019).
- Madhusudan Raman, TIFR, Mumbai. Gave a talk on "Modular Symmetry and its Taller Cousins" (September 2019).
- Arnab Roy, INRIA, Nancy, France. Gave a talk on "Stabilization of a rigid body moving in a compressible viscous fluid" (September 2019).

- Amit Kumar Singh, Institute of Mathematical Sciences, Chennai. Gave a talk on " Semi-Stability of Certain Vector Bundles on Elliptic Curves" (October 2019).
- Tulsi Srinivasan, Azim Premji University. Gave a talk on "Lower Bounds for Topological Complexity" (October 2019).
- Amit Kumar Paul, IIT Kanpur. Gave a talk on "Higher analogs of simplicial and combinatorial complexity" (October 2019).
- Samir Shukla, IIT Bombay. Gave a talk on "An introduction to some graph coloring complexes" (October 2019).
- K.V. Raghavan, IISc, Bangalore (October 2019).
- Suchetan Das, Beluruniversity. Gave three talks on "OPE blocks in holography", "Modular Hamiltonian and its eigenmodes in vacuum and excited states" and "Connection between OPE blocks and modular eigen modes and application in holography" under "Seminar on a study of OPE blocks and modular Hamiltonian in AdS_3/CFT_2" (October 2019).
- TM Krishna Writer in residence at Chennai Mathematical Institute. Gave a talk at CMI Arts Initiative Lecture on "Sebastian and Sons" (October 2019).
- Sourav Bhattacharya, IIT Ropar. Gave a talk on "Some aspects of black hole physics in de Sitter spacetime" (November 2019).
- Nitin Nitsure, TIFR. Gave a talk on "Curvature, torsion and the quadrilateral gaps" (November 2019).
- Anand Sawant, TIFR. Gave five talks under "Motivic Homotopy Theory and Applications" on "Some contributions of motivic homotopy theory to algebraic geometry", "Introduction to motivic homotopy theory", "Affine homotopy invariance of G-torsors" "Obstruction theory for projective modules" and "Some possible applications and open questions" (November 2019).
- Radhika Kulkarni, Vice President, Advanced Analytics R&D at SAS Institute Inc. (Retired). Gave a series of four lectures on "Optimization, Business Analytics and Artificial Intelligence - A Brief Introduction" (October–November 2019).
- TM Krishna, Writer in residence at Chennai Mathematical Institute. Conducted Open House on Carnatic Music at CMI Arts Initiative Lecture (November 2019).
- Vidyadhar Kulkarni, Department of Statistics and OR UNC, Chapel Hill. Gave a series of four lectues on "Data Driven Decision Making" (October–November 2019).
- Arvind Nair, TIFR. Gave a talk on "Mixed motives and automorphic forms I" "Mixed motives and automorphic forms II" and "Arc spaces of algebraic varieties and applications" (November 2019).

- Satyanad Kichenassamy, Université de Reims Champagne-Ardenne. Gave two talks under "Ancient Indian Mathematics for modern Mathematicians" on "Recent progress on the analysis of ancient Indian mathematical texts" & "The impact and modern relevance of ancient Indian Mathematics" and a talk on "Algebraic aspects of Fuchsian Reduction" (December 2019).
- Ramanathan T S, MPI-SWS, Kaiserslautern, Germany. Gave a talk on "Regular Separability and Intersection Emptiness are Independent Problems" (December 2019).
- Chris Van Den Broeck, Utrecht University, Netherlands and Nikhef, Amsterdam. Gave a talk on "Probing the strong-field dynamics of gravity and the nature of compact objects with gravitational waves" (December 2019).
- Prantar Ghosh, Dartmouth College, USA. Gave a talk on "Streaming Verification of Graph Computations via Graph Structure" (December 2019).
- Béatrice Bérard, Sorbonne Université - LIP6 France. Gave a talk on "Verification of Hybrid Systems" (December 2019).
- Pratyush Pranav, ENS de Lyon. Gave a talk on "Geometry and Topology : Application to (cosmological) datasets" (December 2019).
- Peter Wong, Bates College, USA (December 2019).
- Sougata Bose, LaBRI, University of Bordeaux, France. Gave a talk on "Resynchronizers for Word Transducers with Origin Information" (January 2020).
- Nomaan X, Raman Research Institute. Gave a talk on "Studies on Sorkin-Johnston vacuum in De-Sitter spacetime" (January 2020).
- Ronnie Sebastian, IITB. Gave a talk on "Some computations of Fundamental Group Schemes" (January 2020).
- Nikhil Balaji, University of Oxford. Gave a talk on "On the complexity of Value Iteration" (January 2020).
- Swastik Bhattacharya, BITS Pilani Hyderabad. Gave a talk on "Microscopic model building for Black Hole Membranes from Constraints of Symmetry" (January 2020).
- Sagnik Mukhopadhyay, KTH Royal Institute of Technology, Sweden. Gave a talk on "Connecting query and communication algorithms:Upper and lower bounds" (January 2020).
- Uma Girish, Princeton University, USA. Gave a talk on "Quantum versus Randomized Communication Complexity, with Efficient Players" (January 2020).
- Ashwin Ganesan. Gave a talk on "Performance Guarantees of Distributed Algorithms Using Graph and Hypergraph Interference Models" (January 2020).

- Rameshwar Pratap, IIT, Mandi. Gave a talk on "Efficient Sketching Algorithm for Sparse Binary Data" (February 2020).
- Natarajan Shankar, SRI International Menlo Park, CA. Gave a talk on "The Kernel of Truth: Trust and Verification in Proof Systems" and "A Code Generator for a Functional Language" (February 2020).
- Aditya Karnataki, BICMR, Peking University, Beijing, China. Gave a talk on "Triangulation at the boundary of eigencurve" (February 2020).
- Varun Ramanathan, LaBRI, University of Bordeaux, France. Gave a talk on "The Quantifier Alternation Hierarchy of Synchronous Relations" (February 2020).
- Cindy Lynn Brown, Writer in Residence. Gave CMI Arts Initiative Lecture about her work method and her previous books (February 2020).
- Sumanta Chakraborty, IACS, Kolkata. Gave a talk on "Strong Cosmic Censorship Conjecture: Recent Progress" (February 2020).
- Panagiotis Gavriiloglou, Writer in residence. Gave CMI Arts Initiative Lecture on "Crisis and Greek Fiction" (February 2020).
- Deepali Mishra, NISER Bhubaneshwar. Gave a talk on "Generalised Garfinkle-Vachaspati Transform" (February 2020).
- Avinash Khare, University of Pune. Gave a talk on "Kinks With Power Law Tails" (February 2020).
- Pushpa Khare (retired), Utkal University. Gave a talk on "Gravitational waves: A new window to the universe" (February 2020).
- Oscar Garcia-Prada, ICMAT-Madrid. Gave a talk on "Arakelov-Milnor inequalities and maximal variations of Hodge structure" (February 2020).
- Kenneth Krabat. Gave CMI Arts Initiative Lecture (February 2020).
- Loic Helouet, INRIA Rennes. Gave a talk on "Timed Negotiations" (February 2020).
- Shilpa Kastha, Max Planck Institute for Gravitational Physics, Hannover, Germany. Gave a talk on "Parameterized tests of the multipolar structure of compact binary inspiral" (February 2020).
- Luc Illusie, Université Paris-Sud, France. Gave a series of lectures on "Theme of de Rham complexes" (February 2020).
- N V Narendra Kumar, IDRBT Hyderabad. Gave a talk on "Blockchain Technology - Concepts and Applications" (March 2020).

- Amit Behra, Ben-Gurion University, Israel. Gave a talk on "Almost Public Quantum Coins" (March 2020).
- Jagan Sankaranarayanan, Google. Gave a talk on "Scalable Network Distance Browsing in Spatial Databases" (March 2020).