Tathagata Karmakar

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INTERESTS

Open quantum systems, continuous measurements, machine learning approaches in physics, superresolution imaging, quantum thermal machines.

EDUCATION

Ongoing	Ph.D., Physics and Astronomy, University of Rochester.
2020	M.A., Physics and Astronomy, University of Rochester.
2018	BS, Physics CPI: 9.9/10, IIT Kanpur.

PROFESSIONAL APPOINTMENTS

2021–Ongoing	Affiliated student researcher, Chapman University.
Jul.–Sep. 2023	Research Intern, PHI Lab, NTT Research, Inc., CA.
2017	Summer research assistant, CCA, Simons Foundation.

PUBLICATIONS

[1] Sethuraj K. R., **T. Karmakar**, A. N. Jordan and A. N. Vamivakas, and "Experimental realization of supergrowing fields", arXiv: 2309.00016 (2023).

[2] **T. Karmakar**, A. Chakraborty, A. N. Vamivakas and A. N. Jordan, "Supergrowth and sub-wavelength object imaging", Opt. Exp. **31**, 37174-37185 (2023).

[3] **T. Karmakar** and A. N. Jordan, "Beyond Superoscillation: General Theory of Approximation with Bandlimited Functions", J. Phys. A: Math. Theor., **56** 495204 (2023).

[4] **T. Karmakar**, É. Jussiau, S. K. Manikandan, and A. N. Jordan, "Cyclic superconducting quantum refrigerators using guided fluxon propagation", arXiv: 2212.00277 (2022).

[5] **T. Karmakar**, P. Lewalle, and A. N. Jordan, "Stochastic path-integral analysis of the continuously monitored quantum harmonic oscillator", PRX Quantum **3**, 010327 (2022).

[6] **T. Karmakar**, S. Genel, and R. S. Somerville, "The relationship between galaxy and halo sizes in the Illustris and IllustrisTNG simulations", Monthly Notices of the Royal Astronomical Society, **520**, 1630 (2023).

[7] **T. Karmakar** and T. Sarkar, "Distinguishing Between Kerr and Rotating JNW Space-Times via Frame Dragging and Tidal Effects", General Relativity and Gravitation **50**, 85 (2018).

RESEARCH EXPERIENCE

2023–Ongoing	**ML based Model reduction, NTT Research, Inc.**
	Built a neural operator based learning architecture that can solve for the dynamics of 256 quantum harmonic oscillators simultaneously.
2022-2023	**Superoscillations and supergrowth [1–3]**

Developed an algorithm to generate functions with arbitrary superoscillation/supergrowth by choosing the values of only the first two coefficients in a series expansion.

Developed an algorithm to reconstruct objects that are an order of magnitude smaller than the illuminating wavelength.

Collaborated on the experimental realization of supergrowing optical fields.

2021-2022 **Fluxon refrigerator [4]**

Devised a refrigeration scheme utilizing the flow of magnetic field vortices along a magnetic field gradient in a type-II superconducting device.

2020-2021 **Stochastic path integral [5]**

Formulated a stochastic action principle-based description of a continuously monitored harmonic oscillator.

TALKS

Oct. 2023   *Supergrowing Optical Fields: Subwavelength Imaging and Experimental Synthesis* ↗ , Chapman University.

Aug. 2023   *A discussion on quantum convolutional neural networks*, PHI Lab, NTT Research, Inc.

Mar. 2023   *Cyclic superconducting quantum refrigerators using guided fluxon propagation*, APS March Meeting.

Jun. 2022   *Stochastic path integral analysis of a harmonic oscillator* ↗ , Quantum Thermodynamics Conference.

Mar. 2022   *Tomography of a Continuously Monitored Qubit*, APS March Meeting.

Sep. 2021   *Stochastic path integral analysis of a harmonic oscillator undergoing simultaneous continuous position and momentum measurements* ↗ , IQS, Chapman University.

Mar. 2021   *Stochastic Path Integral Analysis of the Continuously Monitored Simple Harmonic Oscillator*, APS March Meeting.

Jan. 2021   *Optical Field Quadrature Measurements: Introduction to Homodyne and Heterodyne Detections*, with Dr. Philippe Lewalle, University of Rochester.

AWARDS AND FELLOWSHIPS

2020   Okubo Prize, Department of Physics and Astronomy, UR.

2018-2020   Robert L. and Mary L. Sproull fellow, UR.

2017   S. N. Bose Scholar (WSF, DST Govt. of India, IUSSTF).

2016   Academic Excellence Award (dean's office, IIT Kanpur).

2015   Academic Excellence Award (dean's office, IIT Kanpur).

2014-2018   KVPY fellow, DST, Govt. of India.

PROGRAMMING EXPERIENCE

Python (5+yrs, PyTorch, JAX), Mathematica (5+ yrs), QuTiP, Fortran, C.

SUMMER SCHOOLS

Jun. 2023   Quantum Connections, Stockholm, Sweden.
Jun. 2022   Solstice of Foundations, ETH Zürich.
Aug. 2021   Quantum Thermodynamics (online), ETH Zürich.

TEACHING EXPERIENCE

Jan.–Apr. 2019   Teaching assistant, 20th Century Physics.
Aug.–Nov. 2018   Teaching assistant, Gravitation and General Relativity.

PEER-REVIEWER/REFEREE

Phys. Rev. A, Annals of Physics, npj Quantum Information, Applied Physics Letters.

SELECTED COURSEWORK

Quantum optics I and II (UR).