

# Tathagata Karmakar

Andrew N. Jordan  group

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<https://tathagata-karmakar.github.io/>

## 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.

## 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.

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

## SELECTED TALKS

*Oct. 2023*            *Supergrowing Optical Fields: Subwavelength Imaging and Ex-*  
*perimental Synthesis*  $\square$  , 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*  $\square$  ,  
Quantum Thermodynamics Conference.  
*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).