Pronoy Das

Donnan Fellow, Graduate Research Assistant
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Education

Ph.D. in Electrical & Computer Engineering (Expected: Dec 2026) **2021 – Present**
Purdue University, West Lafayette, IN *GPA: 3.89/4.0*

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

Honors & Awards

Hugh W. and Edna M. Donnan Dissertation Fellowship **2026**
Awarded by Purdue University for excellence in research.

APS Distinguished Student (DS) Award **2025**
Awarded by the APS Forum on International Physics (FIP) for presenting research at APS GPS 2025.

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.

Research Experience

Graduate Research Assistant **Aug 2021 – Dec 2025**

Purdue University, Prof. Zubin Jacob's Research Group

(2024-2025) Deep-microscopic optical band theory of tellurium (Sponsor: Office of Naval Research)

- 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 (Purdue-PicoMax) to calculate nonlocal optical response in crystals
- **Skills 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 (Sponsor: Army Research Office)

- 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
- **Skills gained: Quantum field theory, Quantum optics, numerical simulations in Matlab and Python**

(2021-2022) Quantum sensing of photonic spin density of light using nitrogen defects (NV) in diamonds (Sponsor: Army Research Office)

- 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
- **Skills gained: Temperature-controlled single-mode optical interferometry, reactive ion etching + photolithography + annealing, COMSOL**

Undergraduate Researcher **Aug 2019 – July 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
- **Skills gained: ODMR spectroscopy, simulation of open quantum systems in Python**

(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
- **Skills gained: UV photolithography, ESR spectroscopy, electromagnetic simulations in CST Studio Suite**

Publications

[9] **Das P.**, Bharadwaj S., Mun J., Wang X., Rho J. & Jacob Z. (2026). Quantum Theory of Optical Spin Texture in Chiral Tellurium Lattice. *Phys. Rev. B. 113*, L041116 [**Letter** | **Editor's Suggestion**]

[8] **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**]

[7] **Das P.**, Yang LP. & 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**]

[6] Bharadwaj S., Schreiber M., Mun J., Ruttiman S.,**Das P.**, Hayashida M., Malac M., Nordlander P.& Jacob Z. (2025). Observation of Crystalline Nonlocal Volume Plasmon Waves. *arXiv 2510.07612*.

[5] Mahmud S., Kalhor F., **Das P.**, & Jacob Z. (2025). Coherent coupling of spinning light and NV centers in diamond. *Journal of the Optical Society of America B*, 43(1).

[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, 27(054102)*.

[3] Khosravi F., Yang LP., **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).

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 **Quantum Science, Technology, and Engineering at Purdue**, Poster: *Deep-Microscopic Optical Band Theory of Tellurium*, Purdue University

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 (Recognized by 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

- **(2023 – present) Scientific reviewer for *Physical Review A. and Physical Review R. (APS Publishing), New Journal of Physics* (IOP Publishing), *Proceedings of the Royal Society A*, *SciPost Physics***
- **(2025) Volunteer at APS Global Summit 2025 for Department of Condensed Matter Physics**
- **(2017 – 2018) Team Lead, Multimedia and Web Technology, INQUIVESTA, IISER Kolkata**