Daksh Kumar Singh

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Education

Bachelor of Science in Electrical Engineering | Dean's List 6/6 Semesters | **Graduation:** December 2025
Purdue University, West Lafayette, IN
Concentrations: Quantum Technology, Wireless & Optical Engineering, Microelectronics & Semiconductors

Master of Science in Electrical & Computer Engineering (Admitted – Start Jan 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
Relevant Coursework: Lasers (ECE 552), Applied Quantum Computing (ECE 595), Microelectronics, Semiconductor Devices, Antennas & EM Fields

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Research Experience

Undergraduate Research Assistant
Advisors: Prof. Alexandra Boltasseva, Prof. Vladimir Shalaev, Prof. Alexander Kildishev
Purdue University, West Lafayette, IN
Dates: January 2023 – Present

- Contributed to nanofabrication and quantum photonics research, with focus on **designing, fabricating, and characterizing photonic devices**.
- Developed cleanroom expertise in various fabrication and characterization techniques like e-beam lithography, thin-film deposition, and optical testing for novel metastructures.
- Co-authored multiple peer-reviewed publications and a patent (pending).

Summer 2025
Dates: May 2025 – August 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.

Summer 2024
Dates: May 2024 – August 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.

Summer 2023 [Summer Undergraduate Research Fellow]
Dates: May 2023 – August 2023

- 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 $\mathbf{g^{(2)}}$ correlation measurements to characterize quantum emitters.
- Integrated optics, detectors, and software into a functioning experimental platform.

Spring 2023 [First Time Researcher Fellow]
Dates: January 2023 – May 2023

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

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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. [Accepted 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/10.1117/12.3027858
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/10.1117/1.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)

Honors and Fellowships

- Dean's List, 6/6 Semesters — Fall 2022 – Spring 2025
- Semesters Honors, 5/6 Semesters — Fall 2022 – Spring 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

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)

- 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 - Present)

- **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-Present)

- 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.

Study Abroad Program (Italy, March 2025)

- Participated in the "Global Problems, Global Solutions" program through the John Martinson Honors College, collaborating on cross-cultural international problem-solving initiatives.

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
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