

Daksh Kumar Singh

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Education

Master of Science in Electrical & Computer Engineering | Graduate Research Assistant | Dec 2026

Purdue University, West Lafayette, IN

Primary Area: Fields and Optics – Coherent and Quantum Optics

Related Area: Microelectronics and Nanotechnology – Compound Semiconductor Materials and Devices

Bachelor of Science in Electrical Engineering | Dean's List 7/7 Semesters | Dec 2025

Purdue University, West Lafayette, IN

Concentrations: Quantum Technology, Wireless & Optical Engineering, Microelectronics & Semiconductors

Research Experience

Graduate Research Assistant

Advisors: Prof. Alexandra Boltasseva, Prof. Vladimir Shalaev, Prof. Alexander Kildishev

Purdue University, West Lafayette, IN

Dates: January 2026 – Present

- Conduct research at the intersection of **nanofabrication, photonics, and quantum materials**, focusing on metasurfaces and single-photon emitters.
- **Cleanroom fabrication:** Proficient in e-beam lithography, thin-film deposition (PLD, sputtering, evaporation), and optical/SEM/AFM characterization of nanostructures.
- **Simulation & modeling:** Utilize **GRCWA, S4, and FDTD** methods in Python for optical design and diffraction optimization.
- **Optical testing:** Perform **photoluminescence (PL)** and **g(2) correlation** measurements for emitter–cavity coupling.
- **Publications & IP:** Co-authored multiple peer-reviewed papers (*SPIE Advanced Photonics 2024*, *Nanophotonics 2025*, *Optica FiO+LS 2025*) and one **patent (pending)** on ML-assisted chip anti-counterfeiting.

Undergraduate Research Assistant

Advisors: Prof. Alexandra Boltasseva, Prof. Vladimir Shalaev, Prof. Alexander Kildishev

Purdue University, West Lafayette, IN

Dates: January 2023 – January 2026

2025

- Simulated nanostructure metasurfaces to enhance **single-photon emission** using **2D graphene and WSe2**.
- Fabricated gold contacts to study **spin injection** in monolayer **2D CrSBr flakes**.
- Performed exfoliation and transfer of 2D CrSBr onto multiple samples.
- Conducted optical characterization for emitter – cavity coupling, integrating fabrication with testing.

2024

- Designed and simulated **metalenses** for optical tweezer control in analog **neutral-atom quantum computers**.
- Simulated and studied the properties of various photonic systems using **GRCWA** and **S4** packages in **Python**.
- Attended **USQIS** (US Quantum Information Science) **Summer School** at **Oak Ridge National Laboratory**.

2023

Summer 2023 [Summer Undergraduate Research Fellow]

- Selected as **1 of 400** for the prestigious SURF program at Purdue University to work in various fields of study at research lab in Birck Nanotechnology Center
- Manufactured **10+** microwave waveguides for application to various projects within the research group
- Fabricated thin-film **transparent conducting oxides** (TCOs) and conducted optical property testing for radiative heat transfer. Imaged **200+** frames to diagnose and repair state-of-the-art pulsed laser deposition (PLD) system.
- Helped establish a **time-correlated single photon counting (TCSPC) system**, performing PL and $g^{(2)}$ correlation measurements to characterize quantum emitters.
- Integrated optics, detectors, and software into a functioning experimental platform.

Spring 2023 [First Time Researcher Fellow]

- Fabricated and characterized **20+** samples intended for applications in microelectronics packaging and anti-counterfeiting efforts
- Studied machine learning models to analyze quantitative data

Publications and Patents

Publications:

1. *Singh, D.K., Wilson, B., Chen, Y., Ojha, R., Bezick, M., Boltasseva, A., Shalaev, V.M., Kildishev, A.V. (2025). Machine Learning Framework for Semiconductor Chips Anti-Counterfeiting Using a Plasmonic Physically Unclonable Function. Frontiers in Optics + Laser Science 2025. [Presented Contribution]*
2. Chen, Y., McNeil, A.M., Park, T., Wilson, B., Iyer, V., Bezick, M., Choi, J., Ojha, R., Mahendran, P., Singh, D.K., Chitturi, G., Chen, P., Do, T., Satuloori, V., Kildishev, A.V., Shalaev, V.M., Moebius, M., Cai, W., Liu, Y., Boltasseva, A. (2025). Machine-Learning-Assisted Photonic Device Development: A Multiscale Approach from Theory to Characterization. Nanophotonics 2025.
<https://doi.org/10.1515/nanoph-2025-0049>
3. Wilson, B., Chen, Y., Singh, D. K., Ojha, R., Bezick, M., Pott, J., Shalaev, V. M., Boltasseva, A., & Kildishev, A. V. (2024). Machine-learning-assisted optical authentication of chip tampering. Photonic Computing: From Materials and Devices to Systems and Applications, 16.
<https://doi.org/10.11117/12.3027858>
4. Wilson, B., Chen, Y., Singh, D. K., Ojha, R., Pottle, J., Bezick, M., Boltasseva, A., Shalaev, V. M., & Kildishev, A. V. (2024). Authentication through residual attention-based processing of tampered optical responses. Advanced Photonics, 6(05). <https://doi.org/10.11117/1.ap.6.5.056002>

Patents:

- First Inventor: Kildishev, Alexander V.; Co-Inventors: **Singh, Daksh Kumar**; Wilson, Blake A.; Chen, Yuheng; Ojha, Rohan; Pottle, Jaxon; Bezick, Michael; Boltasseva, Alexandra; Shalaev, Vladimir M. 2024. ML Assisted Authentication via Tampered Optical Responses. Application No. 19/233,515, filed June 10, 2025. Patent Pending.

Conference Presentations:

- Singh, D. K., Ojha, R.; Co-Authors: Chen, Y., Wilson, B., Shalaev, V., Boltasseva, A., Kildishev, A. (2023). Machine Learning Assisted Realization of PUFs with Random Plasmonic Systems. Cyberinfrastructure Symposium, RCAC, West Lafayette, IN.
- Singh, D. K., Chen, Y.; Authors: Kudyshev, Z., Bogdanov, S., Isacsson, T., Kildishev, A., Boltasseva, A., Shalaev, V. (2023). Rapid Classification of Quantum Sources Enabled by Machine Learning. Quantum Science Center All-Hands Meeting, Nashville, TN.

Skills

- **Optical Fabrication & Processing:** E-Beam Lithography, Photolithography, Pulsed Laser Deposition, Metal Evaporation and Sputtering, Chemical Vapor Deposition, 2D material exfoliation and transfer
- **Optical Characterization & Assembly:** Variable Angle Spectroscopic Ellipsometry, Dark Field Microscopy, Scanning Electron Microscopy, Atomic Force Microscopy, Photoluminescence (PL), $g^{(2)}$ correlation measurements, Optical Alignment, Lens/Mirror system assembly
- **Simulation & Computation Tools:** Ansys Lumerical FDTD, Ansys HFSS, Tidy3D FDTD, RCWA, KiCad, LTSpice, MatLab, Python: ML/AI, HDL: Verilog/SystemVerilog, QICK, QISKit

- **Soft Skills:** Leadership, Communication, Documentation, Time Management, Teamwork
 - **Languages:** English (Native/Bilingual Proficiency), Hindi (Native/Bilingual Proficiency)
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Certifications

- C²QA Quantum Information Science Summer School on A Practical Guide to Superconducting Qubit Experiments 2023
 - DoE QSC US Quantum Information Summer School 2024
 - IBM Quantum QISKIT Fall Fest 2025
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Honors and Fellowships

- First Place, SPARK Challenge Fall 2025
 - Dean's List, 7/7 Semesters Fall 2022 – Fall 2025
 - Semesters Honors, 6/7 Semesters Fall 2022 – Fall 2025
 - Summer Undergraduate Research Fellowship Award May 2023
 - Best Poster Presentation Award (Purdue Summer Research Symposium) August 2023
 - First Time Researcher Fellowship Award January 2023
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Professional Affiliations

- Optica (Purdue University Chapter) – **Treasurer**
 - DoE QSC (Department of Energy: Quantum Science Center)
 - SSA (Semiconductor Student Alliance – Purdue Chapter)
 - Collaborator: QuEra Computing Inc., Microsoft Azure Quantum, Quantinuum
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Leadership and Campus Involvement

Purdue University Admissions Ambassador – Campus Tour Guide (April – December 2025)

- Led campus tours for prospective students and families, engaging with groups of 20–30 visitors per session.
- Delivered personalized stories and insights about academics, student life, and research opportunities to highlight Purdue’s culture and strengths.
- Represented Purdue as a student leader, answering questions and fostering a welcoming environment for diverse audiences.
- Contributed to admissions outreach by connecting with 250+ prospective students and families.

Boiler Gold Rush (BGR) Team Supervisor (October 2024 – October 2025)

- **1 of 150 chosen** through a rigorous selection process to be a part of one of the largest college orientation programs in the country
- Learnt further about varying **leadership** styles while increasing **socio-cultural awareness** and understanding
- Interviewed over **30** prospective orientation leaders for Boiler Gold Rush 2025
- Trained and lead **10** Team Leaders for Boiler Gold Rush 2025
- Helped facilitate large events with over **8500** participants

Run Club Field Captain (August 2023 – November 2025)

- Actively participated in team activities to promote **fitness** and **community engagement**.
- Handled **logistical planning** for equipment, created tailored **training programs**, and **coordinated with other organizations and universities** for competitions.

Boiler Gold Rush (BGR) Team Leader (March – August 2023 & March – August 2024)

- Volunteered and selected as **1 of 750** to be a part of one of the largest college orientation programs in the country
- Learnt and embraced the central idea of this program: **servant leadership**
- Lead a large group of **30+** students through a week of activities that helped their transition from high school to college
- Helped guide new students through myriad aspects of college

Summer Visit Days (SVD) Conductor (June 2024 & June 2025)

- Volunteered and selected as **1 of 40** to help facilitate a very large program with more than **2000** total participants

- Guided incoming admitted students and their supporters through days of multiple activities that helped the students feel at home at Purdue
 - Answered queries regarding student life at Purdue and alleviated concerns of the incoming students as well as their supporters
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References

Prof. Alexandra Boltasseva

Ron and Dotty Garvin Tonjes Distinguished Professor of Electrical and Computer Engineering, Elmore Family School of ECE

Professor of Materials Engineering (courtesy appointment), School of Materials Engineering
Birck Nanotechnology Center, Purdue University

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Prof. Vladimir Shalaev

Robert and Anne Burnett Distinguished Professor of Electrical and Computer Engineering, Elmore Family School of ECE

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Prof. Dwaine Jengelley

Clinical Associate Professor, John Martinson Honors College

Director Of Interdisciplinary Sports Studies Research Generator

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