BIVEEN SHAJILAL

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LinkedIn Profile – Biveen Shajilal
Google Scholar Profile - Biveen Shajilal

Quantum Innovation Centre (Q.InC)
Agency for Science, Technology and Research
Fusionopolis, Singapore

SHORT BIO & INTERESTS

• Scientist (Quantum Physics) at A*STAR Quantum Innovation Centre (Q.InC) • Private consulting for startups in quantum technologies • PhD from the Australian National University specialising in Quantum Optics and Quantum Information • Member of Prof. Ping Koy Lam's Quantum Optics and Quantum Information research group • Former affiliation with the Centre for Quantum Computation and Communication Technology, Australia • Currently affiliated with Centre for Quantum Technologies, National University of Singapore, Singapore • Research interests: (i) Non-classical light sources at 1550 nm and 1064 nm for secure communications and metrology (ii) Quantum optics, and (iii) Quantum metrology, and (iv) Quantum sensing • Seeking opportunities in quantum or optical technologies for applications in secure communications, metrology, and sensing.

EDUCATION AND EXPERIENCE

2023 Scientist in Quantum Physics — ***Agency for Science, Technology and Research, Singapore***
(May. 2023 – Ongoing) — Quantum Innovation Centre (Q.InC)
Reporting Officers: Dr. Young-Wook Cho, Dr. Syed Assad, and Prof. Ping Koy Lam
Area of research: Quantum Optics, Quantum Information, Squeezed Light Sources for Quantum Metrology

Skills: Quantum information theory, Experimental quantum optics, Free space optics and Fibre optics - 1550 nm and 1064 nm (along with second-harmonics), Optical instrumentation (low-noise optomechanics etc), Resonator cavity design and development, Development of coherent feedback control systems for laser locking and interferometer stabilization - Digital (FPGA-based) and Analog systems (PDH analog circuits), Optical sideband resolved measurements (RF frequencies), RF electronics, High efficiency - high bandwidth optical homodyne and heterodyne detection, Noise budgeting, Phase noise measurements, Shot noise limited laser doppler vibrometry, Automation of experiments and real-time data processing stacks using Python or NI LabView suite (NI hardware and software), Adoption of Red-Pitaya based control loops for replacing NI hardware - low cost operation, Infrastructure development - Managed the development of the quantum metrology lab in Q.InC., etc.

Software: MATLAB, Mathematica, LabView, Python, Julia, Autodesk Fusion, Blender, etc.

Duties: Engagement with external stakeholders on grant proposals and management, Grant writing, Supervision of PhD candidates, Supervision of research engineers and trainees, Engagement with technology translation bodies, Procurement and management of equipments (including procurement of export controlled commodities) etc.

2023 Private Consultant — ***Independent contractor - Consulting in Quantum Technologies, Singapore***
(May. 2023 – Ongoing) Feasibility study on quantum key distribution systems for short-medium scale fibre links
Areas covered: Protocol feasibility, Hardware design, Noise budgeting, Budget estimation for large scale deployment, Policy and standardisation etc

2023 PhD in Quantum Optics — ***Australian National University, Canberra, Australia***
(Nov. 2018 – May 2023) — Department of Quantum Science
Advisors: Dr. Jiri Janousek, Prof. Elanor Huntington and Prof. Ping Koy Lam

Thesis: "Experimental and theoretical investigation of quantum communication resources: A study on squeezing, entanglement and entropic accord"

2018 Master of Science in Photonics (Five Year Integrated Programme)
(July 2013 – June 2018)
Cochin University of Science and Technology, Kerala, India
Specialisation: Nonlinear optical materials, Whispering gallery mode heralded single photon sources

INTERNSHIPS

2017 Graduate Research Student ***University of Exeter, U.K.***
(Dec. 2017 – May 2018) Living Systems Institute
Host: Prof. Frank Vollmer

2016 Summer Research Fellowship, Indian Academy of Sciences ***Physical Research Laboratory, India***
(April 2016 – July 2016) Quantum Optics and Singular Optics Division
Host: Prof. R. P. Singh

2015 Summer Research Fellowship, Jawaharlal Nehru Centre for Advanced Scientic Research
Theoretical Physics Unit
(May 2015 – July 2015) Condensed Matter Theory Group
Host: Prof. Shobhana Narasimhan

AWARDS & SCHOLARSHIPS

2018 – 2022 **International Student PhD Scholarship and HDR Fee Remission Scholarship**
Tuition fee award and living allowance stipend

2018 – 2022 **Postgraduate Research Scholarship** (funded by CQC2T)
Living allowance top-up

2018 **Prof. Leggett Award (Programme topper - MSc in Photonics)**

2014 **Nalanda Endowment Award, International School of Photonics. Top scorer for first year of MSc in Photonics programme**

PUBLICATIONS

[14] **Spin correlations in recirculating multipass alkali cells for advancing quantum magnetometry**
Q. L. Kee, L. Zhao, R. Lecamwasam, B. Shajilal, X. Liang, J. K. Jose, Y. Chen, P. K. Lam, T. Wang
arXiv:2506.14160 [quant-ph], Under review in *IOP Quantum Science and Technology*

[13] **Attainability of quantum state discrimination bounds with collective measurements on finite copies**
L. O. Conlon, J. M. Koh, B. Shajilal, J. Sidhu, S. Tserkis, P. K. Lam, S. M. Assad
Physical Review A 111.2 (2025): 022438

[12] **Improving Gaussian channel simulation using nonunity-gain heralded quantum teleportation**
B. Shajilal, L. O. Conlon, A. Walsh, S. Tserkis, J. Zhao, J. Janousek, P. K. Lam, S. M. Assad
Physical Review Applied 22.5 (2024): 054070

[11] **Mapping Guaranteed Positive Secret Key Rates for Continuous Variable Quantum Key Distribution**
M. Sayat, O. Thearle, B. Shajilal, S. P. Kish, P. K. Lam, N. Rattenbury, J. Cater
Entropy 26, no. 10 (2024): 865

[10] **Verifying the security of a continuous variable quantum communication protocol via quantum metrology**
B. Shajilal, L. O. Conlon, A. Walsh, J. Zhao, J. Janousek, P. K. Lam, S. M. Assad
npj Quantum Information. 2024 Apr 4;10(1):35

[9] **Satellite-to-Ground Continuous Variable Quantum Key Distribution: The Gaussian and Discrete Modulated Protocols in Low Earth Orbit**
M. Sayat, B. Shajilal, S. P. Kish, S. M. Assad, T. Symul, P. K. Lam, N. Rattenbury, J. Cater
IEEE Transactions on Communications, doi: 10.1109/TCOMM.2024.3359295

[8] **Enhancing quantum teleportation efficacy with noiseless linear amplification**
J. Zhao, H. Jeng L. O. Conlon, S. Tserkis, B. Shajilal, K. Liu, T. C. Ralph, S. M. Assad, P. K. Lam
Nature Communications. 2023 Aug 7;14(1):4745

[7] **Surpassing the repeaterless bound with a photon-number encoded measurement-device-independent quantum key distribution protocol**
O. Erkilic, L. O. Conlon, B. Shajilal, S. P. Kish, S. Tserkis, Y.S. Kim, P.K. Lam, S. M. Assad
npj Quantum Information, 2023 Mar 28;9(1):29

[6] **12.6 dB squeezed light at 1550 nm from a bow-tie cavity for long-term high duty cycle operation**
B. Shajilal, A. Tranter, O. Thearle, Y. Lu, E. Huntington, S. M. Assad, P. K. Lam, and J. Janousek
Optics Express. 2022 Oct 10;30(21):37213-23

[5] **A new entropic quantum correlation measure for adversarial systems**
B. Shajilal, E. Huntington, P. K. Lam, S.M. Assad
Scientific Reports. 2023 Jan 25;13(1):1436

[4] **Brillouin optomechanics: from strong coupling to single-phonon-level operations**
G. Enzian, L. Freisem, J. J. Price, A.O. Svela, J. Clarke, M. Szczykulska, J. Nunn, I. A. Walmsley, J. Silver, L. D. Bino, S. Zhang, P. D. Haye, B. Shajilal, J. Janousek, B. C. Buchler, P. K. Lam, M. R. Vanner
Proceedings of Optical and Quantum Sensing and Precision Metrology II; 120160E (2022)

[3] **Non-Gaussian Mechanical Motion via Single and Multiphonon Subtraction from a Thermal State**
G. Enzian, L. Freisem, J. J. Price, A.O. Svela, J. Clarke, B. Shajilal, J. Janousek, B. C. Buchler, P. K. Lam, M. R. Vanner
Physical Review Letters 127, 243601 (2021)

[2] **Single-and Multi-Phonon Subtraction to a Mechanical Thermal State via Optomechanics**
G. Enzian, L. Freisem, J. J. Price, A. O. Svela, J. Clarke, B. Shajilal, J. Janousek, B. C. Buchler, P. K. Lam, M. R. Vanner
Laser Science 2021, (pp. LM6E-1), Technical Digest Series, Optica Publishing Group (2021)

[1] **Observing sub-Poissonian statistics of twisted single photons using oscilloscope**
N. Lal, B. Shajilal, A. Ali, C. Perumangatt, R.P. Singh
Review of Scientific Instruments 90, 113104 (2019)

Manuscripts under Preparation

[1] **Scalable entanglement distribution using noiseless linear amplifiers**
A. A. Baiju, S. M. Assad, P. K. Lam, B. Shajilal, L. O. Conlon

[2] **Virtual photon subtraction for prepare and measure communiation protocols**
B. Shajilal, L. O. Conlon, P. K. Lam, S. M. Assad

[3] **Virtual photon addition on thermal states**
H. Jeng, B. Shajilal, P.K. Lam, S. M. Assad

[4] **Eliminating parameter estimation feedback loop requirements in QKD using post-selective protocols**
O. Erkilic, B. Shajilal, P. K. Lam, S. M. Assad

Supervising Experience

- Co-supervision of **Simon Yung** (Undergraduate research student) *Australian National University*
  Research topic: Bow-tie cavity for second harmonic generation at 1064 nm
  (2022)
- Co-supervision of **Angela Anna Baiju** (Doctorate research student) *National University of Singapore*
  Research topic: Squeezed light sources, quantum communication and quantum metrology
  (2023)
- Co-supervision of **Mayank Joshi** (Doctorate research student) *Australian National University*
  Research topic: Next generation 2D materials for integrated squeezing modules
  (2024)
- Co-supervision of **Sanjeeth Swaroop Panda** (Doctorate research student) *Australian National University*
  Research topic: Quantum teleportation for secure quantum communications, Quantum Imaging using SPDC sources
  (2024)

Tutoring Experience

- **Fibre Optic Communication Systems** (PHYS3060) *Australian National University*
  Semester 1, 2019, '20, '21, '22 (Course coordinator: Dr. Geoff Campbell)

- **Photonics Laboratory** (PHYS8015) *Australian National University*
  Semester 2, 2019, '20 (Course coordinator: Dr. Geoff Campbell)

- **Physics II** (PHYS1201) *Australian National University*
  Semester 2, 2019 (Course coordinator: Dr. Geoff Campbell)

Seminars, Conferences and Workshops

- **The International Network in Space Quantum Technologies, Workshop 4, hosted by Physical Research Laboratory, India**
  Presentation Title:
  "*Continuous variable quantum communications : Resources, Gaussian channel Simulation and Verification through metrology*"
  (Mar. 20 – 22, 2024) *Ahmedabad, India*

- **American Physical Society Annual March Meeting 2024**
  Presentation Title:
  "*12.6 dB squeezed light at 1550 nm from a bow-tie cavity for long-term high duty cycle operation*"
  (Mar. 3 – 8, 2024) *Minneapolis, United States of America*

- **Institute of Physics Singapore Meeting 2023**
  Presentation Title:
  "*12.6 dB squeezed light at 1550 nm from a bow-tie cavity for long-term high duty cycle operation*"
  (Sep. 27 – 29, 2023) *Singapore*

- **Quantum Australia 2022**
  (Feb. 23 – 25, 2022) *Sydney, Australia*

- **Centre of Excellence for Quantum Computation and Communication Technology Workshop 2022**
  (May 30 – June 1, 2022) *Tasmania, Australia*

- **Centre of Excellence for Quantum Computation and Communication Technology Workshop 2021**
  (February 8 – 11, 2021) *Online*

- **Australian National University - Laboratoire Kastler Brossel Paris Workshop**
  Presentation Title: "*Towards a better optical parametric amplifier at 1550 nm*"
  (Jan. 20 – 21, 2021) *Online*

- **Centre of Excellence for Quantum Computation and Communication Technology Workshop 2020**
  (February 11 – 14, 2020) *Kingscliff, Australia*

- **Centre of Excellence for Quantum Computation and Communication Technology Workshop 2019**
  (February 12 –14, 2019) *Sydney, Australia*

- **Australian National University - University of Tokyo Workshop**
  (Feb. 25 – March 1, 2019) *Kioloa, Australia*

- "Statistics of heralded single photon sources", *Physical Research Laboratory, India*
  (July 2016) Summer Research Fellows' seminar series

- "Generation, characterisation and sorting of orbital angular momentum states of light", *International School of Photonics, India*
  (Dec 2016) Thursday seminar series

- **Annual Photonics Workshop (APW)**
  (2013,'14,'15) *Cochin, India*

- **National Initiative on Undergraduate Science (Physics) Workshop**
  (June, 2014) *Mumbai, India*

Research Center Memberships

- **Centre for Quantum Computation & Communication Technology** (2018 – 2023)
  Australian research centre of excellence led by the University of New South Wales, Australia
- **Centre for Quantum Technologies** (2023 – Ongoing)
  Research Centre of Excellence hosted by the National University of Singapore, Singapore

References

- **Prof. Ping Koy Lam**
  (Reporting Officer at A*STAR)
  Chief Quantum Scientist
  Quantum Innovation Centre (Q.InC)
  Agency for Science, Technology and Research
  2 Fusionopolis Way, Singapore, 138634
  Email: pingkoy@imre.a-star.edu.sg

- **Dr. Young-Wook Cho**
  (Reporting Officer at A*STAR)
  Director - Quantum Science and Metrology Pillar
  Quantum Innovation Centre (Q.InC)
  Agency for Science, Technology and Research
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  Department of Quantum Science
  Australian National University
  Canberra, ACT 2601 Australia
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