Pronoy Das

Graduate Research Assistant

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Education

Ph.D. in Electrical & Computer Engineering (Ongoing) **2021 – Present**
Purdue University, West Lafayette, IN *GPA: 3.89/4.0*

BS-MS in Physical Sciences **2016 – 2021**
Indian Institute of Science Education and Research (IISER) Kolkata *GPA: 8.82/10*

Honors & Awards

Hugh W. and Edna M. Donnan Fellowship (Bilsland Dissertation Fellowship) **2025**
Awarded by Purdue University for research excellence to support the final year of dissertation work.

APS Distinguished Student (DS) Award **2025**
Awarded by the APS Forum on International Physics (FIP) & Forum for Early Career Scientists (FECS).

Purdue ECE Bravo Award for Excellence in Teaching **2024**
Recognized for excellence and outstanding contributions as a Graduate Course Instructor.

Summer Research Grant **2024**
Competitive university-wide grant from Purdue University to support full-time summer research.

Publications

[7] **Das, P.**, Bharadwaj, S., Mun, J. Wang, X., Rho, J. & Jacob, Z. (2025). Quantum Theory of Optical Spin Texture in Chiral Tellurium Lattice. *arXiv.*

[6] **Das, P.**, Bharadwaj, S. & Jacob, Z. (2024). Quantum theory of orbital angular momentum in spatiotemporal optical vortices. *New Journal of Physics*, 26(083008). [**One of the most read articles during Aug and Sept'24**]

[5] **Das, P.**, Yang, L. & Jacob, Z. (2024). What are the quantum commutation relations for the total angular momentum of light? tutorial. *Journal of the Optical Society of America B*, 41(8). [**Most downloaded article during July, Aug and Sept'24**]

[4] Mahmud, S., Zhang, W., Kalhor, F., **Das, P.**, & Jacob, Z. (2025). Quantum imaging of photonic spin texture in an OAM beam with NV centers in diamonds *New Journal of Physics.*

[3] Khosravi, F., Yang, L., **Das, P.** & Jacob, Z. (2024). New angular momentum conservation laws for electromagnetic waves interacting with Dirac fields. *New Journal of Physics*, 26(093041). [**Most read article in Sept and Oct'24**]

[2] Roy, S., Nandi, A., **Das, P.** & Mitra, C. (2021). Detection of electron spin resonance down to 10 K using localized spoof surface plasmon. *Journal of Physics D: Applied Physics*, 54(285003).

[1] Roy, S., Nandi, A., **Das, P.** & Mitra, C. (2021). S-band electron spin resonance spectroscopy using a short-circuited coplanar waveguide resonator. *IOP SciNotes*, 1(035202).

Research Experience

Graduate Research Assistant — Aug 2021 – Present

Purdue University, Prof. Zubin Jacob's Research Group

(2024-2025) Deep-microscopic optical band theory of tellurium

- Established the optical band structure formalism for chiral tellurium
- Solved the problem of the origin of highly-dispersive optical activity in tellurium
- Unveiled hidden optical waves and optical spin textures within the tellurium lattice
- Co-authored an open-source software to calculate nonlocal optical response in crystals
- **Experience gained: Lattice-level light-matter interaction, Software development for lattice-scale EM simulations in C++**

(2022-2024) Quantum properties of structured light in single photon limit

- Solved the long-standing debate on the correct quantum commutation relations for photon angular momentum
- Discovered new fundamental quantum fluctuations in the orbital angular momentum of spatiotemporal optical vortices
- **Experience gained: Quantum field theory, Quantum optics, numerical simulations in Matlab**

(2021-2022) Quantum sensing of photonic spin density of light using nitrogen defects (NV) in diamonds

- Developed a GHz phase and amplitude modulation setup for spin textured light using single-mode optical fibers
- Fabricated shallow NV defects (30nm from surface) in diamond
- Involved in building single NV Optically-Detected Magnetic Resonance (ODMR) cryogenic setup
- **Experience gained: Temperature-controlled single-mode optical interferometry, reactive ion etching + photolithography + annealing, COMSOL**

Undergraduate Researcher 2019 – 2021

IISER Kolkata, Prof. Chiranjib Mitra's Research Group

(2020-2021) ODMR + quantum synchronization in diamond defects

- Developed a home-built confocal and ODMR spectroscopy setup for bulk NV setup
- Conceptualized the phenomenon of quantum synchronization in the ground state of NV diamond centers
- **Experience gained: ODMR spectroscopy, simulation of open quantum systems**

(2019-2020) On-chip antenna design for electron spin resonance spectroscopy (ESR)

- Devised lumped circuitry microwave antenna designs and performed EM simulation in S-band in CST Studio Suite
- Fabricated μm-scale microwave antennas using UV photolithography
- Involved in developing a home-built ESR setup at <10K
- **Experience gained: UV photolithography, ESR spectroscopy, CST Studio Suite**

Conferences & Invited talks

Invited talks

2024 **Nanotechnology Student Advisory Council talks**, *Quantum Theory of Orbital Angular Momentum in Spatiotemporal Optical Vortices*, Birck Nanotechnology Center, Purdue University

Contributed talks and Posters

2025 **Workshop on Real and Momentum Space Topology**, Poster: *Deep-Microscopic Optical Band Theory of Tellurium*, University of Notre Dame

2025 **APS Global Physics Summit**, Talk: *Nonlocal Super-Dispersion of Optical Gyrotropy in Tellurium*, Anaheim Convention Center

2024 **Midwest Quantum Collaboratory Entanglement**, Poster: *Quantum theory of orbital angular momentum in spatiotemporal vortices*, Michigan State University

2024 **Quantum Photonics Integrated Design Center (QuPIDC) + Energy Frontier Research Center (EFRC) conference**, Poster: *Quantum theory of orbital angular momentum*, Purdue University

2023 **Midwest Quantum Collaboratory Entanglement**, Poster: *What are the correct quantum commutation relations for the orbital angular momentum of light?*, Purdue University

2022 **Midwest Quantum Collaboratory Entanglement**, Poster: *Quantum sensing of photonic spin density using nitrogen-vacancy centers in diamonds*, University of Michigan

2021 **APS March Meeting 2021**, Talk: *Quantum synchronization in nitrogen-vacancy centers in diamonds*, Virtual

Teaching Experience

Graduate course instructor

Term	Course	Study program
Spring 2024	Electrical Engineering Fundamentals I Lab	ECE-20007 (Purdue University)
Fall 2023	Electrical Engineering Fundamentals I Lab (Received the Purdue ECE Bravo Award for Excellence in Teaching)	ECE-20007 (Purdue University)

Teaching responsibilities: Course instructor for 60-80 students per semester, including teaching and co-ordinating with 6 teaching assistants.

Teaching assistant

Term	Course	Study program
Spring 2021	Quantum Information Processing	PH4207 (IISER Kolkata)
Fall 2020	Intermediate Classical Mechanics	PH3101 (IISERK Kolkata)

Teaching responsibilities: Teaching assistant for two courses with 30-40 students per semester.

Professional Outreach

- Reviewer for *Physical Review A. (APS Publishing), New Journal of Physics* (IOP Publishing), *Proceedings of the Royal Society A*, *SciPost Physics*
- Volunteered at APS Global Summit 2025 for sorting abstracts for Department of Condensed Matter Physics

References

Available on request