Abhishek Jamunkar

BS MS DUAL DEGREE · AGE: 26 (MALE)

Centre for Quantum Technologies, National University of Singapore

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"Reality is just a set of beliefs; I believe."

Personal Profile

Research assistant working on an ambitious project of developing quantum processors using a neutral atom array at CQT, NUS. I have 1.5 years of industry experience in Quantum Technologies and hold a combined Bachelor's and Master's degree with a specialization in physics from IISER Pune. I am also interested in scientific entrepreneurship, aiming to convert laboratory technologies into practical commercial applications.

Research and Work Experience

Research Assistant at Centre of Quantum Technologies, National University of Singapore — *CQT, NUS*

SUPERVISOR: ASSOC PROF. DAVID WILKOWSKI — ***JUNE 2024 – PRESENT***

- Part of the NAA project aiming to develop quantum processors with more than 200 qubits using neutral atom array.
- Leading the designing, construction and characterization of a compact two-dimensional Magneto-Optical Trap (2D MOT) as a source of cold atom flux for the processors.
- The 2DMOT consist of three parallel cooling beams along the two dimensions, a hollow cooling beam along the axial dimension and a push beam; everything boxed up in a form factor of 25cm x 25cm x 25cm.
- Setting up a system of automated laser beam alignment using piezo-controlled mirror mounts for the project.

Quantum Engineer at Qdit Labs Pvt. Ltd, Bengaluru — *BENGALURU, INDIA*

INDUSTRY: QUANTUM TECHNOLOGIES — ***SEP 2022 – APRIL 2024***

- Worked on developing entangled photon sources and implementation of Quantum Key Distribution(QKD) protocols.
- Led and delivered a project on developing a simulation suite for entangled photon sources.
- Led a project on developing an indigenous Self-Certifying Quantum Random Number Generator(SC-QRNG).
- Performed simulation and published a paper on distributed-phase-reference quantum key distribution protocols and various attacks on them.

Bell State Measurements in Quantum Information Theory and Quantum Foundations (MS Thesis) — *IISER-DIAT, PUNE*

SUPERVISOR: PROF. G RAGHAVAN — ***JULY 2021 – APRIL 2022***

- Performed a detailed theoretical and experimental study of Bell State Measurements which lies at the heart of many protocols in Quantum Information Theory.
- Built an entangled photon source using non-linear BBO crystal. Performed Quantum State Tomography; reconstructed the density matrix using Maximum Likelihood Estimation and linear inversion.
- Experimentally superimposed two identical photons and observed the Hong-Ou-Mandel(HOM) effect. Certified entanglement by testing the CHSH inequality violation. Measured the second-order correlation by performing the HBT experiment.
- Addressed a foundational question concerning the importance of complex numbers in Quantum Theory. Proposed an optimized interferometric scheme that allows experimental testing of a Bell-like inequality that can rule out a set of quantum theories defined over real vector field.
- Proposed an interferometric scheme that creates path-polarization based single photon entangled states. Proved that the scheme can be used to perform CHSH inequality violation and hence can generate certified quantum random numbers.

Education

Bell State Measurements in Quantum Information Theory and Quantum Foundations (MS Thesis) *IISER PUNE*

BS-MS DUAL DEGREE IN BASIC SCIENCE (SPECIALIZATION IN PHYSICS) *AUG 2017 – MAY 2022*

- Major: Physics
- Minor: Chemistry

Coursework (Advanced Courses)

- **Physics:** 1) Classical Mechanics 2) Electrodynamics 3) Quantum Mechanics
  4) Mathematical Methods in Physics 5) Statistical Mechanics 6) Astronomy and Astrophysics
  7) Quantum Mechanics 2 8) Quantum Information 9) Advanced Physics Lab
  10) Advanced Optics. 11) Computational Physics 12) Gravitation and Cosmology
  13) Group Theory in Physics 14) Experimental Physics 15) Quantum Field Theory
  16) Plasma Physics
- **Chemistry:** 1) Statistical Thermodynamics 2) Quantum Chemistry 3) Chemistry of Clean energy
- **Interdisciplinary:** 1) Data Science 2) Geofluid Dynamics 3) Isotope Geochemistry
  4) Development studies 5) Mathematical and Computational Biology

Skills

- **Computational:** Python (Advanced)
- **Designing:** Solidworks (Advanced)
- **Experimental:** Optics handling and alignment
- **Simulation:** 1) Ansys: Lumerical Interconnect (Advanced)
  2) COMSOL Multiphysics (Basic)
- **Technical:** Machining parts (Basic): Milling machine, drill press, and Lathe
- **Interpersonal:** Leadership, Collaboration, Problem-solving and other soft skills.

Publication and Conferences

- Venkat Abhignan, **Abhishek Jamunkar**, Gokul Nair, Mohit Mittal and Megha Shrivastava, Simulations of distributed-phase-reference quantum key distribution protocols, Physica Scripta, Sep 2024.
- Poster presentation at IPS meeting 2024. **Abhishek Jamunkar**, Tong-Yan Xia, Vasu Dev, Kai Xiang Lee, Jinyu Zhou, Vincent Mancois, Kelvin Lim, Jintao Yang, Zhengjiang Li, Mujahid Aliyu, Zilong Chen, and David Wilkowski: **Toward Neutral Atom Array Quantum Processors in Singapore**

Potential References

Assoc Prof. David Wilkowski

CQT, NUS; CDPT NTU; MajuLab, NTU

- Associate Professor at Centre for Quantum Technologies, National University of Singapore
- Email: david.wilkowski@ntu.edu.sg

Prof. G Raghavan

DIAT PUNE

- Director of School Of Quantum Technology, DIAT, Pune
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