Debaditya Bhattacharya

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EDUCATION

Cornell University — Ithaca, NY, USA
Doctor of Philosophy in Electrical and Computer Engineering — 2023 - Present

- **GPA:** 4.0 / 4.0
- **Advisors:** Prof. Debdeep Jena, Prof. Huili Grace Xing, Prof. Farhan Rana
- **Research Area:** Semiconductor epitaxy, nanofabrication, and electronic & photonic devices

Indian Institute of Technology (IIT) Kanpur — Kanpur, UP, India
Bachelor of Science in Physics; Minor in Electrical Engineering — 2019 - 2023

- **CGPA:** 9.3 / 10.0
- **Advisor:** Prof. Shubham Sahay
- **Relevant Projects:** Spintronics, ferroelectric field effect transistors

CURRENT RESEARCH PROJECTS

- **Epitaxial Growth & Characterization of III-Nitride and III-Oxide Alloys:**
  Synthesis of AlGaN thin films via molecular beam epitaxy (MBE) and metal organic chemical vapor deposition (MOCVD). Optical metrology – including spectroscopic ellipsometry, UV-Vis spectroscopy, and photoluminescence spectroscopy – of nitride and oxide semiconductors for defect identification, determination of bandgaps and dielectric functions. Investigation of electrical transport in AlScN for lattice-matched device applications.
- **Deep-UV Photonics & Optoelectronics:**
  Design and fabrication of UVC lasers targeting a wavelength $\sim$ 270 nm and far-UVC LEDs with emission below 240 nm. Heterostructure design and development of microfabrication techniques to improve carrier injection and light extraction efficiency for next-generation solid-state UV light sources.
- **Ultra-Wide Bandgap (UWBG) & Colossal Bandgap (CBG) Power Electronics:**
  Development of high-breakdown, low on-resistance AlGaN pin diodes and α-$(Al,Ga)_2O_3$ based transistors and diodes with band gaps up to 8.8 eV. Optimization of nanofabrication techniques to minimize ohmic contact resistance, suppress reverse leakage, and implement field-management strategies for high-performance power architectures.

PUBLICATIONS

Peer Reviewed Articles

1. S. Agrawal, H.-W. S. Huang, **D. Bhattacharya**, M. Ramesh, K. Nowakowski-Szkudlarek, H. Turski, V. Protasenko, H. G. Xing, and D. Jena, "Electrical analysis of 265 nm UV-C emitting AlGaN diode heterostructures grown by MBE on bulk AlN", AIP Advances **16**, 035322 (2026).
2. **D. Bhattacharya**, S. Agrawal, H.-W. S. Huang, M. Ramesh, J. E. Dill, V. Protasenko, H. G. Xing, and D. Jena, "Dielectric assisted liftoff enabled simultaneous low n- and p- differential contact resistivities in ultrawide bandgap AlGaN pn diodes on bulk AlN", en, Japanese Journal of Applied Physics **65**, 036503 (2026).
3. P. Lonergan, M. Ramesh, S. Agrawal, **D. Bhattacharya**, T.-S. Nguyen, V. Protasenko, H. Turski, H. G. Xing, and D. Jena, "AlScN as an electron blocking layer in blue light emitting diodes: A first look", Applied Physics Letters **128**, 093304 (2026).
4. R. Singh, N. Veeraraghavan, C. Savant, **D. Bhattacharya**, W. Zhao, T. Nguyen, A. Ithepalli, P. Lonergan, H. G. Xing, and D. Jena, "Molecular beam epitaxy of AlScN on Si(111)", Journal of Applied Physics **139**, 115301 (2026).
5. M. Gremmel, C. Prakash Savant, **D. Bhattacharya**, G. Schönweger, D. Jena, and S. Fichtner, "The effect of boron incorporation on leakage and wake-up in ferroelectric $Al_{1-x}Sc_xN$", Journal of Applied Physics **137**, 244101 (2025).
6. H.-W. S. Huang, S. Agrawal, **D. Bhattacharya**, V. Protasenko, H. G. Xing, and D. Jena, "Low p-contact resistance InGaN-capped AlGaN-based DUV LEDs on bulk AlN substrates", Applied Physics Letters **127**, 193305 (2025).

7. J. Steele, J. Chen, T. Burrell, N. A. Pieczulewski, **D. Bhattacharya**, K. Smith, K. Gann, M. O. Thompson, H. G. Xing, D. Jena, D. A. Muller, M. D. Williams, M. K. I. Senevirathna, and D. G. Schlom, "Growth of conductive Si-doped α-Ga_2O_3 by suboxide molecular-beam epitaxy", APL Materials **13**, 101117 (2025).

Conference Proceedings

1. **D. Bhattacharya**, S. Agrawal, H. W. S. Huang, V. Protasenko, K. Szkudlarek, H. Turski, H. G. Xing, and D. Jena, "Low Temperature Electroluminescence of AlGaN based UV Edge Emitting LEDs grown by MBE on Bulk AlN Substrates", in 2025 Device Research Conference (DRC), ISSN: 2640-6853 (June 2025), pp. 1–2.

Preprints

1. J. E. Dill, X. Wei, C. Yu, A. Arvind, S. Agrawal, **D. Bhattacharya**, K. Shinohara, D. Jena, and H. G. Xing, "Low Resistance Non-Alloyed Ohmic Contacts to High Al Composition n-type AlGaN", arXiv:2512.08871 [cond-mat], `10.48550/arXiv.2512.08871` (2025).

TECHNICAL SKILLS

Device Design & Simulation:
1D Poisson, NextNano, Silvaco Atlas (TCAD), and COMSOL Multiphysics

Material Characterization:
X-ray Diffraction, Atomic Force Microscopy, Photoluminescence, Scanning Electron Microscopy, and Optical Microscopy

Cleanroom Nanofabrication:
Photolithography, Reactive Ion Etching, Atomic Layer Deposition, Plasma Enhanced Chemical Vapor Deposition, and Sputtering & e-beam Evaporation

Device Characterization & Testing:
Transistors/Diodes - DC I-V/C-V Characterization, Pulsed I-V, Electroluminescence
Methods - Transfer Length Method, Hall Effect, Internal Photoemission Spectroscopy

Semiconductor Epitaxy:
Molecular Beam Epitaxy and Metal Organic Chemical Vapor Deposition of AlGaN

Programming & Hardware Interfacing:
Languages - Python, C/C++, Embedded C
Instrument Interface - GPIB (IEEE-488), RS-232, Tektronics TSP

TEACHING AND MENTORSHIP

Teaching Assistant & Course Ambassador Roles

- **Quantum Physics and Engineering** Fall 2025
  Teaching Assistant aiding Prof. Farhan Rana
- **Physics of Semiconductors and Nanostructures** Spring 2025
  Course Ambassador under Prof. Debdeep Jena
- **Semiconductor Electronic and Photonic Devices** Fall 2024
  Course Ambassador under Prof. Debdeep Jena

Mentorship

- **Jasper Shen** – Master's student, Jena-Xing group Fall 2025 - Present
  Project Topic: Photoluminescence spectroscopy of nitride materials and devices
- **Bill Xu** – Undergraduate student, Jena-Xing group Spring 2026 - Present
  Project Topic: Electrical characterization of AlGaN pn diodes

WORK & VOLUNTEER EXPERIENCE

Electron Devices Society (EDS) at Cornell University 2024 - 2025
President

- Hosted over 20 technical seminars across two semesters to foster research exchange.
- Launched the official *EDS at Cornell YouTube channel* to archive technical talks and expand outreach to the global semiconductor community.

AGNIT Semiconductors Pvt. Ltd. 2023
Process Development Engineering Intern

- Developed *Process Control Modules (PCM)* for epitaxy qualification for *GaN RF HEMTs*.
- Automated *TLM analysis workflows* to streamline device characterization and data processing.

Academics and Career Council, IIT Kanpur 2021 - 2022
Associate Head, Research

- Spearheaded the *Students' Research Convention 2023*, a 3-day conference and poster competition.
- Launched a research *newsletter* and organized guidance sessions with alumni to mentor junior students.
- Managed the strategic functioning and oversight of the Research Wing's campus-wide initiatives.

Science Coffee House, IIT Kanpur 2021 - 2022
Leader

- *Revitalized* club operations after a 2-year dormancy, engaging over 200 students in new projects.
- Led a technical reading group on *semiconductor physics* and organized the "Elucidate" video competition.

HONOURS AND RECOGNITION

- **Academic Excellence Award, IIT Kanpur** 2019 - 2023
  Awarded for four consecutive years in recognition of outstanding academic performance.
- **Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship** 2019 - 2023
  National-level fellowship awarded by the Department of Science and Technology (DST), Govt. of India, to students with high aptitude for scientific research.
- **Summer Research Fellowship, Indian Academy of Sciences** 2021
  Highly competitive fellowship awarded to undergraduate students to pursue research at premier national laboratories and institutes.

REFERENCES

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