Arpan Sur

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Education

M.Sc. in Electrical and Electronic Engineering (EEE) July 2023 – June 2025 (Expected)
Bangladesh University of Engineering and Technology (BUET) Dhaka, Bangladesh
- CGPA: **3.92**/4.00

B.Sc. in Electrical and Electronic Engineering (EEE) April 2018 – May 2023
Bangladesh University of Engineering and Technology (BUET) Dhaka, Bangladesh
- CGPA: **3.53**/4.00

Research Interests

- Integrated Optics
- Nonlinear Optics
- Quantum Optics
- Ultrafast Optoelectronics
- Nanophotonics
- Plasmonics

Research Experience

Research Fellow
November 2023 – Present
Supervisor: Dr. Ahmed Zubair Dept of EEE, BUET

Improvement of thin film solar cells beyond the visible spectrum
- Performed structural optimization on plasmonic nanoparticles (NPs) to maximize the near-field and far-field enhancement, while excluding the parasitic absorption of NPs.
- Analyzed the light-trapping effects of hyperuniform nanohole patterns in different solar cells.

Ultra-compact dielectric-coated graphene-based integrated logic gates
- Investigated the surface plasmon polariton modes and their propagation through graphene at various chemical potential in the MIR to THz frequency range.
- Designed an ultra-compact graphene plasmonic logic gate operating at the MIR wavelength, capable of voltage controlled AND/OR operations.

Hyperbolic Metamaterial Sensor for Efficient Salinity Detection
- Calculated the bulk plasmon polariton (BPP) mode frequency shift, sensor sensitivity parameter, and the hyperbolic dispersion region for multilayer HMM structure.
- Proposed a Cu/InP multilayer structure that exhibited two salinity-level sensitive BPP modes.

Research Student
May 2024 – Present
Supervisor: Dr. Md. Kawsar Alam Dept of EEE, BUET

2D material-based agent design for photo-thermal therapy
- Investigated optical and thermal properties of the 2D MoA_2Z_4 family using first principal calculations and identified $MoGe_2P_4$ with improved absorption in the NIR-I biological window.
- Performed FDTD simulations to assess light absorption and solved bio-heat equation to calculate heat conversion in tumor environment.

Undergraduate Research Student
May 2022 – May 2023
Supervisor: Dr. Md Farhad Hossain Dept of EEE, BUET

Collaborative multi-robot coverage path planning and target search system
- Tested multi-robot exploration algorithms, considering dynamic constraints of both vehicles and sensors.
- Developed a robust semi-centralized area partitioning algorithm utilizing a PID controller to guide multiple ground robots through UAV communication to efficiently explore the search space.

Publication: Conference [* Equal Contribution]

Arpan Sur, Ahmed Zubair, *"Ultra-Compact Voltage-Controlled Dielectric-Cladded Graphene Plasmonic Waveguide Based Optical Logic Gate"*. **Accepted in 13th IEEE ICECE** (2024)

Sudipta Saha*, Arpan Sur*, Sajib Bain, Tanisha Tanzina Hasan, *"Development of a Low-Cost Spectrometer for Educational Applications"*. **Accepted in 13th IEEE ICECE** (2024)

Sanath Kumar Das*, Arpan Sur*, Md. Farhad Hossain, *"Collaborative Path Planning and Target Search in Multi-Robot Systems with PID-Controlled Uniform Area Partitioning"*. **Accepted in 27th IEEE ICCIT** (2024)

Publications Under Review and Preparation [* Equal Contribution]

Sudipta Saha*, Arpan Sur*, Labonno Saha, Md. Kawsar Alam, *"NIR-I Responsive 2D $MoGe_2P_4$ for Targeted Photothermal Tumor Therapy"*. **Manuscript submitted to Small** (2024)

Arpan Sur, Sudipta Saha, Ahmed Zubair, *"NIR-Responsive Hyperbolic Metamaterial Sensor for Efficient Salinity Detection"*. **Abstract submitted to CLEO** (2025)

Academic Projects, Technical Writings and Presentations

Design of a Bangla Calendar Clock [Demonstration] Sept 2022
- Developed a clock displaying time and date in Bangla language with internet time synchronization.

Design of a Spectrometer Operating in Visible Wavelength [Presentation] Feb 2023
- CD grating and low-cost camera assisted spectrometer was developed to characterize light sources by inspecting their intensity-wavelength and light-current characteristics in the visible region.

Self-consistent Schrodinger-Poisson Solver for Double-gate MOSFET [Report] Aug 2023
- Numerically computed potential profile, band-structure and C-V characteristics using MATLAB.

Investigation of Ternary Barrier Layers in GaN-Based HEMT Devices [Report] Sept 2023
- Invetigated the 2DEG concentration of InAlN/GaN and ScAlN/GaN interface using BandEng.

Review on Material Platform for Integrated Single Photon Detector [Report] Oct 2023
- Studied the working principle of single photon detector (SPD) and conducted a literature survey on widely adopted SPD technologies (SNSPD, SPAD and TES) to classify them into different material platforms.

Review on Impact of Graphene and its Derivatives Photovoltaic Application Feb 2024
- Reviewed the functionality of Graphene and its derivatives in different layers of various third generation solar cells.

Optoelectronic Simulation of Plasmonic Star-Shaped Nano Prism Incorporated Solar Cell Sept 2024
- Presented in 85^{th} JSAP (Japan Society of Applied Physics) Autumn Meeting 2024 [Presentation]

Technical Skills

Languages: C/C++, MATLAB, Octave, Python Toolbox (MEEP, MPB, Qiskit, PyTorch), ARMv7, Verilog

Simulation Tools: Ansys Lumerical (FDTD, MODE, CHARGE, HEAT), COMSOL Multiphysics, Material Studio, Quartus, Proteus, PSpice, Cisco Packet Tracer, CoppeliaSim, Webots, AutoCAD, PCB design

Microcontroller and Microprocessor: STM32L47x, ATmega328P, Xtensa LX6

Scientific Writing, Graphics and 3D Modelling: LaTeX, Origin, MS Office, Blender, Adobe Illustrator

Honors and Awards

Postgraduate Research Fellowship, BUET [Appointment] Nov 2023–Apr 2025
- Selected as one of the top 6 research proposals from Department of EEE

RISE Student Research Grant, BUET [Certificate] Aug 2022–Aug 2023
- Selected among 155 undergraduate student research proposals.

EEE Faculty Dean's List Award, BUET 2022–2023
- For obtaining a GPA of 3.75 or above in two regular terms of an academic year.

Relavant Coursework

Undergraduate Courses
- Optoelectronics
- Optical Communication
- Solid State Devices
- Engineering Electromagnetics

Postgraduate Courses
- Heterostructures and Compound Semiconductor Devices
- Nanophotonics and Plasmonics
- Quantum Computing and Quantum Photonics
- Nanoscale Device Modeling and Simulation Techniques
- Laser Theory
- Machine Learning and Pattern Recognition