

Sudipta Romen Biswas

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Summary

- 3.5+ years of experience in testing, validation, characterization, design, simulation, and optimization of electro-optical sensors and devices. 7+ years of research experience studying optics and photonics.
- Experience in collaborative work across multi-disciplinary fields, diverse teams, and locations, working simultaneously on multiple projects.
- Contributions: 5 provisional US patent applications, 1 accepted patent, 9 peer-reviewed journals and conference papers, 3 conference presentations. Total citation on Google Scholar to date: 457.

Technical Strengths

Simulation Tools & Software: COMSOL, Zemax, LightTools, Solidworks, JMP, ImageJ, Lumerical (MODE, Interconnect), KLayout, Inkscape, PSpice/LTSpice, MS Office.

Programming/Scientific Computing: Matlab, Python, GitHub.

Optical Metrology: Rx/Tx measurements with spectrometer & integrating-sphere, optical sensor (illuminance, crosstalk, thermal, spectral response) and display panel (transmission, luminance, BSDF) performance testing and validation measurements, bench-top laser-based optical imaging analysis, imaging with pinhole-camera and image sensor, inspecting samples with Keyence digital microscope.

Image Sensor Metrology: Image sensor power-consumption, thermal testing, image orientation/readout, gain/exposure linearity, and timing/trigger measurements.

Hardware Tools: Oscilloscope, power supplies, digital multimeter, function generator, spectrometer, tunable light source, illuminance meter, luminance meter, solar simulator, ALS test fixture, linear & rotational motors, REFLET 180S Scatterometer, TPS thermal chamber.

Automation: Python/Matlab based automation of hardware tools and data analysis.

Agentic AI Tools: Claude Code/Codex, Cursor/Windsurf/Antigravity, Manus, NotebookLM, OpenClaw.

Work & Research Experience

HARDWARE ENGINEER (SENSOR VALIDATION) | META | NOV 2025 – MAR 2026

- Performed validation tests supporting image sensors. Collected and performed statistical analyses on test data to correlate it with performance metrics.
- Implemented and improved test automation and data analysis workflow to evaluate sensor performance for wearable applications.
- Supported image sensor characterization/validation engineers in providing high-quality electrical/optical test infrastructure.
- Supported debugging and problem-solving efforts, collaborating with cross-functional teams to evaluate next-generation sensor technologies.
- Worked with the team to identify ways to improve existing capabilities and add new ones.

OPTICAL SENSING HARDWARE ENGINEER | APPLE | FEB 2024 – MAY 2025

- Led end-to-end lab validation to support new electro-optical sensor development. Developed, implemented, and updated sensing-hardware validation plans.
- Validated ambient light sensor performance via illuminance, emission, scattering, angular, and spectral response measurements.
- Hands-on experience with sensor characterization hardware and software using Python automation, spectrometers, and illuminance meters. Maintenance and operation of test setups for different use cases.
- Managed and reported the engineering build process using Python/Matlab and JMP to analyze large sets of data and track key figures of merit. Converted data to visual plots/charts.

- Benchmarked optical device performance from early prototype to product launch. Assisted the team with lab work to conduct failure analysis or research such as display light leakage, cover glass properties, affects from thermal environment etc.
- Simulated factory and lab testing set-ups in LightTools to find root cause of measurement discrepancies and updated testing procedure.
- Analyzed data to draw conclusions and delivered presentations of results in regular reviews to cross-functional teams. Updated and refined standard operating procedure (SOP) for validation tests.

DEVICE ARCHITECTURE SCIENTIST | LUMILEDS (R&D/ OFFICE OF CTO) | JAN 2022 – JUNE 2023

- Utilized simulation and modeling tools such as LightTools (ray tracing simulations, color & illumination analysis), SolidWorks (CAD designs for prototyping), COMSOL Multiphysics (wave optics simulations), JMP (design of experiment (DOE) and variability analysis), and Matlab (automating simulations, design-space parameter sweeps, and data analysis) to analyze and optimize the LED light output by up to 30-50%.
- Drove research on meta-optic device designs with the aim of tailoring the LED emission patterns to enhance performance. Led efforts to re-design optic to improve transmission efficiency of prototypes by up to 30%.
- Conducted hands-on lab work—from sample prep to data analysis—using integrating spheres, spectrometers, microscopes, and laser-based bench-top imaging equipment.
- Collaborated with cross-functional teams to communicate analyses and propose solutions aligning with customer needs.
- Improved simulation models and conducted validation experiments for automotive and illumination products; contributed to five US patent applications and received company awards.

GRADUATE RESEARCH ASSISTANT | UNIVERSITY OF MINNESOTA | MAY 2016 – DEC 2021

- **Tunable metasurface reflectarray:** Designed a graphene-based metasurface capable of electrostatically switching between beam steering, focusing, and cloaking. Validated its performance through electromagnetic simulations using COMSOL Multiphysics and Matlab.
- **Tunable optical response in 2D materials:** Proposed and theoretically demonstrated a mechanism for strong anisotropic second harmonic generation in bilayer SnS via double-resonance effect through electronic band-structure engineering with an external electric field, achieving up to ~1000x SHG enhancement. Also theoretically demonstrated tunable hyperbolic topology in monolayer WTe₂, suggesting directions for novel low-dimensional nanophotonic devices.
- **Plasmonic gas sensing:** Designed a graphene metasurface device for label-free infrared gas detection and confirmed adsorption as the main gas-trapping mechanism. This work enables versatile applications in highly effective gas sensing.

Certifications

- Silicon Photonics Design, Fabrication and Data Analysis ([UBCx Phot1x](#)) by EdX.
- Optical Engineering and Optical Instrument Design Certification by UC Irvine DCE (Ongoing)
[Completed courses: Introduction to Lens Design, Advanced Lens Design, Optical Systems Engineering, Introduction to Fiber Optics, Introduction to Radiometry]

Education

- **University of Minnesota, Twin Cities**
 - PhD in Electrical Engineering (Jan 2022)
 - MS in Electrical and Computer Engineering (June 2021).
 - Supervisor: Dr. Tony Low, Associate Professor, Dept. of ECE.
 PhD Thesis Title: “Tunable Nonlinear Response and Hyperbolicity in Two-Dimensional Materials through Band Nesting and Potential Metasurface Applications.”
 - Graduate Fellow: 3M Science & Technology Doctoral Fellowship (2015-2019).
 - Teaching Assistantship: Also worked as a grading and lab TA for undergrad level courses.
- **Bangladesh University of Engineering & Technology (BUET), Dhaka, Bangladesh**
 - BSc. in Electrical & Electronic Engineering (July 2014)
 - University Merit Scholarship in 6 out of 8 semesters, Dean's List Award in all four levels.

Internship Experience

GRADUATE SUMMER INTERN | 3M COMPANY | SUMMER 2018, 2019

- **Summer 2019:** Drove the application of transfer learning and computer vision with pre-trained deep neural network-based models (SSD, Faster RCNN) on custom image dataset for classification and object detection (using Tensorflow). The corresponding project has been submitted for a US patent.
- **Summer 2018:** Worked on projects developing unique 3M materials for actuation, sensing, and soft robotics. Simulated electro-mechanical interactions of layered electro-active materials with COMSOL (Solid Mechanics and Electrostatic modules).

Selected Publications

Journals:

- **Sudipta Romen Biswas**, Cristian E. Gutiérrez, Andrei Nemilentsau, In-Ho Lee, Sang-Hyun Oh, Phaedon Avouris, and Tony Low. "Tunable graphene metasurface reflectarray for cloaking, illusion, and focusing." *Physical Review Applied* 9, no. 3 (2018): 034021. Part of the contributions to the Physical Review Applied collection Millie Dresselhaus: Her living scientific legacy.
- **Sudipta Romen Biswas**, Jin Yu, Zhenwei Wang, Diego Rabelo da Costa, Chujun Zhao, Shengjun Yuan, and Tony Low. "Double resonant tunable second harmonic generation in two-dimensional layered materials through band nesting." *Physical Review B* 107, no. 11 (2023): 115409.
- Hai Hu, Xiaoxia Yang, Xiangdong Guo, Kaveh Khaliji, **Sudipta Romen Biswas**, F. Javier García de Abajo, Tony Low, Zhipei Sun, and Qing Dai. "Gas identification with graphene plasmons." *Nature communications* 10, no. 1 (2019): 1131.
- Kaveh Khaliji, **Sudipta Romen Biswas**, Hai Hu, Xiaoxia Yang, Qing Dai, Sang-Hyun Oh, Phaedon Avouris, and Tony Low. "Plasmonic gas sensing with graphene nanoribbons." *Physical Review Applied* 13, no. 1 (2020): 011002.

Patents:

- **Sudipta Romen Biswas**, Yu-Chen Shen, Grigoriy Basin. "Microlens array with built-in air gap." U.S. Patent No. 12,572,055 B2, Application No. 19/001,078.
- **Sudipta Romen Biswas**, Yu-Chen Shen. "Transparent structure on pcLED to increase light flux." U.S. Patent Application No. 19/211,391.
- Orlin B. Knudson, **Sudipta Romen Biswas**, et al. "DRONE-HOSTED CONSTRUCTION DEFECT REMEDIATION." U.S. Patent Application No. 18/554,616.
- 3 more provisional patent applications while working at Lumileds LLC.

Conferences:

- **Sudipta Romen Biswas**, Kaveh Khaliji, and Tony Low. "Graphene Plasmonic Metasurface for Beam Forming and Gas Sensing." In *2019 IEEE Research and Applications of Photonics in Defense Conference (RAPID)*, pp. 1-3. IEEE, 2019.
- Poster Presentation at Nanophotonics of 2D materials, N2D 2017, Donostia-San Sebastian (Spain), Jul 31- Aug 3, 2017

Paper Peer Review: IEEE JETCAS, IEEE Access, Physics Letters A.

Volunteering Activities

- Co-captain of multiple USTA NTRP 3.5 Adult league teams, USTA NorCal, South-bay area (2025, 2026).
- Volunteered with Our City of Forest nursery and Keep Coyote Creek Beautiful for habitat restoration.
- Site Social Events Committee Member, Lumileds, San Jose (2022-2023).
- Volunteer Judge at MN State Science Fair and Junior Science Symposium 2019, 2020, & 2021.
- Member on Board of Directors (Dec 2020 - June 2021) and Building Coordinator (Aug 2020 – Aug 2021) at Como Student Community Co-Op, Minneapolis, MN
- Secretary (2016 - 2017), and Vice President (2017 - 2018) at Bangladeshi Student Association (BDSA), U. of Minnesota.