URBASI SINHA

QUANTUM INFORMATION AND COMPUTING LAB,
LIGHT AND ATOMIC MATTER PHYSICS GROUP,
RAMAN RESEARCH INSTITUTE, BANGALORE, 560080, INDIA
EMAIL: USINHA@RRI.RES.IN
URBASI.SINHA@UCALGARY.CA

Current Position:

Canada Excellence Research Chair in Photonic Quantum Science and Technologies, University of Calgary, Canada from 2024.

Professor at the Raman Research Institute, Bangalore, India from 2020.

Affiliate faculty at the Institute for Quantum Computing, Waterloo, Canada.

Past Position:

Associate Professor II at the Raman Research Institute, Bangalore, India from 2015-2020.
Associate Professor I at the Raman Research Institute, Bangalore, India from March 2012 – December 2014.

Professional experience:

1. Postdoctoral Research Fellow in the Institute for Quantum Computing, Waterloo, Canada, September 2007 – February 2012. I was working on fundamental experimental tests of Quantum Mechanics using quantum optics tools as well as nanotechnology-based projects concentrating on fabricating solid-state quantum bit devices and their applications to Quantum Computing.
2. Postdoctoral Research Fellow in the Cavendish Laboratories, University of Cambridge, U.K., July 2006 - August 2007. I worked on an industry funded research project which dealt with investigation of soft condensed matter based techniques to develop a thinner, whiter version of paper than the conventionally available ones.

Present Editorial assignments:

Member of Editorial Board, Optica, October 2023 onwards; Steering committee member for Quantum, 2016 onwards.

RESEARCH INTERESTS

Quantum Mechanics, Quantum Computing, Quantum Optics, Quantum Communication, Quantum Sensing, Nanotechnology, Device fabrication, Superconductivity.

EDUCATION

1. Cambridge University, U.K. - PhD in Physics and Material Science, Supervisors - Prof. Mark Blamire and Dr. Edward Tarte -- 2002 - 2006.
2. Cambridge University, U.K. - B.A., M.A, 1st class in Part III Natural Sciences Tripos -- 2000-2002.
3. Jadavpur University, Kolkata, India - B.Sc., Physics honours - 1st class with distinction, placed among top few -- 1997 - 2000.
4. Ashok Hall Girls' Higher Secondary School, Kolkata, India - All India Senior School Certificate Examination (Class XII, equivalent to the A-Level) - 91% Physics, 97% Mathematics -- 1997.
5. Carmel Convent School, New Delhi, India - C.B.S.E (class X, equivalent to the O-Level)- 95% science, 98% mathematics -- 1995.

NATIONAL AND INTERNATIONAL LEADERSHIP ROLES

1. Member of the Coordination team for the World Quantum Day network as the Asian representative, June 2024 onwards.
2. Invited member of the OECD Global Forum on Technology (GFTech) expert focus group on quantum technologies, December 2023 onwards.
3. Part of the awards committee for the Ehrenfest best paper award in quantum foundations, IQOQI, Vienna, 2023.
4. Mentor and judge at the NYUAD Quantum Computing for good hackathon, NYUAD, Abu Dhabi, UAE, 2023.
5. Invited member of the Quantum Information Focus group of International Union of Pure and Applied Physics (IUPAP) as the representative of India, February 2023 onwards.
6. Member of the advisory board for the incubation of the Open Quantum Institute, GESDA, January 2023 onwards.
7. Invited member representing Academia in the Inter-Ministerial Committee on Quantum Communications, Dept. of Telecommunications, Govt of India, January 2022 onwards.
8. Invited country representative of the GESDA (Geneva Science and Diplomacy Anticipator) Open Quantum Initiative core task force, June 2021 onwards.
9. Elected a member of C15 commission of International Union of Pure and Applied Physics (IUPAP) as the representative of India in that commission for the three-year term, 2021-2024.
10. Governing board member for Quantum Ecosystems and Technology Council of India.
11. Invited Indian representative for the World Quantum Day Network, a global network of quantum physicists who are engaged in promoting and showcasing quantum science and technologies through diverse fora.
12. Member of the draft project report committee for the National Mission on Quantum Technologies and Applications (NMQTA), 2020.
13. Member of the expert evaluation panel for the recently launched Emerging Technology Initiative (ETI) under the New Emerging & Strategic Technologies Division of the Ministry of External Affairs (NEST, MEA), the Office of the Principal Scientific Adviser to the Government of India and the Science Policy Forum (SPF), 2020.
14. Invited member of the Focus Group on Quantum Information Technologies for Networks (FGQIT4N) constituted by the ITU, United Nations, only invited member from India, 2020.
15. Member of the Editorial board of the Institute of Physics journal, New Journal of Physics, 2018-

16. The Indian theme coordinator for the "Quantum" theme of the India Trento Programme for Advanced Research (ITPAR) – a networking programme to launch Indo-Italian Collaboration in Quantum Physics among other themes, 2019-
17. The Indian coordinator for the "Quantum" session of the Indo-UK Frontier of Science (FOS) meeting, organized in collaboration with the Royal Society which was held in UK in May 2018
18. Part of the Steering Committee for the journal "Quantum".
19. Member of Editorial Board, New Journal of Physics, 2018-2023.

RESEARCH PUBLICATIONS

1. *Estimating the link budget of satellite-based Quantum Key Distribution (QKD) for uplink transmission through the atmosphere,* Satya Ranjan Behera, U. Sinha, *EPJ Quantum Technology* **11** Article no. 66, 2024.

2. *Single system based generation of certified randomness using Leggett-Garg inequality,* P.P.Nath, Debashis Saha, Dipankar Home, U.Sinha, *Physical Review Letters*, **133**, 020802, 2024.

3. *Relating an entanglement measure with statistical correlators for two-qudit mixed states using only a pair of complementary observables,* S. Sadana, S. Kanjilal, D.Home and U.Sinha, *Quantum Information Processing* **23**, 138 (2024).

4. *Revealing incommensurability between device-independent randomness, nonlocality, and entanglement using Hardy and Hardy-type relations*, S. Sasmal, S.Gangopadhyay, A.Rai, D.Home, U.Sinha, *Physica Scripta*, **99**, 035012, 2024.

5. *Massive Spatial Qubits for Testing Macroscopic Nonclassicality and Casimir Induced Entanglement*, B.Yi, U.Sinha, D.Home, A.Majumdar, S.Bose, *Physical Review Research* **5** 033202 (2023).

6. *Noise analysis for the Sorkin and Peres tests performed on a quantum computer*, S. Sadana, L. Maccone and U. Sinha, *Quantum Information Processing* **22,** 317 (2023).

7. *Unambiguous joint detection of spatially separated properties of a single photon in the two arms of an interferometer*, S.N. Sahoo, S. Chakraborti, S. Kanjilal, S.R. Behera, D. Home, A. Matzkin and U. Sinha, *Communications Physics* **6**, Article number: 203 (2023)**.**

8. *Polarization correction towards satellite-based QKD without an active feedback*, S. Chatterjee, K. Goswami, R. Chatterjee and U.Sinha, *Communications Physics* **6**, Article number: 116 (2023).

9. *Entanglement protection in higher dimensions*, A. Singh and U.Sinha, Physica Scripta, **97**, 085104, 2022.

10. *Direct determination of entanglement monotones for arbitrary dimensional bipartite states using statistical correlators and one set of complementary measurements,* D. Ghosh, T.Jennewein, U.Sinha, *Quantum Science and Technology*, **7** 045037*, 2022.*

11. *Testing quantum foundations with quantum computers,* S. Sadana, L. Macconne, U.Sinha, *Physical Review Research* 4 L022001, 2002.

12. *Loophole free interferometric test of macrorealism using heralded single photons*, K.Joarder, D.Saha, D.Home, U.Sinha, *PRX Quantum,* **3**, 010307, 2022.

13. *Quantum State Interferography,* S.Sahoo, S. Chakraborti, A.K.Pati, U.Sinha, *Phys. Rev. Lett.* **125** 123601, 2020.

14. *qkdSim: An experimenter's simulation toolkit for QKD with imperfections, and its performance analysis with a demonstration of the B92 protocol using heralded photon,* R. Chatterjee, K. Joarder, S. Chatterjee, B.C. Sanders, Urbasi Sinha, *Phys. Rev. Applied* **14**, 024036 (2020).

15. *Pearson Correlation Coefficient as a measure for Certifying and Quantifying High Dimensional Entanglement*, C.Jebarathinam, D.Home, U.Sinha, *Physical Review A* **101**, 022112, 2020.

16. *Revisiting comparison between entanglement measures for two-qubit pure states*, A.Singh, I.Ahmed, D.Home, U.Sinha, *Journal of Optical Society of America B,* **37**(1), 157-166, 2020.

17. *Double slit interferometry as a lossy beam splitter,* S.Sadana, B.C.Sanders and U.Sinha, *New Journal of Physics* **21** 113022, 2019.

18. *Near-100 % two-photon-like coincidence-visibility dip with classical light and the role of complementarity,* S.Sadana, D. Ghosh, K. Joarder, A. Nagalakshmi, B.C.Sanders and U.Sinha, *Physical Review A* **100** 013839, 2019.

19. *Measuring average of non-Hermitian operator with weak value in a Mach-Zehnder interferometer*, G.Nirala, S.N.Sahoo, A.K.Pati and U.Sinha, *Physical Review A* **99** 022111, 2019.

20. *Correlated photonic qutrit pairs for quantum information and communication,* D.Ghosh, T.Jennewein, P.Kolenderski and U.Sinha, *OSA Continuum* **1** (3), 2018.

21. *Measuring the Deviation from the Superposition Principle in Interference Experiments*, G.Rengaraj, U.Prathwiraj, S.N.Sahoo, R.Somashekhar and U.Sinha, *New Journal of Physics*, **20** 063049, 2018.

22. *The Quantum Cheshire Cat effect: Theoretical basis and observational implications,* Q.Duprey, S.Kanjilal, U.Sinha, D.Home and A.Matzkin, *Annals of Physics*, **391** 1-15, 2018**.**

23. *Manipulation of entanglement sudden death in an all optical set-up*, A.Singh, S.Pradyumna, A.R.P Rau and U.Sinha, *Journal of Optical Society of America B,* **34 (3)** 681-690, 2017.

24. *Violation of no signaling in higher order quantum measure theories,* K.S.Joshi, R.Srikanth and U.Sinha, *International Journal of Quantum Information* **14** 1650024, 2016.

25. *Measuring Non-Hermitian operators via weak values,* A.Pati, U.Singh and U.Sinha, *Physical Review A* **92** 052120, 2015.

26. *On the superposition principle in interference experiments,* A.Sinha, A.H.Vijay and U.Sinha, *Scientific Reports*, **5** 10304, 2015.

27. *An Experimental test of Envariance,* L.Vermeyden, X.Ma, J.Lavoie, M.Bonsma, U.Sinha, R.Laflamme and K.Resch, *Physical Review A*, **91** 012120, 2015.

28. *Non-classical paths in quantum interference experiments,* R.Sawant, J.Samuel, A.Sinha, S.Sinha and U.Sinha, *Physical Review Letters*, **113** 120406, 2014, selected as Focus article in *Physics*.

29. *Playing a quantum game with a qutrit,* U.Sinha,P.Kolenderski,L.Youning, T.Zhao, M.Volpini, A.Cabello, R.Laflamme and T.Jennewein, American Institute of Physics Conference Proceedings (refereed) Vol.1633, 38 (2014).

30. *Effect of environmental coupling on tunneling of quasiparticles in Josephson junctions*, M.H.Ansari, F.K.Wilhelm, U.Sinha and A.Sinha, *Superconductor Science and Technology* **26**(12) 125013, 2013.

31. *Temperature-dependent electron mobility in InAs nanowires*, N.Gupta, Y.Song, G.W.Holloway, U.Sinha, C.Haapamaki, R. R.LaPierre and J.Baugh, arXiv: 1210.3665v1, *Nanotechnology* **24** 225202, 2013.

32. *Playing the AharonVaidman Quantum Game using a Young type photonic qutrit,* P.Kolenderski, U.Sinha,L.Youning, T.Zhao, M.Volpini, A.Cabello, R.Laflamme and T.Jennewein, *Phys.Rev.A* **86** 012321, 2012.

33. *Triple Photons and Triple Slits: A new frontier in Quantum mechanics tests,* T.Jennewein, H.Hubel, D.Hamel, A.Fedrizzi, S.Ramelov, K.Resch, U.Sinha, C.Couteau, R.Laflamme and G.Weihs in *Quantum Electronics and Laser Science Conference (refereed),* 2011.

34. *Born Rules*, U.Sinha, in *75 Years of Quantum Entanglement: Foundation and Information Theoretic Applications,* D.Home, G.Kar and A.S.Majumdar (Eds), American Institute of Physics Conference Proceedings, Vol.1384, pp 254-261, New York, 2011.

35. *Ruling out Multi-path interference in Quantum Mechanics*, U.Sinha, C.Couteau, T.Jennewein, R.Laflamme and G.Weihs, *Science* **329** 418-421, 2010.

36. *A Triple slit test for Quantum Mechanics,* U.Sinha, C.Couteau, F.Dowker, T.Jennewein, G.Weihs and R.Laflamme, *Physics in Canada,* **66** No.2, April-June 2010 (invited paper).

37. *Improving high Tc dc-SQUID performance by junction asymmetry,* U.Sinha, A.Sinhaand F.K.Wilhelm, *Superconductor Science and Technology* ***22,*** (2009), 055002.

38. *Testing Born's rule in Quantum mechanics with a triple slit experiment,* U.Sinha**,** C.Couteau, Z. Medendorp, I. Sollner, R. Laflamme, R. Sorkin, G. Weihs, arXiv: 0811.2068. in *Foundations of Probability and Physics-5,* L. Accardi, G. Adenier, C. Fuchs, G. Jaeger, A. Yu. Khrennikov, J.-Å. Larsson, S. Stenholm (Eds.), American, Institute of Physics Conference Proceedings, Vol. 1101, pp. 200-207, New-York (2009).

39. *On transmission line resonances in high Tc dc SQUIDS,* U.Sinha**,** A. Sinha and E.J. Tarte, *Superconductor Science and Technology* ***21,*** (2008), 085021.

40. *Dielectric characterization of strontium titanate thin films using Josephson junction based on-chip resonators*, U.Sinha, G.Burnell, M.G.Blamire and E.J.Tarte, *Superconductor Science and Technology* ***19,*** 427-432, 2006.

41. *Investigation of YBCO SQUIDS with gold damping resistors,* D.S.Pinker, L.K.Sahoo, D.A.Ansell, U.Sinha, S.H.Menema, G.Burnell and E.J.Tarte, *IEEE Transactions in Applied Superconductivity***15** (2), 789-792, Part 1, 2005.

42. *Device fabrication and Optimization for Josephson Broadband Spectroscopy of Ferroelectric thin films,* U.Sinha, P.F.McBrien, S.H.Menemma, D.Zhang, D.S.Pinker, G.Burnell, Z.H.Barber and E.J.Tarte, Ferroelectrics **329,** 1029-1034, 2005.

43. *Investigation of gold/YBCO contacts for use with resistively shunted SQUIDS*; D.S.Pinker, G.Burnell, U.Sinha, D.A.Ansell and E.J.Tarte; published in Conference Proceedings, European Conference in AppliedSuperconductivity (EUCAS), September 2003.

44. *Studies of transport properties of MgB_2 superconducto*r; A.Poddar, B.Bandyopadhyay, P.Mandal, D.Bhattacharya, P.Choudhury, U.Sinha and B.Ghosh, Physica C **390,** 191-196, 2003.

45. *Emerging superconducting materials: Electrical resistivity,Thermoelectric power and thermal conductivity of Magnesium diboride,MgB_2*; A.Poddar, B.Bandyopadhyay, P.Mandal, D.Bhattacharya, P.Choudhury,

U.Sinha and B.Ghosh, published in refereed Conference proceedings DAE Symposium, India, 2002.

PREPRINTS

1. *Measuring a "Probability" >1*, S. Chakraborti, R. D. Sorkin, and U. Sinha, arXiv:2407.15702.
2. *Daytime and Nighttime QKD over an atmospheric free space channel with passive polarisation bases compensation,* S.R.Behera, Melvee George, U. Sinha, arXiv: 2310.02115 (2023)
3. *Generation of intraparticle quantum correlations in amplitude damping channel and its robustness,* Animesh Sinha Roy, Namitha C.V., Subroto Mukerjee, Prasanta Panigrahi, Urbasi Sinha, arXiv: 2303.01238
4. *Statistical Correlators and Tripartite Entanglement*, S.Khan, D.Home, U.Sinha, S. Jain, arXiv:2308.16236.
5. *Spatial qubit entanglement witness for quantum natured gravity*, B.Yi, U.Sinha, D.Home, A.Majumdar, S.Bose, arXiv: 2211.03661(2022).

PATENTS

1. *Method and system for generating cryptographic keys,* R. Chatterjee, S. Chatterjee, B. C. Sanders, and U. Sinha, Indian Patent No.:458753 (October 2023).

2. *Method and System for Random Number Generation From Loophole-Free Leggett-Garg Architecture*, P. P. Nath, A. Sinha and U. Sinha, Indian Patent application number: 202341042304(June,2023).

3. *Methods and a system for optimizing performance of a quantum key distribution (QKD) protocol*, S. Chatterjee and U.Sinha, Indian Patent Application No.: 202341035230 (May, 2023).

BOOK CHAPTERS AND POPULAR ARTICLES

1. *Photon sources and their applications in quantum science and technologies,* Urbasi Sinha, Saumya Ranjan Behera, Mehak Layal, Progress in Optics book chapter 2023 (https://www.sciencedirect.com/science/article/abs/pii/S0079663823000021?dgcid=author)

2. *Photon sources for quantum technologies,* Urbasi Sinha, *Encyclopaedia of Materials: Electronics,* ISBN: 9780128197288, 2023.

3. *The experiments that led to the Nobel prize in Physics 2022*, Urbasi Sinha, *Resonance*, **28** (1), 2023.

4. *Quantum Slits open New Doors*, U.Sinha, *Scientific American* (invited article), January 2020 issue.

5. *Single photon sources: ubiquitous tools in quantum information processing,* U.Sinha, S.N.Sahoo, A.Singh, K.Joarder, R.Chatterjee, S.Chakraborti, Invited feature article: Optics and Photonics News Vol. **30**, Issue 9, pp. 32-39 (2019).

6. *Quantum Frontiers and Fundamentals: Meeting Report,* U.Sinha, *Current* Science, **115** (1), 2018.

AWARDS/FELLOWSHIPS/SCHOLARSHIPS/GRANT

1. Rashtriya Vigyan Puraskar: Yuva Shanti Swarup Bhatnagar Award 2024 for Physics (highest science prize from the Govt of India in the said category), August 2024.
2. Distinguished International Associate award from the Royal Academy of Engineering, UK, 2024.

3. The 26th SIES Chandrasekarendra Saraswathi National Eminence award in Science and Technology, 2023.
4. Canada Excellence Research Chair (CERC) in Photonic Quantum Science and Technologies, Govt. of Canada, 2023.
5. ASSOCHAM Women in Cyber: Making a Difference award in the category: Cyber - Leading from the front, 2021.
6. Winner (expert member in the two member winning team) at the World Skills International Competition in Quantum Technology at the BRICS Future Skills Challenge, organised by the Russian Quantum Centre in Moscow, Russia with competitors from several countries worldwide, August 2020. https://rqc.ru/article/the-worldskills-international-online-competition-in
7. Simon's Emmy Noether Fellowship, Perimeter Institute Canada, 2021-2023.
8. Awarded grant from the Ministry of Electronics and Information Technology (MEITY) towards "Centre of Excellence for Quantum Technology", April 2020 onwards.
9. Awarded grant under the Quantum Enabled Science and Technology network programme of the DST, April 2019 onwards.
10. Awarded grant under the India Trento Programme on Advanced Research (ITPAR) for Indo-Italian collaborative project on Quantum Communications, February 2019 onwards.
11. Recognised as one of Top 100 Scientists in Asia in the 2019 edition of Asian Scientist 100.
12. Recognised as "Asia's Scientific Trailblazer", Asian Scientist Magazine, November 2018.
13. ICTP-ICO Gallieno Denardo Award 2018.
14. Awarded project under the VAJRA (Visiting Advanced Joint Research) scheme of the SERB, DST (Science and Engineering Research Board, Department of Science and Technology, India), November 2017 onwards.
15. Awarded grant from the Indian Space Research Organization (ISRO) for Quantum Experiments using Satellite Technology, September 2017 onwards.
16. Homi Bhabha Fellowship, July 2017 onwards.
17. Research grant from the John Templeton Foundation, USA, November 2015 - July 2018
18. Queens' College Bursary, University of Cambridge, November 2005.
19. Lundgren Research Award, University of Cambridge, October 2005.
20. Cambridge Philosophical Society studentship, October 2005.
21. Gates Cambridge Scholarship for PhD in the Dept. of Material Science and Metallurgy, July 2002. (Typically around 100 scholars are chosen every year from around 10,000 applicants worldwide.)
22. Overseas Research Students awards scheme 2002-2005 (Typically one or two students are chosen every year in a particular department).
23. 1st class in Part III Natural Sciences Tripos, Cambridge, June 2002.
24. Tutorial prize, St.Edmund's College, Cambridge, June 2002.
25. Tutorial travel awards, St. Edmund's College, Cambridge, March 2001 and March 2002.
26. Chevening-Nehru Cambridge Scholarship to pursue a Masters degree in Physics-2000 (the only physics recipient of the award that year).

PROFESSIONAL RECOGNITION

1. Our lab's research highlighted by the Perimeter Institute, Canada. https://insidetheperimeter.ca/sparks-of-discovery-at-the-junction-between-theory-and-experiment/
2. Interview on our research by science popularisation forum, Science for a Billion https://www.youtube.com/watch?v=a2vDD8R0RTM https://www.youtube.com/watch?v=sOB8rBHLI78
3. Interview by Science popularisation form, Rozender Science https://www.youtube.com/watch?v=35uHekXWEOw https://www.youtube.com/watch?v=-AdX4xyJzRU
4. Interview and Discussion on "Quantum Physics and the quest for understanding Reality" in the Thought Integrator podcast series (https://www.youtube.com/watch?v=2gL4cndJT7o).

5. Recognised as "Outstanding Referee for the month of October 2021" by *Communications Physics*, Nature Publishing Group (https://www.nature.com/commsphys/referees/outstanding-referees).
6. Our lab's work on Quantum Information, Computing and Communications and its innovations were broadcasted on the national news channel DD News, dated 7th February 2021. The Youtube links are listed below.
   https://youtu.be/KieW2loOpbw (Hindi)
   https://youtu.be/KfjT3-S4bYo (Video starts at 19.00 to 22.40)
7. The office of the Principal Scientific Officer of the Prime Minister has highlighted our lab's work on their website. This was a top featured article from the office of the PSA.
   https://www.psa.gov.in/article/way-lab-bengaluru-leading-india-quic-ly-catchquantum-race/2487
8. Only Indian work highlighted in the category of Physics and Mathematics in the white paper compilation of Asian research for the last five years, Asian Scientist 2020. The Asian Scientist magazine recently released a white paper, which provides a snapshot into Asia's thriving scientific landscape and the scientists leading the way.
   (https://www.asianscientist.com/wp-content/uploads/2020/12/Five-Years-Of-The-Asian-Scientist-100.pdf?utm_source=web&utm_medium=email&utm_campaign=as500)
9. The Department of Science and Technology in listing the 20 major success stories of 2020, highlighted her recent work in Quantum Key Distribution as well as their development and demonstration of a novel quantum state estimation protocol.
   https://dst.gov.in/sites/default/files/DST-Achievement2020.pdf
10. Recent work in Quantum Key Distribution also highlighted by India Science- The nation's Science Channel as one of the top ten innovations for 2020.
    (https://www.youtube.com/watch?v=CA_9orTBAsk)
11. Work highlighted in interview by *New Scientist*, 14th March 2020 issue.
12. Work highlighted in #TechniqueThursday which is an online recognition of the Asian Scientist Magazine, January 2020.
13. Recognised as one of Top 100 Scientists in Asia in the 2019 edition of Asian Scientist 100.
14. Recognised as "Asia's Scientific Trailblazer", Asian Scientist Magazine, November 2018.

CONFERENCES

1. Invited speaker at the World Telecommunications Standardization Assembly (WTSA) 2024 Innovation Xchange Summit, 23rd October 2024.
2. Invited speaker at the India Mobile Congress (IMC 2024), Quantum Advantage Summit, 17th October 2024.
3. Keynote speaker at the Quantum Alberta workshop, Calgary, Canada, 1st October 2024.
4. Invited speaker at the Indo-US Quantum workshop, 16th September 2024.
5. Plenary speaker at the International Conference on Quantum Communications, Measurement and Computing, QCMC 2024, 30th August 2024.
6. Invited speaker at IEEE Connect conference, Bengaluru, 12th July 2024.
7. Invited speaker at the IQST student retreat conference, Stuttgart/Ulm, Germany, 22nd May 2024.
8. Opening speaker at New Frontiers in Semiconductor Technology and Quantum Technology" 13th May 2024, Amity Institute of Nanotechnology, Amity University Uttar Pradesh.
9. Invited speaker and invited panellist at CLEO 2024, Charlotte, North Carolina, USA, 6th May 2024 and 9th May 2024.
10. Keynote speaker at the NYUAD Quantum Hackathon for Social Good, NYU Abu Dhabi, 28th April 2024.
11. Invited Speaker at Bristol Quantum Information Technology Workshop, Bristol, United Kingdom, 22nd April 2024.
12. Invited speaker at the National Workshop on Quantum Physics, Alice in Wonderland, organised by the Indian Association for Physics teachers, 14th April 2024.
13. Invited speaker at SYNAPSE conference, Gurgaon, India, 25th February 2024.

14. Invited panellist for the "Quantum Networks session" as a part of the Canadian National conference Quantum Days, 23rd February 2024.
15. Keynote note at "Creating tomorrow" event as a part of Quantum Days, 21st February 2024.
16. Invited conclave talk at the "National Physicists Conclave 2024", SRM University, 8th February 2024.
17. Invited talk at the International Conference on Quantum Information and Quantum Communications as a part of the Bose Centenary Fest, SN Bose National Centre, 30th January 2024.
18. Invited talk at India International Science Festival (IISF) 2024, Faridabad, India, 20th January 2024.
19. Keynote talk at the " QCom(P) workshop on Quantum Communication and Computing, 16th International Conference on COMmunication Systems and NETworkS (COMSNETS 2024), 7th January 2024.
20. Keynote talk at the "National Quantum Science and Technologies Symposium (NQSTS)", Delhi, India, 14th December 2023.
21. Invited panellist for the Session 'Get Ready for a Quantum Spin Bowling – The Future of Quantum Computing' Bengaluru Tech Summit, Bengaluru, India, 30th November 2023.
22. Invited intervention at the "OECD GFTech event: Future in flux? Global issues and national strategies for responsible quantum technology development", 27th November 2023.
23. Invited opening talk at the "UK-India Quantum Technology workshop", 8th November 2023.
24. Invited intervention at the "IIT-IISER Tirupati CAMOST-G20-S20 Consortium Panel Discussion on Quantum Technologies", 28th October 2023.
25. Invited speech at the "Geneva Science and Diplomacy Anticipator (GESDA) annual summit", 13th October 2023.
26. Invited talk at "TSDSI Tech Deep Dive 2023 conference in the session: Security for 6G: Challenges and Approaches", 5th October 2023.
27. Invited talk at "Condensed Matter meets Quantum Information conference", International Centre for Theoretical Sciences (ICTS), Bengaluru, 4th October 2023.
28. Invited talk at "Quantum Position Verification (QPV 2023) conference", Perimeter Institute, Waterloo, Canada, 20th September 2023.
29. Invited talk at "Webinar on Critical and Emerging Technology: Quantum Technologies and Artificial Intelligence for Transforming Lives", Indo US Science and Technology Forum, 23rd August 2023.
30. Invited talk at "Webinar on Quantum Technologies: From research to Commercialization", Matrix Forum, TIE Bangalore, 10th August 2023.
31. Invited talk at "Raymond Laflamme's 60th birthday conference", Waterloo, Canada, 20th July 2023.
32. Invited talk at "India Space Congress 2023", New Delhi, India, 10th July 2023.
33. Invited talk at "Photonics 2023", Indian Institute of Science, Bengaluru, India, 5th July 2023.
34. Invited talk at "QuEST National symposium", Palampur, India, 14th May 2023.
35. TED talk at the National Technology Day summit, New Delhi, India, 11th May 2023.
36. Invited speaker at QIQT 2023, IISER Kolkata, 8th May 2023.
37. Keynote speaker at "NYUAD Quantum Hackathon for Social Good", New York University Abu Dhabi, 30th April 2023.
38. Invited speaker at "Quantum in India: Navigating Forward to Scale", Science for Scale summit, IBM, Bengaluru, India, 13th April 2023
39. Invited speaker at "International Quantum Communications Conclave", Dept. of Telecommunications, Vigyan Bhavan, New Delhi, India, 27th March 2023.
40. Inaugural speaker at *Quantum Techade* organized by CDAC Bangalore, Mysuru, India, 10th March 2023.
41. Invited speaker at a panel discussion on "Indo-French cooperation in quantum technologies with Nobel Laureate Serge Haroche", Shiv Nadar University, India, 13th February 2023.
42. Keynote lecture titled "Photonic quantum science and technologies", at The International Conference on Quantum Computing and Communications, QCC 2023, Bathinda, Punjab, India, 9th February 2023.
43. Invited speaker at the Cyber Security Roadshow, Data Security Council of India and CySeck, Indian Institute of Science, Bengaluru, India, 2nd February 2023.
44. Invited speaker at the international conference on Progress in Quantum Science and technologies, IIT Madras, India, 24th January 2023.

45. Invited speaker at the Physics Teachers Training Programme: Quantum mechanics, International Centre for Theoretical Sciences, Bengaluru, 13th January 2023.
46. Invited speaker at the panel discussion on "Smart Women: Drivers of the Modern era" at the Tech Conclave, IIT Bombay, Mumbai, 23rd December 2022.
47. Invited speaker at the Conference on Women in Optics and Photonics in India, WOPI 2022, 6th December 2022.
48. Invited speaker at the IBM Quantum Computing bootcamp, 30th November 2022.
49. Chief guest speech on "Photonic quantum science and technologies", ATAL Faculty Development Programme on Quantum Computing and Quantum Information Technology at Manipal Institute of Technology, 28th November 2022.
50. Invited speaker at the KSTA Nobel Lecture Series, 23rd November 2022.
51. Invited speaker at "Showcasing RRI event" as a part of RRI Platinum Jubilee Celebrations, 9th November 2022.
52. Invited speaker at GESDA (Geneva Science and Diplomacy Anticipator) annual summit, 13th October 2022.
53. Invited speaker at QMAT 2022, IIT Kanpur, Kanpur, India, 20th September 2022.
54. Invited speaker at CQIQC IX conference, University of Toronto, Toronto, Canada, 29th August 2022.
55. Invited speaker at Quantum Technology workshop, IISER Pune, Pune, India, 21st August 2022.
56. Invited Speaker at Apportunity 2022, global online conference, 3rd June 2022.
57. Inaugural speaker for the CDAC Quantum Technology workshop, Bangalore, 2nd June 2022.
58. Invited speaker at QIQT 2022, IISER Kolkata, 1st June 2022.
59. Invited speaker at the QuEST National symposium, IIIT Hyderabad, 11th April 2022.
60. Invited speaker at the School of Physical Sciences March meeting, JNU, 29th March 2022.
61. Invited speaker at the International Conference on Quantum Information and Foundations, ICQIF 2022, ISI/SNBNCBS/CU Kolkata, 18th February 2022.
62. Invited speaker at the National Laser Symposium, Bhabha Atomic Research Centre, 19th January 2022.
63. Invited speaker at the National Student Symposium on Physics, Indian Association of Physics Teachers, Indian Academy Degree College, Bangalore, 12th November 2021.
64. Keynote talk titled "Photonic Quantum Science and Technologies", IEEE Quantum Week international conference, 20th October 2021.
65. Invited speaker at the panel discussion on Global Quantum Communication, 5th International Yanqi Lake meeting, 15th October 2021.
66. Invited speaker at the panel discussion at the Quantum Security Symposium, Data Security Council of India, 15th September 2021.
67. Invited talk titled "Revealing new facets of Superposition and Interference", Vienna Quantum Foundations conference, Vienna, Austria, 7th September 2021.
68. Invited speaker at the panel discussion on Security in the Post Quantum World, TCS Global event Anvetion, 1st September 2021.
69. Invited speaker at the panel discussion " Race for Quantum Rays (Q-Rays)", 28th August 2021.
70. Plenary talk titled "Quantum Science and Technologies using photons", National Quantum Science and Technology Symposium (NQSTS 2021), 30th July 2021.
71. Keynote talk titled "Quantum Computing and Secure Quantum Communications: Two sides of the same coin", Quantum Computing session at the CDAC Technology Conclave, 28th July 2021.
72. Keynote lecture titled "Quantum Communications" in the AICTE STTP Hands on training on "Quantum Computing and its Applications", MAKAUT West Bengal, 23rd July 2021.
73. Invited lecture on "Quantum Communications" organized by IEEE Photonics Society Bombay Chapter, 17th July 2021.
74. Plenary lecture on "Photonic Quantum Science and Technologies", Summer school on Quantum Information and Quantum Technology QIQT 2021, IISER Kolkata, India, 5th July 2021.
75. Invited lecture on "Photonic Quantum Science and Technologies", TIFR Vigyan Vidushi Programme, 14th June 2021.

76. Invited speaker at the panel discussion at ASSOCHAM 2nd Annual international: India Quantum Technology Conclave IQTC2021, Unlocking the Potential of Quantum for India, 25th May 2021.
77. Invited speaker at the Science Technology and Innovation Forum Side Event: The Era of Quantum Information Technology- Promises and Pitfalls organized by the ITU and the UN Department of Economic and Social Affairs, 3rd May 2021.
78. Invited speaker at workshop on "International Women's Day-2021" organized jointly by Vigyan Prasar and the Office of the Principal Scientific Adviser to the Govt of India, 8th March 2021.
79. Invited speaker at the Royal Society Yusuf Hamied Workshop for India and the UK, organized by the Royal Society UK and the Indian National Science Academy, 4th March 2021.
80. Invited speaker at the Student Conference on Advances in Optics (SCAO 2021) organized by the TIFR OSA Student Chapter, TIFR Mumbai, 5th February 2021.
81. Inaugural lecture at the Quantum Information and Computing Workshop, IIITDM Kurnool, 25th January 2021.
82. Invited lecture on secure quantum communications as a resource person for the ATAL Faculty Development workshop on quantum computing organized by Thakur College of Engineering and Technology, India, 22nd January 2021.
83. Invited speaker at webinar on quantum technologies, Indian Institute of Space Science and Technology Alumni Association, 16th January 2021.
84. Invited review talk at the Young Scientist's conference, India International Science Festival (IISF 2020), 22nd December 2020.
85. Invited speaker at the session titled "Quantum Safe and Enabled Security – leveraging QC while making security safe from it" at the fifteenth edition of the NASSCOM–DSCI Annual Information Security Summit (AISS), 17th December 2020.
86. International conference titled "Quantum Fundamentals, Technology and Applications, QFTA 2020", 5th December 2020.
87. Invited speaker at session on Quantum Communication and Internet at the yearly Conference of India Internet Foundation, 1st December 2020.
88. Invited participation in the virtual roadshow on showcasing cyber security R&D, organized by the National Centre of Excellence for accelerating Cyber security technology development in India, Data Security Council of India (DSCI) with support of the Ministry of Electronics and Information Technology (MEITY) on the 6th November 2020. The invitation was extended to our lab at RRI by virtue of being a key player in the domain of cyber security R&D in India and our booth at the roadshow witnessed excellent footfalls and received high positive feedback.
89. World Summit on the Information Society (WSIS) Forum 2020 session on Cybersecurity in the era of Quantum Information Technology (QIT): challenges and considerations for ICT networks, 31st July 2020.
90. Invited speaker at the online symposium on quantum information and computation (Quantum Talks) organized by IEEE Hyderabad, 2nd July 2020.
91. Indo-German Symposium on Quantum Science and Technologies, IIT Madras, India, 9th to 10th February 2020 (invited speaker).
92. International conference on *Quantum Frontiers and Fundamentals (QFF2020)*, RRI, Bengaluru, India, 13th to 18th January 2020 (overview organiser talk on "Quantum Communication at RRI Bangalore").
93. FGQIT4N, first meeting of the Focus group for developing standards in Quantum Information Technology and Networks, Jijan, China, 9th to 10th December 2019 (invited member of the Focus group formed by the ITU, United Nations).
94. Quantum Computing Workshop at IIIT Hyderabad by IEEE Quantum Computing Special Interest Group, Hyderabad, India, 16th November 2019 (Invited expert lecture).
95. TESSERACT 2019, PDPU Gandhinagar, India, 9th to 10th November 2019 (Invited guest lecture).
96. *OPTO 2019*, Torun, Poland, 23rd to 27th July 2019 (OSA travelling lecturer, invited expert talk).
97. Summer school on Quantum Information and Quantum Technology, IISER Kolkata, Kolkata, India 3rd July 2019 (set of lectures on photon sources and quantum communications).
98. ITU Workshop on Quantum Information Technology for Networks, Shanghai, China 5th to 7th June 2019 (Invited Expert Talk; only invitee from India).
99. *C-DAC Technology Conclave*, C-DAC Innovation Park, Pune, India 4th to 5th April 2019 (Invited Expert Talk).

100. *Topical Meeting on Advances in Photonics (TMAP 2019)*, National Institute of Science, Education and Research, Bhubaneswar, India 29th to 30th March 2019 (Invited talk).
101. 22*nd National Conference on Atomic and Molecular Physics (NCAMP 2019*), Indian Institute of Technology, Kanpur, India 25th to 28th March 2019 (Plenary talk).
102. *Indo-French workshop on Physical and Mathematical Sciences*, Universite Cote d-Azur, Nice, France, 4th to 9th February 2019 (Invited expert talk).
103. *Celebrating the Physics of Anthony Leggett: Tony Leggett's 80th birthday symposium*, Raman Research Institute, Bangalore, India, 3rd-4th February 2019 (Organiser and Overview talk).
104. *International Conference on Quantum Information Processing and Applications (QIPA 2018),* HRI, Allahabad, India, 2nd – 8th December 2018 (Invited talk).
105. *National Workshop on Quantum Computing and Communication Technologies (NWQCCT*), DRDO Bhavan, New Delhi, India, 5th October 2018 (Invited Expert talk).
106. *International Conference on Photonics, Signal Processing and Communication Technologies (ICPSPCT),* Bangalore, India 18th – 20th July 2018. (Invited expert talk).
107. *Frontiers of Science Meeting 2018* co-organized by the Department of Science and Technology and the Royal Society, UK, Royal Society, Chicheley Hall, UK 15th – 18th May 2018 (Invited Talk as well as Indian Organizer for the "Quantum" theme).
108. *Quantum Frontiers and Fundamentals 2018 (QFF 2018)*, Raman Research Institute, Bangalore, India, 30th April – 4th May 2018 (Organiser and Overview talk).
109. *American Physical Society March Meeting 2018,* Los Angeles, USA 5th-9th March 2018 (Invited Talk in a prestigious All Invited Special Session).
110. *International Symposium on New Frontiers in Quantum Correlations 2018*, Kolkata, India 29th January – 2nd February 2018 (Invited Talk).
111. *International Conference on Quantum Foundations 2017,* Patna, India, 4th -9th December 2017 (Invited talk).
112. *International OSA Network of Students (IONS 2017)* organized by OSA student chapter at CUSAT, Cochin, India, 11th-14th September 2017 (Invited speaker).
113. *Student Conference on Optics and Photonics (SCOP 2017)* organized by OSA student chapter at PRL, Ahmedabad, India, 1st-2nd September 2017 (Invited speaker).
114. *International Conference on Women in Physics* organized by the International Union of Pure and Applied Physics, University of Birmingham, UK, 16th-18th July 2017 (part of 5 member delegation from India, co-presented Country poster, presented scientific poster and short talk).
115. *Workshop on Quantum Information Science (WQIS),* Pondicherry, India, 17th-18th February 2017 (Invited lecturer).
116. *Fundamental Problems in Quantum Physics (FPQP 2016),* Bengaluru, India, 21st November – 10th December 2016 (Invited lectures at the school and invited talk at the Discussion meeting).
117. *International Conference on Quantum Foundations 2016,* Patna, India, 30th November – 4th December 2015 (Invited talk).
118. *Workshop on Quantum Information,* National Physical Laboratories, New Delhi, India, 19th August, 2016 (Invited talk as a subject expert).
119. *Formulating and Finding Higher Order Interference*, Perimeter Institute for Theoretical Physics, Waterloo, Canada, 3rd -5th August 31, 2016 (Invited talk).
120. *International Conference on Quantum Information Processing and Applications (QIPA 2015),* HRI, Allahabad, India, 7th – 3th December 2015 (Invited talk).
121. *International Conference on Quantum Foundations 2015,* Patna, India, 30th November – 4th December 2015 (Invited talk).
122. *Workshop on Multi Photon Interferometry,* Shanghai, China, 7th – 10th May 2015 (invited talk).
123. *IEEE Photonics Society workshop on Quantum Computation and Quantum Communication*, IISc, Bangalore, India, 8th January 2015 (invited seminar).
124. *Discussion meeting on Quantum Measure Theory*, RRI, Bangalore, India, 5th – 9th January 2015 (invited talk).
125. *ICTS Discussion meeting on Light-Matter Interactions,* Kolkata, India, 19th – 22nd December 2014 (invited talk).

126. *American Physical Society March Meeting 2014,* Denver, Colorado, USA, 3rd – 7th March 2014 (talk in a focus session).
127. *International Program on Quantum Information (IPQI 2014),* IOP, Bhubaneswar, India, 17th – 28th February 2014 (invited talk).
128. *Quantum Information Processing and Applications (QIPA 2013),* HRI, Allahabad, India, 2nd – 8th December 2013 (invited talk).
129. *International Conference on Quantum Information and Quantum Computing (ICQIQC 2013),* Benagluru, India, 7th -11th January 2013 (invited talk).
130. *International Conference on Quantum Communication, Measurement and Computing (QCMC 2012*), Vienna, Austria, 30th July – 3rd August 2012 (poster presentation).
131. *75 years of Quantum Entanglement 2011,* Kolkata, India, 6th-10th January 2011 (invited talk).
132. *Quantum Works Annual General Meeting 2010*, Ottawa, Canada, 10th -11th June 2010 (poster presentation).
133. *Cross Border Workshop on Laser Science 2010*, IQC, Waterloo, Canada, 3rd -5th June 2010 (poster presentation).
134. *QISS* (*Quantum Information with Spins and Superconductors*), IQC, Waterloo, Canada, 16th – 18th May 2010 (poster presentation).
135. *CIFAR (Canadian Institute for Advanced Research) QIP meeting,*held at Caledon, Canada, 24th – 27th May 2009 (invited talk).
136. *The American Physical Society March meeting,* held in Pittsburgh, Pennsylvania, U.S.A 15th-20th March 2009 (oral presentation).
137. *The clock and the quantum,* held at Perimeter Institute, Canada, 27th September-2nd October, 2008 (oral presentation).
138. *International Superconductive Electronics Conference (ISEC 2005),* held in Holland, 5th– 9th September 2005 (poster presentation).
139. *Applied Superconductivity Conference (ASC 2004)*, held in Jacksonville, Florida, U.S.A. 4th-8th October 2004 (oral and poster presentation).
140. *Condensed Matter and Materials Physics Conference (CMMP 2004)*, Warwick, U.K. 4th -7th April 2004. (Poster presented).
141. *International Conference on Nanoscience and Technology (ICONSAT)*, Kolkata, India, 17th-20th December 2003. (Poster presented).
142. *Asian Meeting on Ferroelectricity (AMF4),* Bangalore, India, 12th-15th December 2003. (oral presentation).
143. *European Conference on Applied Superconductivity (EUCAS),* Sorrento, Italy, 14th-17th September 2003. (co-author in a poster presentation).
144. *European Meeting on Ferroelectricity (EMF4),* Cambridge, U.K., 3rd-7th August 2003.

SEMINARS

1. **Institute Colloquium** titled " Light, Camera, Action", Tata Institute for Fundamental Research (TIFR) Mumbai, 6th November 2024.
2. **Institute Colloquium** titled " Light, Camera, Action", Chennai Mathematical Institute, Chennai, India, 29th August 2024.
3. **Public lecture** titled "Photonic Quantum Science and Technologies" as a part of the Creactive series, Bengaluru, India, 14th July 2024.
4. **Invited seminar** titled "Photonic Quantum Science and Technologies" at Duke Quantum Center, Duke University, USA, 10th May 2024.
5. **National Science day lecture** titled "Quantum Technologies for Viksit Bharat @2047, Vigyan Bhavan, New Delhi, 28th February 2024.
6. **Invited seminar** titled "Photonic Quantum Science and Technologies" at BEL R&D Excellence Awards, 2nd February 2024.
7. **Colloquium** titled "Photonic Quantum Science and Technologies: Interference at the Heart of Quantum" at Shiv Nadar Institute of Eminence, 19th January 2024.

8. **Invited seminar** titled "Interference at the heart of Quantum", University College London (UCL), 13th November 2023.
9. **Invited talk** titled "Photonic Quantum Science and Technologies" at The Optics and Quantum Electronics seminar series, MIT, USA, 22nd September 2023.
10. **Invited talk** on "Satellite based quantum communications", DST National Consultative Meeting, India, 12th July 2023.
11. **Public lecture cum interview** on "Quantum Technologies", IGNITION 2023, Chennai, India, 14th June 2023.
12. **Public lecture** titled " Role and significance on the National Quantum Mission in India's development", 49th STIP (Science Technology Innovation Policy) forum Public lecture, India, 31st May 2023.
13. **Colloquium** titled "Photonic quantum science and technologies", IISER Mohali, Mohali, India, 22nd March 2023.
14. **Invited seminar** organized by *Quantum@Trento* titled " Revealing new facets in experimental quantum information processing using photons", University of Trento, Trento, Italy, 15th March 2023.
15. **Institute colloquium** titled "Photonic quantum science and technologies", Indian Association for the Cultivation of Sciences (IACS), Kolkata, India, 3rd March 2023.
16. **Invited seminar** titled "The Nobel Prize in Physics 2022", Indian Institute of Science, Bengaluru, India, 12th December 2022.
17. **Institute colloquium** titled "Photonic quantum science and technologies", Ashoka University, India, 2nd December 2022.
18. **Invited seminar** titled "The Nobel Prize in Physics 2022", Indian Association for Physics Teachers (IAPT), 26th November 2022.
19. **Public lecture** titled "The Nobel Prize in Physics 2022", Vignyana Kathegalu series, RRI, 24th November 2022.
20. **Invited seminar** titled "Quantum Communications and beyond: magic of photons", at the Indian Institute of Technology (IIT) Bombay, Mumbai, India, 28th September 2022.
21. **Invited seminar** titled "Revealing new facets in experimental quantum information processing with photons" at the University of Vienna, Vienna, Austria, 20th July 2022.
22. **Institute colloquium** at the Perimeter Institute for Theoretical Physics, Waterloo, Canada, 4th July 2022.
23. **IQC alumni seminar**, Institute for Quantum Computing, Waterloo, Canada, 30th June 2022.
24. **Invited talk** at IISc Quantalks series titled "Revealing new facets in experimental quantum information processing with photons", 30th March 2022.
25. **Expert talk** titled "Photonic Quantum Science and Technologies" organized by Dept. of Applied Sciences, IIIT Allahabad, 24th March 2022.
26. **Invited Physics dept. colloquium** titled "Photonic Quantum Science and Technologies" at Indian Institute of Technology (IIT) Delhi, 9th March 2022.
27. **Chief guest of honour speech** titled "Photonic Quantum Science and Technologies" at National Science Day celebrations, Laboratory for Electro-Optics systems, Indian Space Research Organization, 28th February 2022.
28. **Invited speaker** at Panel discussion event on Quantum Networks, organized by ERNET with SETS & CDAC, 2nd December 2021.
29. **Invited** talk titled "Photonic Quantum Science and Technologies" at the Quantum Aspects of Space Time and Matter series, 11th November 2021.
30. **Invited Physics dept. colloquium** titled "Photonic Quantum Science and Technologies" at the Indian Institute for Science Education and Research (IISER) Pune, 25th October 2021.
31. **Invited institute colloquium** titled "Photonic Quantum Science and Technologies" at the Centre for Atomic, Molecular and Optical Sciences and Technologies (CAMOST) anniversary colloquium series, 18th August 2021.
32. **Invited** lecture on "Quantum Experiments with Satellite Technology" at SAMEER, Ministry of Electronics and Information Technology, 2nd March 2021.

33. **Invited speaker** at panel discussion organized on "Quantum Revolution and its impact in India" by the Institution of Engineering and Technology<https://india.theiet.org/> (IET) on the 27th November 2020.
34. **Invited institute colloquium** at the ICTS monthly colloquium series on "Quantum State Interferography", 16th November 2020.
35. **Invited talk** on "Photonic quantum technologies" at the special symposium on quantum technologies at the Indian Academy of Sciences 86th Annual meeting, 6th November 2020. I was also invited to organize this special session on behalf of the Academy.
36. **Invited institute colloquium** on "Photonic quantum technologies", IIT Gandhinagar, 4th November 2020.
37. **Invited speaker** at ThoughtWorks-E4R symposium 2020, 11th October 2020.
38. **Keynote speaker** at IEEE Quantum Week satellite event organized by IEEE Hyderabad sector Quantum Computing SIG, 3rd October 2020.
39. **Invited Talk** titled "Quantum Experiments with Satellite Technology": Invited to speak at IBM QiSkit Quantum Seminar series, 25th September 2020.
40. **Invited talk** on Quantum Communication at RRI Bangalore, Data Security Council of India Crypto-Innovation Webinar Series: Part IX, 24th August 2020.
41. **Invited speaker** at webinar on Opportunities for Cooperation in Quantum Technologies between India and Russia, 19th August 2020.
42. **Invited talk** on "Secure Quantum Communication & Quantum Key Distribution" at Quantum Computing India seminar series, 15th August 2020.
43. **Keynote speaker** at Accenture Products and Platforms 3rd Annual Day, 1st July 2020.
44. **Invited institute colloquium** at the Russian Quantum Centre online colloquium series, 19th June 2020.
45. **Invited speaker** at panel discussion organized by the Russian Quantum Centre and ROSSCONGRESS (aired on TV BRICS) in a discussion series on quantum technologies. Was invited to speak both at the "Quantum Computing session" on June 4th 2020 as well as "Quantum Communications session" on June 11th 2020.
46. **Invited lectures** on secure quantum communications as a resource person for the ATAL innovation series workshop on quantum technologies organized by Govt College of Engineering, Sengipatti, Thanjavur, India, 4th June 2020.
47. **Plenary lecture** titled "Quantum Experiments using Satellite Technology", National Science Day, IISER Kolkata, 28th February 2020.
48. **Institute Colloquium** under the Quantum at Trento Colloquium series titled "Manipulating Light Quanta", University of Trento, Trento, Italy, 25th September 2019.
49. **Invited seminar** titled "Hong-Ou-Mandel effect: New surprises and revelations" at University of Innsbruck, Innsbruck, Austria, 29th July 2019.
50. **Invited seminar** titled "On Superposition, Interference and Feynman Paths" at University College London, London, UK, 11th July 2019.
51. **Invited seminar** titled "Hong-Ou-Mandel effect: New surprises and revelations" at University of Science and Technology, Shanghai, China, 4th June 2019.
52. **Physics Colloquum** titled "On Superposition, Interference and Feynman Paths" at Ashoka University, Sonipat, Haryana, India, 27th March 2019.
53. **Institute Colloquium** titled "On Superposition, Interference and Feynman Paths" at Saha Institute of Nuclear Physics, Kolkata, India, 16th January 2019.
54. **Expert talk** on activities of the Quantum Information and Computing lab at the PSA Meeting on Quantum Computing, Vigyan Bhavan, New Delhi, India, 13th – 14th January 2019.
55. **IQST seminar** titled "On Superposition, Interference and Feynman Paths" at the Institute for Quantum Science and Technology, University of Calgary, Canada, 21st November 2018.
56. **Invited seminar** titled "On Superposition, Interference and Feynman Paths" at the Department of Applied Mathematics and Theoretical Physics (DAMTP), University of Cambridge, UK, 21st May 2018.
57. **Physics colloquium** titled "On Superposition, Interference and Feynman Paths" at Louisiana State University, USA, 13th March 2018.

58. **APS colloquium** titled "Manipulating Light Quanta" at the American Physical Society Editorial Office, Ridge, New York, USA, 1st March 2018.
59. **Kaapi with Kuriosity public lecture** titled "Fascinating world of photons, superposition and entanglement" at Jawaharlal Nehru Planetarium, 25th February 2018, monthly public lecture series organized by the International Centre for Theoretical Sciences, Bangalore.
60. **Award lecture** titled "A Tale of Three slits: From Superposition to Scalable Quantum Computing" on being awarded the ICTP-ICO Gallieno Denardo Award in Optics 2018, International Centre for Theoretical Physics (ICTP), Trieste, Italy 13th February 2018.
61. **Physics department Colloquium** titled "Fascinating world of photons, superposition and entanglement" at Indian Institute of Technology Madras, 24th January 2018.
62. **Invited seminar** titled "Quantum Technology with photons", PRAVEGA Innovation Summit, IISc Bangalore, 19th January 2018. Also a part of expert panel for panel discussion on Quantum Technology in Pravega Innovation Summit symposium.
63. **Invited seminar** titled "Measuring a deviation from the Superposition principle in interference experiments", IISER Kolkata, India, 9th November 2017.
64. **Institute Colloquium** titled "Fascinating world of photons, superposition and entanglement", Presidency University, Kolkata, India, 8th November 2017.
65. **Invited seminar** titled "Fascinating world of photons, superposition and entanglement", Indian Institute of Space Science and Technology, Trivandrum, India, 16th May 2017.
66. **Invited seminar** titled "Fascinating world of photons, superposition and entanglement", IISU, Indian Space Research Organization, Trivandrum, India, 16th May 2017.
67. **Invited seminar** titled "Spatially correlated qutrits", IISER, Trivandrum, India, 15th May 2017.
68. Talk titled "Measuring the deviation of the superposition principle in interference experiments", at the RRI In House Meeting 6th April 2017.
69. **Keynote lecture** titled " Fascinating world of photons, superposition and entanglement", on the occasion of **National Science day** , Indian Academy Degree College, Bengaluru, India, 28th February 2017.
70. **Institute seminar** titled "A Tale of Three slits: From Superposition to Correlated qutrits", SN Bose National Centre for Basic Sciences, Kolkata, India, 14th September 2016.
71. **Invited seminar** titled "A Tale of Three slits: From Superposition to Correlated qutrits", University of Innsbruck, Innsbruck, Austria, 22nd June 2016.
72. **Invited seminar** titled "A Tale of Three slits: From Superposition to Correlated qutrits", Institute for Quantum Optics and Quantum Information, Vienna, Austria, 20th June 2016.
73. **Invited seminar** titled "A Tale of Three slits: From Superposition to Correlated qutrits", Laboratoire de Physique Théorique et Modélisation, University de Cergy Pontoise, France,17th June 2016.
74. **Invited seminar** titled "A Tale of Three slits: From Superposition to Correlated qutrits", Laboratoire Aime Cotton, Orsay, France, 15th June 2016.
75. **Invited seminar** titled "Surprises regarding the Superposition principle in interference experiments", Institute for Quantum Computing, University of Waterloo, 22nd May 2015.
76. **Invited seminar** titled "Surprises regarding the Superposition principle in interference experiments" CQIQC Quantum Optics seminar, Department of Physics, University of Toronto, 20th May 2015.
77. Talk titled "On the Superposition Principle in Interference experiments" at the RRI Annual In-House meeting, RRI, Bangalore 15th April 2015.
78. **Invited seminar** titled "Quantum Experiments: Superposition, Entanglement and Interference" at the IEEE Photonics Society workshop on Quantum Computation and Quantum Communication, IISc, Bangalore 8th January 2015.
79. **Invited seminar** titled `Non classical paths in quantum interference experiments' at **Nicolas Copernicus University, Torun, Poland** 12th November 2014.
80. **Physics Colloquium** titled "Precision Tests of Quantum Mechanics" at **Harish Chandra Research Institute, Allahabad, India** 4th April 2014.
81. **Public lecture** titled "Quantifying the Quantum" on the occasion of *Women's Day* at **SRN Adarsh College , Bangalore, India** 11th March 2014.
82. **Public lecture** titled 'Quantifying the Quantum" on the occasion of *National Science Day* at **BNM Institute of Technology, Bangalore, India** 28th February 2014.

83. **Invited seminar** titled `Quantifying the Quantum' at the **Centre for Nanoscience and Engineering (CeNSE), Indian Institute of Science, Bangalore, India** 28th November 2013.
84. **Public lecture** under the KSTA-BUB lecture series at Bangalore University titled `Quantifying the Quantum' at **Venkatagiri auditorium, Jnanabharathi campus, Bangalore university, Bangalore, India** 27th September 2013.
85. **Invited seminar** titled `Quantifying the Quantum' at the **Institute for Quantum Science and Technology, University of Calgary, Calgary, Canada** 17th July 2013.
86. **Institute Colloquium** titled `Quantifying the Quantum' at **Tata Institute for Fundamental Research (TIFR), Mumbai, India** 17th April 2013.
87. **Invited talk** titled `Triple slits, Born Rule and Beyond..' at **Indian Association for Cultivation of Sciences, Kolkata, India** 7th May 2012.
88. Seminar titled `Triple slits, Born Rule and Beyond..' at th**e University of Toronto, Toronto, Canada** 8th December 2011**.**
89. Seminar titled `Triple slits, Born Rule and Beyond..' at **Institute for Quantum Information Science, Calgary, Canada** 29th November 2011.
90. **Invited talk** titled `Born Rule(s)' at the 75 Years of Quantum Entanglement conference, **Kolkata, India** 7th January 2011.
91. **Invited talk** titled `Born Rule(s)' at the IQC Board meeting, **Institute for Quantum Computing, Waterloo, Canada** 22nd October 2010.
92. **Invited talk** titled `Born Rule(s)' at **Princeton University, Princeton, NJ, USA** 27th September, 2010.
93. **Invited talk** titled `Born Rule(s)' at **University of Kentucky, Lexington, KY, USA** 31st August, 2010.
94. **Invited talk** titled `Testing quantum mechanics using a three slit experiment' at **Indian Association for Cultivation of Sciences, Kolkata, India** 10th February 2010.
95. **Invited talk** titled `Testing quantum mechanics using a three slit experiment' at **University of Illinois Urbana Champaign, IL, USA** 9th December 2009.
96. **Invited talk** titled `Testing quantum mechanics using a three slit experiment' at **Indian Institute for Sciences, Bangalore, India** 14th August 2009.
97. **Invited talk** titled `Testing quantum mechanics using a three slit experiment' at **Raman Research Institute, Bangalore, India** 13th August 2009.
98. **Invited talk** titled ` Testing quantum mechanics using a three slit experiment' at the **CIFAR QIP meeting, Caledon, ON, Canada** 25th May 2009.
99. **Oral presentation** titled ` Testing quantum mechanics using a three slit experiment' at The **American Physical Society March meeting**, **Pittsburgh, Pennsylvania, USA** 16th March 2009.
100. Seminar titled 'Testing quantum mechanics using a triple slit experiment', **Saha Institute for Nuclear Physics (SINP), Kolkata, India**, 9th January, 2009.
101. Seminar titled 'Dielectric characterization using resonances in high T_CJospehson junction circuits', **S.N Bose National Centre for Basic Science, Kolakta, India**, 9th January, 2009.
102. Seminar titled 'Resonances, asymmetry, SQUIDs, noise and all that jazz', **Tata Institute for Fundamental Research (TIFR), Mumbai, India**, 6th January, 2009.
103. Seminar titled 'Resonances, asymmetry, SQUIDs, noise and all that jazz', **Indian Institute for Sciences (IISc), Bangalore, India**, 17th December, 2008.
104. Seminar titled 'Testing quantum mechanics using a triple slit experiment', **Institute for Mathematical Sciences, Chennai, India**, 15th December, 2008.
105. **Oral presentation** titled ` Testing quantum mechanics using a three slit experiment' at **The Clock and the Quantum conference**, **Perimeter Institute, Waterloo, Canada**, 30th September 2008.
106. Seminar titled 'Three slit experiment',**National Physical Laboratories, London, UK,** 5th September, 2008.
107. Seminar titled 'Three slit experiment', **Cavendish Laboratories, University of Cambridge, U.K.,** 3rd September, 2008.
108. Seminar titled 'Dielectric characterization using resonances in high T_CJosephson junction circuits', **MIT, Cambridge, USA** 22nd July 2008.
109. Seminar titled 'Three slit experiment', **Indian Association for Cultivation of Sciences, Kolkata, India,** 18th February 2008.

110. Seminar titled 'Development of microporous paper coatings', **Cavendish Laboratories, University of Cambridge, U.K.,** 19th June 2007.
111. **Nanoscale Science and Engineering Science (NSEC) seminar at Harvard University, USA**, 13th October 2006.
112. Seminar titled 'Dielectric characterization using resonances in high T_CJospehson junction circuits', **Clarke Group seminar, University of California Berkeley (UCB), USA**, 10th October 2006.
113. Seminar titled 'Dielectric characterization using resonances in high T_CJospehson junction circuits', **Martinis Group seminar, University of California Santa Barbara (UCSB), USA**, 4th October 2006.
114. Seminar titled 'Dielectric characterization using resonances in high T_CJospehson junction circuits', **Thin films and Interfaces Group seminar, Cavendish laboratories**, **University of Cambridge**, U.K., 25th September 2006.
115. Seminar titled 'JOBS and SQUIDs' as a part of the Device Materials Group termly seminar series, **University of Cambridge**, U.K., 9th June 2005.
116. **Oral presentation** titled `Characterization of Ferroelectric thin films by a Josephson-junction based On-chip spectrometer' at The **Applied SuperconductivityConference (ASC)**, **Jacksonville, Florida**, 7th October 2004.
117. **Invited talk** titled `Josephson broadband Spectroscopy' at the **Speclab, SanJuan, Puerto Rico, USA** on 11th October 2004.
118. Seminar titled 'Josephson Broadband Spectroscopy of nearly ferroelectric thin films' as a part of the Device Materials Group termly seminar series, **University of Cambridge**, U.K., 3rd June 2004.
119. **Invited talk** titled 'Device fabrication and Optimization for Josephson Broadband Spectroscopy of Ferroelectric thin films' **at Saha Institute of Nuclear Physics (SINP)**, **Kolkata, India**, 8th January 2004.
120. **Oral presentation** titled 'Device fabrication and Optimization for Josephson Broadband Spectroscopy of Ferroelectric thin films' at **The Asian Meeting on Ferrolectricity (AMF4)**, **Indian Institute of Sciences (IISC), Bangalore, India**, 14th December 2003.
121. Seminar titled 'Josephson Broadband Spectroscopy of thin films' at the departmental Postgraduate Seminar day, **University of Cambridge**, U.K., June 2003.
122. **Invited talk** titled 'Pulsed Laser Deposition, Lithography techniques and An Introduction to Josephson Broadband Spectroscopy of Ferroelectric thin films' at **Indian Association forCultivation of Sciences (IACS), Kolkata**, April 2003.
123. **Invited talk** titled 'High T_c Axial gradiometers using Superconducting imaging surface' at **Saha Institute of Nuclear Physics (SINP), Kolkata**, 6th September 2002.
124. **Invited talk** titled 'High T_c Axial gradiometers using Superconducting imaging surface' at **Indian Association for Cultivation of Sciences (IACS), Kolkata**, 10th September 2002.

PUBLIC OUTREACH AND REPORTS ON MY RESEARCH

1. https://timesofindia.indiatimes.com/home/science/rri-moves-step-closer-to-ground-to-satellite-based-secure-quantum-communications/articleshow/99167615.cms?from=mdr
2. https://www.thehindu.com/news/cities/bangalore/raman-research-institute-researchers-demonstrate-ground-to-satellite-secure-communication-quantum-key-distribution-qkd/article66687197.ece
3. https://www.deccanherald.com/science-and-environment/rri-breakthrough-to-power-secure-satellite-based-quantum-communication-1205729.html
4. https://www.deccanherald.com/state/defence-sector-will-gain-from-quantum-communication-breakthrough-1205862.html
5. https://www.newindianexpress.com/states/karnataka/2023/apr/02/raman-research-institutebreakthrough-to-make-online-transactions-safe-2561836.html
6. https://www.prajavani.net/amp/district/bengaluru-city/safe-communication-significant-research-in-rri-1028362.html
7. https://www.youtube.com/watch?v=VyZJE9p0dxw

8. https://www.anandabazar.com/science/to-make-defence-security-fully-hacking-proof-isro-tested-technolgy-proposed-by-bengali-woman-8-years-back-dgtls/cid/1272393
9. https://www.anandabazar.com/science/dsts-quest-urbasi-sinha-using-relay-repeater-technology-for-most-secure-telecommunication-dgtlx/cid/1264305
10. https://timesofindia.indiatimes.com/india/in-a-first-rri-transfers-quantum-encryption-key-safely-between-buildings/articleshow/81138499.cms
11. https://www.deccanherald.com/science-and-environment/bengaluru-scientists-make-quantum-technology-breakthrough-954329.html
12. https://bangaloremirror.indiatimes.com/bangalore/others/take-the-quantum-leap-between-two-buildings/articleshow/81143123.cms
13. https://www.thebetterindia.com/250496/professor-urbasi-sinha-raman-research-insititute-bengaluru-quantum-communication-end-to-end-encryption-him16/amp/
14. http://www.rri.res.in/quic/RajasthanPatrika.jpeg
15. http://www.telegraphindia.com/1100723/jsp/frontpage/story_12716779.jsp
16. http://news.therecord.com/article/757952
17. http://www.anandabazar.com/9pro6.htm
18. http://www.youtube.com/watch?v=tDDFmy7n5FQ&feature=player_embedded
19. An article in the Indian monthly magazine "Desh", September issue.
20. An article in the August 13th 2010 issue of India Abroad news magazine.
21. http://www.telegraphindia.com/1110108/jsp/calcutta/story_13408505.jsp

TEACHING AND OUTREACH ACTIVITIES

1. Member of the Doctoral Programme Management Committee (DPMC), Raman Research Institute, 2023 onwards.
2. Member of Local Organising Committee for the First Raman Conference on Light and Matter Physics, August 14th to 18th 2023.
3. Main organiser of the Women in Optics and Photonics in India conference, Raman Research Institute, Bangalore, India, December 5th to 7th 2022.
4. Teaching a graduate level course on Quantum Optics at RRI Bangalore, India in the August 2022-January 2023 term.
5. Quantum@School as a part of World Quantum Day, Main organiser, April 2022.
6. Subject expert member of the Evaluation Committee for National Centre for Quantum Material Technologies by Ministry of Electronics and Information Technology, 2020-2021.
7. Am a part of the Program Committee for AQIS 2021 (21st Asian Quantum Information Science conference) to be held in Tokyo, Japan, 1st – 4th September 2021.
8. Teaching a graduate level course on Quantum Information and Computing at RRI Bangalore, India in the February – June 2021 term.
9. Taught a graduate level course on Quantum Optics at RRI Bangalore, India in the August 2020 – January 2021 term.
10. Invited member of the Focus Group on Quantum Information Technologies for Networks (FGQIT4N) constituted by the ITU, United Nations, December 2019- December 2020.
11. Organiser for the 2-day international workshop on *Quantum Communications, Sensing and Metrology*, Centre for Excellence in Quantum Technology, Raman Research Institute, Bangalore, India, 17th-18th August 2020.
12. Main Organiser for the international conference titled *Quantum Frontiers and Fundamentals 2020 (QFF 2020)*, Raman Research Institute, Bangalore, India, 13th – 18th January 2020.
13. Am a part of the Program Committee for AQIS 2019 (19th Asian Quantum Information Science conference) held in Seoul, Korea, 19th – 23rd August 2019.
14. Identified as one of the leaders in the upcoming National Mission on Quantum Computing and Quantum Frontier in meeting organised by the office of the Principal Scientific Advisor to the Govt of India on the "Future of Quantum Computing in India", 13th – 14th January 2019.

15. Taught a graduate level course on Quantum Information and Computing at RRI Bangalore, India in the January – May 2019 term.
16. Vice Chairperson of a Technical Evaluation team for the Defence Research and Development Organisation (DRDO), India, February 2019 onwards.
17. Member of the Editorial Board for New Journal of Physics, July 2018 onwards.
18. Main Organiser/ Convenor for international symposium titled *Celebrating the Physics of Anthony Leggett: Tony Leggett's 80th birthday symposium* at the Raman Research Institute, Bangalore, India, 3rd-4th February 2019
19. Taught a graduate level course on Quantum Information and Computing at RRI Bangalore, India in the January – May 2018 term.
20. Main Organiser for the international conference titled *Quantum Frontiers and Fundamentals 2018 (QFF 2018)*, Raman Research Institute, Bangalore, India, 30th April – 4th May 2018.
21. Was a part of the Program Committee for QCMC 2018 (International Conference on Quantum Communication, Measurement and Computing) held in Louisiana, USA, March 2018.
22. Taught a graduate level course on Quantum Information and Computing at RRI Bangalore, India in the January – May 2017 term.
23. Taught a graduate level course on Quantum Information and Computing at RRI Bangalore, India in the January – May 2016 term.
24. Taught a graduate level course on Quantum Information and Computing at RRI Bangalore, India in the January – May 2015 term.
25. Taught a graduate level course on Quantum Information and Computing at RRI Bangalore, India in the January – May 2014 term.
26. Member of RRI PhD admissions committee, colloquium organizing committee, warden for an RRI student hostel.
27. Taught a graduate level course on Quantum Information and Computing at RRI Bangalore, India in the January – May 2013 term.
28. Co-organized the "ICTS Mini Winter school for Quantum Information and Computing" held at IISc Bangalore, India from 3rd – 5th January 2013.
29. Was a part of the Local Organizing Committee for the "International Conference on Quantum Information and Quantum Computing (ICQIQC 2013)" held at IISc Bangalore, India from 7th – 11th January 2013.
30. Delivered a set of 4 lectures titled "Quantum Information and Computation using Quantum Optics"at the Quantum Information and Computation summer school organized by IISc Bangalore, May 2012.
31. Participated in the IQC annual Open house, September 2010.
32. Lectured on Introduction to Quantum Mechanics in the Quantum Cryptography School for Young Students 2010 held at IQC from 26th – 30th July 2010.
33. Lectured on Introduction to Quantum Mechanics in the Quantum Cryptography School for Young Students 2009 held at IQC from 27th – 31st July 2009.
34. Participated in the Perimeter Institute – IQC outreach workshops for high school children and teachers, Fall 2008.
35. Demonstrated the usefulness of Material Science and science in general to school children as a part of the Physics at Work workshop held in the Cavendish laboratories, Cambridge, September 20-22nd 2005.
36. Supervised students from St.Edmund's College, Cambridge doing Part IA Mathematics Course of the Natural Sciences Tripos, Fall 2003-04. Supervisions in Cambridge are like tutorial sessions or problem classes.
37. Supervised students from Queens' College, doing Part IA Physics Course of the Natural Sciences Tripos, Easter term 2003.

STUDENTS AND PERSONNEL

CURRENT

Post Doc/Scientist C

1. Dr. Satyaranjan Behera
2. Dr. Animesh Sinha Roy
3. Dr. Kallol Sen
4. Dr. Debadrita Ghosh

PhD students

1. Saumya Ranjan Behera
2. Mehak Layal
3. Subhra Dey

Project assistant (equivalent to JRF)/ Project engineers/Scientist B/Consultants:

1. Sujatha S
2. Melvee George

Project students:

1. Mahdi Shamasei (Masters' student)
2. Aavani (Masters' student)
3. Snighdadev Ray (project intern)
4. Sachin Velu (project intern)
5. Subhadip Dutta (Masters' Student)
6. Astha Zalone (project intern)

PAST

Post Doc/Scientist C/Project scientist

1. Dr. Kaumudibikash Goswami
2. Sourav Chatterjee
3. Dr. Mandira Pal

PhD students:

1. Dr. Simanraj Sadana
2. Dr. Ashutosh Singh
3. Dr. Kaushik Joarder
4. Dr. Surya Narayan Sahoo
5. Dr. Sanchari Chakrabarti

Project students:

1. Arnav Bhavsar (Masters's student)
2. Sayan Gangopadhyaya (Bachelors' thesis project)

3. Priyanka M (Masters' thesis project)
4. A. Anuradha
5. Rakshita R.M.
6. Udit Gupta
7. K. Balaji
8. Debadrita Ghosh
9. Thanmay Menon
10. G. Rengaraj
11. U.Prathwiraj
12. Hafsa Syed
13. Nandini S.G. (Masters' thesis)
14. Gareeyasee Saha
15. Sai Dheeraj Nadella
16. Siva Pradyumna
17. Sudhi Oberoi
18. Pradeep N
19. Animesh Aaryan
20. Anjali P.S.
21. Aravind HV (Co-supervised Masters' thesis with Prof. Aninda Sinha, IISc)
22. Shreya Ray (Masters' thesis)
23. Nidhin Prasnnan
24. Reena Sayani (Masters' thesis)
25. Sunny Saurabh (Masters' thesis)
26. Karthik. S. Joshi
27. Arun V.S. (co-supervised with Prof. Vasant Natarajan, IISc)
28. Matthew Volpini and Tong Zhao (co-supervised with Prof. Thomas Jennewein)
29. Nikesh Dattani (co-supervised with Prof. Raymond Laflamme)
30. Zachari Medendorp (co-supervised with Dr.Christophe Couteau and Prof. Gregor Weihs)
31. Rajiuddin SK
32. Tadasha Dash
33. Sreekuttan LS (Masters student, IISER Pune)