

Arya Keni

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Synopsis

Arya Keni is a 3rd year PhD Student at Purdue University in West Lafayette, in the Department of Electrical and Computer Engineering. His research focuses primarily on Quantum Optics and Nanoscale Photonics.

Research Interests

- Quantum Optics
- Nanophotonics
- Solid State Emitters
- Optoelectronics

Education

Purdue University, PhD, MS in Electrical and Computer Engineering July 2023 - July 2028

- GPA: 3.55/4.0

• **Coursework:** Nonlinear Optics, Quantum Mechanics, Quantum Devices

Pennsylvania State University, BS in Computer Engineering August 2019 - May 2023

- GPA: 3.35/4.0

• **Coursework:** Computer Architecture, RF Circuits, Electromagnetics

Experience

Graduate Researcher, Purdue ECE - West Lafayette, IN July 2023 - July 2028

- Optimized chemical synthesis protocols for high-purity anthracene crystals doped with dibenzoterrylene (DBT) for quantum optical applications
- Designed and fabricated nanophotonic architectures to enhance emission properties of DBT-based single-photon emitters
- Implemented active electrical feedback and tuning mechanisms for photostable organic molecular systems to control optical response and stability

Research Assistant, Penn State EECS - State College, PA August 2019 - July 2023

- Developed and analyzed SAT-solving neural networks with custom architectures, focusing on TNNs and bottom-clause guided literal selection.
- Modeled and simulated WOLED deposition processes, optimizing particle flux and film formation using advanced PVD techniques.
- Extended thin-film deposition simulations to non-conformal and anisotropic geometries, integrating dimensional modeling for predictive material growth.

Scientific Researcher, UC San Diego (E4E NSF Program) - San Diego, CA April 2022 - June 2023

- Drone-based radio telemetry platform for wildlife: on-board acquisition (custom Ryzen module) to lab analysis.
- Baseband DSP: CFO estimation/decoding and ICA filtering for multi-transmitter inputs (CFRS error ~ 200 Hz).
- Collaboration with San Diego Zoo Beckman Institute; deployed and validated acquisition + processing chain.

Research Assistant, ICSL (Integrated Circuits & Systems Lab) - State College, PA August 2021 - May 2023

- Class-E PA design/testing for wireless transmission in submerged media (Kiani Lab).
- NSF (ECE-type) award for a wireless power transfer pacemaker system; symposium presentation (Spring 2022).
- Built wireless audio link; analog front-end and filtering for robust reception across refractive media.

Associate Student Researcher, Volvo Group - State College, PA August 2022 - December 2022

- IIoT-enabled smart storage system (Raspberry Pi 4 + ESP32 mesh over MQTT) for material tracking.

- Remote sensing + UI pipeline for sensor cells and display modules; on-device visualization and logging.
- Defined data schema and retrieval workflows for property-based storage and audit.

Machine Learning & Systems Design Research Intern, SenseHawk - Abu Dhabi, April 2021 - May 2022
UAE

- ML models for PV inverter/solar-panel thermal signal processing; telemetry + historical data fusion.
- Built attribute models (TNN) and integrated predictions for power-output forecasting.
- Contributed analysis modules to production web stack with data validation and monitoring.

Machine Learning & Computational Theory Researcher, SenseHawk - Mumbai, May 2020 - May 2022
India

- RL environments (Q-Learning, SARSA, Deep Q) for dual-axis solar tracking; TensorFlow/Keras training.
- Image-analysis + API pipelines for solar-panel efficiency metrics; physics-informed feature engineering.
- Productionized model training/evaluation with reproducible configs and error handling.

Scientific Researcher, Stanford University Graduate School of Education - June 2018 - August 2019
Stanford, CA

- Network-systems modeling for serendipitous search; deep-graph heuristics for query expansion.
- Team research on connection types in literature/sociology; prepared on-site presentations (Summer 2018).
- Applied computing/search mechanisms to node-interaction simulations; documented findings.

Scientific Researcher, Tata Institute of Fundamental Research (TIFR) - Mumbai, March 2018 - April 2019
India

- Worked with Low Temperature Facility (LTF) on cryogenic Dewar vessel development/manufacturing.
- Delivered modeling + algorithmic system enabling sustained in-house Dewar production.
- Coordinated with scientific officers for design feedback and process iteration.

Software Collaboration (Apps), NIST - USA June 2018 - August 2021

- Developed *Cryogen* (cryogenics calculator); licensed/sold for internal use at NIST.
- Part of an apps suite with distribution to partners incl. NASA, TIFR, and ISRO.
- Maintain releases and user support; apps remain IP of the developer per agreements.

Publications

Vapor Phase Assembly of Molecular Emitter Crystals for Photonic Integrated Circuits Feb 2026

Arya D Keni, Christian M Lange, Adhyyan S Mansukhani, Emma Daggett, Ankit Kundu, Ishita Agarwal, Patrick Bak, Benjamin Cerjan, Jonathan D Hood

arXiv quant-ph

A Hybrid Molecular–Nanophotonic Platform for On-Chip Cavity Quantum Electrodynamics and Collective Interactions Mar 2026

Christian M Lange, *Arya D Keni*, Ishita Agarwal, Emma Daggett, Adhyyan S Mansukhani, Ankit Kundu, Benjamin Cerjan, Libai Huang, Jonathan D Hood

ACS Nano, 20-12

Single-photon generation: materials, techniques, and the Rydberg exciton frontier (*Editor's Pick*) Mar 2025

Arya D Keni, Kinjol Barua, Khabat Heshami, Alisa Javadi, Hadiseh Alaeian

Optical Materials Express 15-4

Bottom-up fabrication of 2D Rydberg exciton arrays in cuprous oxide Jan 2025

Kinjol Barua, Samuel Peana, *Arya D Keni*, Vahagn Mkhitarian, Vladimir M Shalaev, Yong P Chen, Alexandra Boltasseva, Hadiseh Alaeian

Communication Materials, 6-21

A brief analogy of NNs and literal selection procedures within SAT solvers Mar 2023

Mahfuza Farooque, *Arya D Keni*

Projects

Circular Bragg Grating Cavity 2025

- Designed and simulated photonic crystal cavities to enhance emission from embedded quantum emitters using radial Bragg reflectors

MicroLens Two Photon Polymerization Design 2025

- Engineered and optimized freeform microlens arrays for femtosecond laser-based two-photon polymerization fabrication

Multi-Emitter Temporal Dynamics Solver 2024

- Developed a simulation tool to model and analyze time-resolved emission dynamics of interacting quantum emitters

Conferences & Presentations

Conference Presentation, Materials Research Society (MRS) Spring Meeting & Exhibit — Seattle, WA April 22–26, 2024

- *Quantum Sensing with Rydberg Excitons* (QT06 topical cluster).
- Presenters: **Arya Keni**, N. Abraham, A. Agrawal, K. Barua, Y. P. Chen, H. Alaeian.
- Results on Cu₂O Rydberg–exciton sensing; device concept and preliminary metrology.

Poster, International Conference of Undergraduate Research (ICUR) — University of Warwick & partner campuses September 27–28, 2023

- *Simulation and Synthesis of Geometrical Coating Complexities in 3D Glass Substrates using PVD*.
- Presented in Engineering/Physics stream; cross-campus Q&A moderated by Warwick/Monash.
- Non-conformal & anisotropic PVD modeling; validation on complex substrate geometries.

Conference Presentation, International Conference on Life Sciences, Engineering & Technology (iLSET) — Denver, CO April 13–16, 2023

- *A brief overview of NN utilization for SAT solving* (with M. Farooque).
- Focus on neural heuristics and literal-selection procedures; solver performance comparisons.
- Presented within the iLSET technical program; associated proceedings entry (ISTES series).

Poster, WorldCUR/BCUR 2023 — University of Warwick — Coventry, UK April 4–6, 2023

- *Simulation and Synthesis of Geometrical Coating Complexities in 3D Glass Substrates using PVD*.
- Listed as PosterExhibition061 in the joint WorldCUR/BCUR Book of Abstracts.
- Track: Engineering/Materials; emphasis on process modeling and deposition geometry.

Technologies

Languages: Python, C, C++, LabView, Matlab, Julia, Markdown, LaTeX, R, Verilog

Electrical Systems: Analog, RF, PZT, electro-acoustics

Software Technologies: Tidy3D, MEEP, Legume, Lumerical, COMSOL, QuTIP, GDSII, FPGA, CAD, Git, PyTorch, Tensorflow, LTSpice, Cadence

Optical Tools: Pico/Femtosecond Pulsed Lasers, CW Lasers, Tunable Lasers, EOM, AOM, Microscopy, Spectroscopy, EM/CCD, Single Photon Detectors, Photodiodes, Polarimetry, FTIR, Raman, Ellipsometry

Fabrication Tools: Photolithography, E-Beam Lithography, Spin-Coating, Sputter/Evaporative Metal Deposition, HDPCVD, ICP RI Etching, Profilometry, 3D Printing, Laser Etching, Wafer Dicing, Nanopolymer Lithography, Wirebonding

Imaging Tools: SEM, AFM, EDX, XRD