

# Tathagata Karmakar

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

## Expertise

Theoretical quantum optics, machine learning in physics, quantum measurement, superresolution imaging, analytical/numerical modeling and optimization.

**Programming languages:** Python (PyTorch, JAX, 5+ yrs), Mathematica (5+ yrs), QuTiP, Fortran, C.

## Education

- Ph.D., Department of Physics and Astronomy, University of Rochester *2018–present*
- BS Physics CPI: 9.9/10, Indian Institute of Technology, Kanpur *2014–2018*

## Internships & academic affiliations

- Research Intern, PHI Lab, NTT Research, Inc., Sunnyvale, CA. *Jul. –Sep. 2023*
- Affiliated student researcher, Chapman University. *Aug. 2021–present*
- Summer research assistant, CCA, Simons Foundation, NYC. *May – Jul., 2017*

## 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”, arXiv: 2307.03352 (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).
- [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

- **Superoscillations and supergrowth [1–3].** *Jun. 2022 – Jun. 2023*
  - Developed a numerical algorithm for image postprocessing for subwavelength object reconstruction using superoscillatory/supergrowing point spread functions.
  - Prescribed a Legendre polynomial based algorithm for generating functions with arbitrary superoscillatory properties.
  - Formulated an algorithm to approximate an arbitrary function in terms of bandlimited functions in a finite interval.
- **Fluxon refrigerator [4].** *Apr. 2021 – Dec. 2022*
  - Devised and optimized a refrigeration scheme utilizing the flow of magnetic field vortices along a magnetic field gradient in a type-II superconducting device.
- **Stochastic path integral [5].** *Jan. 2020 – Mar. 2021*
  - Formulated and optimized a stochastic action principle based description of a harmonic oscillator and confirmed analytical findings with 100,000 simulated trajectories.

## Other Experiences

- Mentor, PASSAGE, Dept. of Physics and Astronomy, University of Rochester (2020-2021).
- Teaching assistant, Dept. of Physics and Astronomy, University of Rochester (2018-2019).