Tathagata Karmakar

Andrew N. Jordan group

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INTERESTS

Tensor network approaches, machine learning approaches in physics, open quantum systems, continuous measurements.

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.

PROFFESSIONAL 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.

SELECTED 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", arXiv: 2306.03963 (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).

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.

2020-2021 **Stochastic path integral [5]**
Formulated a stochastic action principle-based description of a continuously monitored harmonic oscillator.

PROGRAMMING EXPERIENCE

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

SELECTED 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.

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

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

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.

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

Graph theory (IIT Kanpur).