PRIYANKAR BANERJEE

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RESEARCH INTERESTS

Quantum Optics, Quantum Information Science, Many-body physics, Cavity QED, Non-equilibrium dynamics, Open Quantum Systems

EDUCATION

Indian Institute of Technology Guwahati *2020 - 2022*
M.Sc. Physics Cumulative GPA: 8.31/10

Vidyasagar College (University of Calcutta) *2017 - 2020*
B.Sc. (Honours) Physics Percentage: 81.38%

St. Jude's High School, Kolkata *2017*
Indian School Certificate Percentage: 88.25%
Subjects: Physics, Chemistry, Biology, Mathematics, English

RESEARCH EXPERIENCE

Indian Institute of Science Education and Research, Pune Project Assistant
Advised by Dr. Bijay Kumar Agarwalla, Department of Physics *July 2022 - Present*

- Investigating the bounds on the stochastic efficiency of a many-body thermal machine modelled using a Brownian particle undergoing an overdamped motion in a harmonic trap.
- Calculated the thermodynamic quantities like heat and work and their higher-order cumulants by analytically solving the classical Langevin equation and the Fokker-Planck equation for the system.
- Analyzed the system in the linear response regime and currently simulating the Langevin dynamics for the Markovian and the non-Markovian cases on Python.

Indian Institute of Technology, Guwahati M.Sc. Dissertation
Advised by Dr. Amarendra Kumar Sarma, Department of Physics *August 2021 - April 2022*

- Explored a novel scheme to obtain mechanical squeezing in a quadratically coupled optomechanical system using pump modulation.
- Studied the dynamic behaviour of the quadrature variances to show squeezing is achieved in the long-time limit. Then, the ratio of the coupling side bands was optimized to achieve maximum squeezing.
- Analyzed the system approximately and matched it with the exact numerical solution, then went on to study the robustness of the squeezing.
- Preprint submitted to arXiv. Thesis available here.

New York University, Shanghai Research Intern (worked remotely)
Advised by Dr. Tim Byrnes, NYU Quantum Technology Lab *Nov 2021 - Mar 2022*

- Worked on developing an algorithm to reconstruct a spin coherent state in a BEC comprising two qubits (on Mathematica).
- The angles of the two unitary rotations on the Schmidt form, which parameterize the original state, were extracted using singular value decomposition.
- Explored the robustness of our protocol for partial depolarization of the pure states by introducing a specific form of decoherence.
- Project Report and the Mathematica Codes available here.

Birla Institute of Technology and Science Pilani, Hyderabad Campus Project Intern
Advised by Dr. Aranya Bhuti Bhattacherjee, Department of Physics *May 2021 - Feb 2022*

- Studied the mean-field dynamics of the two-photon Dicke model.
- Explored the behaviour of squeezing time and strength near the superradiant phase and the unbounded region of the phase diagram under the Holstein-Primakoff approximation.
- Explored ways to enhance the quadrature squeezing of photons in the large spin limit and numerically matched the critical behaviour of squeezing near the unbounded region.
- Our findings were published in Physics Letters A **446** (2022) 128287

Indian Institute of Technology, Guwahati Project Intern
Advised by Dr. Pankaj Kumar Mishra, Department of Physics *March 2021 - May 2021*

- Surveyed literature on the dynamical behaviour of a rotating trapped BEC in 2-D by solving the Gross–Pitaevskii equation.
- Performed simulations to generate vortex lattices in a rotating BEC in an anisotropic trap for different angular frequencies and non-linearity factors (on Fortran).

PUBLICATIONS/PREPRINTS

Banerjee, Priyankar, Sampreet Kalita and Amarendra K. Sarma "Mechanical Squeezing in Quadratically-coupled Optomechanical Systems", In: ArXiv *e-prints*, (Submitted to Phys. Rev. A) DOI: 10.48550/arXiv.2210.00510.

Banerjee, Priyankar , Deepti Sharma and Aranya B. Bhattacherjee, "Enhanced photon squeezing in two-photon Dicke model", Physics Letters A **446** (2022) 128287, DOI: 10.1016/j.physleta.2022.128287.

WORKSHOPS/SCHOOLS/SEMINARS/COURSES

IEEE workshop on Quantum Photonics 2022, organized by International Institute of Information Technology, Hyderabad, India.

Short online course on INTRODUCTION TO QUANTUM OPTICS, organized by Indian Institute of Science Education and Research (IISER) Tirupati, India.

International Summer Program (ISP) 2021, organized by Osaka University, Japan.

Summer School on Quantum Information and Quantum Technology (QIQT - 2021) organized by Indian Institute of Science Education and Research (IISER) Kolkata, India.

Workshop on Condensed Matter, High Energy, Astrophysics and Cosmology 2020, organized jointly by IIT Guwahati-Tokyo Institute of Technology.

Basic Concepts of Quantum Statistics, one-day seminar organized by the University of Calcutta, India.

ACADEMIC ACHIEVEMENTS

Awarded the Bela Rani medal for proficiency in B.Sc. Physics (Honours) examination of the University of Calcutta.

Ranked 1^{st} out of 75 students in the Department of Physics, Vidyasagar College, University of Calcutta.

Scored 98.31 percentile in IIT-JAM Physics 2020 and secured an All India Rank 277 among 17000 applicants.

Third for Poster Presentation on *Remote Sensing, an expert overview* at Vikram Sarabhai Space Exhibition at Bidhan Shishu Udyan, Kolkata.

COMPUTATIONAL PROFICIENCY

Programming Languages

Intermediate: C++, Fortran

Advanced: Python, Mathematica

Editors and IDEs

Intermediate: JupyterLab

Advanced: LaTeX, MS Office

Operating Systems

Intermediate: Microsoft Windows

Advanced: Linux

ACADEMIC REFEREES

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Dr. Aranya Bhuti Bhattacherjee
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