

SHREYA SAHAI

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EDUCATION

Master of Science in Electrical and Computer Engineering

University of Florida
Thesis: Plasmonic devices for Electro-optic modulation
Advisor: Dr. Yoon
Co-advisor: Dr. Zmuda
GPA: 3.89/4.0

January, 2021- July, 2022
Gainesville, FL

Exchange Program in Computer Science

University of Florida
GPA: 3.4/4.0

January, 2020- May, 2020
Gainesville, FL

Bachelor of Technology in Electronic and Communication Engineering

Jaypee Institute of Information Technology,
Major Project: Biosensors based on Ring Resonator
Advisor: Dr. Anshu Varshney
CGPA: 7.5/10

July, 2016 – May, 2020
Noida, India

PUBLICATIONS

Journals

- Sahai, S., Varshney, A. Solar absorbance enhancement in perovskite solar cells with the inclusion of copper nanoparticles: an architectural study. *Opt Quant Electron* 53, 111 (2021). <https://doi.org/10.1007/s11082-021-02755-9> (*published*)
- Sahai, S., Varshney, A. The Effect of Morphologies of Embedded Plasmonic Cu-nanoparticles on Solar Absorption of Perovskite Solar Cells: A Comprehensive Study. *Optics and Spectroscopy* 8, 1088 (2021) <http://dx.doi.org/10.21883/OS.2021.08.51206.1008-21> (*accepted*)
- Sahai, S., Prashant Chauhan, Varshney, "Efficacy of Double/Single Notched ring resonator on basis of plasmonic nanoparticle", *International Journal of Microwave and Optical Technology*. (*accepted*)
- Sahai, S., Varshney, A. Investigation of Solar absorbance enhancement with the inclusion of dielectric coated plasmonic copper nanoparticles within hybrid organic-inorganic halide perovskite solar cell, *IOP Nanotechnology, 2021* (*submitted*)
- Shreya Sahai, Anshu D. Varshney, "Designing of Slot waveguide-based Urine biosensor: Detection of critical Diseases", *Optik*, (*submitted*)

Conferences

- Shreya Sahai, Anshu D. Varshney, and S.K. Varshney "Analysis, modelling and simulation of all silicon micro ring resonator and their comparison on the basis of their coupling lengths", *AIP Conference Proceedings* 2136, 050011 (2019). (*published*)
- Shreya Sahai, Anshu D. Varshney, "Perovskite solar cells with Copper Nanoparticles", *SPIE conference, Photonics West, 2021*. (*accepted*)
- Shreya Sahai, Anshu D. Varshney, "Analysis of μ -Ring Resonator with metallic nanoparticles", *SPIE conference, Photonics + Optics, 2019* (*accepted*)
- Shreya Sahai, Anshu D. Varshney, "Self-Interference ring resonator based optical sensor", *CAMNP2019*(*accepted*)

INVITED TALKS & PRESENTATIONS

- Invited Talk based on "Perovskite solar cells with Plasmonic Nanoparticles", *Shri Ramswaroop Memorial University* on 8th August 2021.
- Paper Presentation, "Analysis, modelling and simulation of all silicon micro ring resonator and their comparison on the basis of their coupling lengths," *International Conference on Photonics, Metamaterials & Plasmonics*, 14th - 16th February 2019.

- Workshop, “Perovskite solar cells with Nanoparticles,” National workshop on Photooptics, 16th-17th, August, 2019.

RESEARCH EXPERIENCE

University of Florida

Research Intern

Advisor: Dr. Philip Feng

Topic: Optical Biosensors

The goal of this project was to build a highly sensitive, cost-effective optical biosensor for detection of COVID-19 based on silicon photonics. Through literature survey on different classes of coronaviruses was done. Our optical biosensor based on silicon photonics was made very compact, allowing many of resonators to be incorporated on a single chip to perform simultaneous measurements of multiple analyte concentrations. The entire study was based on Finite Difference Time Domain method of simulation.

Gainesville, FL

May 2020 - December 2020

Indian Institute of Technology, Bombay

Research Intern

Advisor: Dr. Anshuman Srivastava

Topic: Perovskite solar cells embedded with plasmonic nanoparticles

The aim of this project was to investigate the geometrical and material aspects of plasmonic nanoparticles embedded within organic–inorganic halide Perovskite solar cells (PSCs). Gold nanoparticles are synthesized using the citrate ion reduction method. Finite Difference Time Domain simulation and numerical analysis of solar absorption enhancement in organic–inorganic halide perovskite films embedding plasmonic metallic nanoparticles was done.

Bombay, India

May, 2019 – July, 2019

Indian Institute of Technology, Kharagpur

Research Intern

Topic: Numerical analysis of Optical ring resonators

The aim of this summer project was to establish a basic understanding of micro ring resonator systems and its underlying physics. We did mathematical modelling of single and cascaded all silicon micro ring resonators and racetrack resonators. The study was further extended to the analysis of transmission spectrum of these models using MATLAB. Further, an Introduction to Finite Difference Time Domain Simulation method, which is not only employed for designing filters but also optical sensors.

Kharagpur, India

May, 2018 – July, 2018

PROJECTS UNDERTAKEN

University of Florida

Graduate Researcher

Master’s thesis Topic: Plasmonic devices for Electro-optic modulation

Advisor: Dr. Yoon

This work seeks to employ these new plasmonic materials as well as new architectures for a tunable electro optic modulator and switch. Specifically, the devices are fabricated using Barium Titanate and Lanthanum Nickelate since these allow for frequency tuning of the device characteristics. The high loss typically associated with Surface Plasmons will be mitigated with unique focusing design as part of the device architecture.

Gainesville, FL

May, 2021 – Present

Jaypee Institute of Information Technology

Undergraduate Researcher

Advisor: Dr. Anshu Varshney

Noida, India

August, 2018 - December, 2019

1. Perovskite Solar cells with Inclusion of Nanoparticles (continued Research Internship project)

We have studied the geometrical and material aspects of plasmonic nanoparticles embedded within organic–inorganic halide Perovskite solar cells (PSCs), to achieve higher solar absorbance enhancement. With the existing PSCs designs, high production costs serve as a paramount threat to its commercialization. A breakthrough in this work presents its replacement with the copper nanoparticles which serve as a cheaper alternative to gold and thus help in the production highly efficient low-cost PSCs.

2. Influence of Different shapes plasmonic nanostructures embedded within Perovskite solar cells: A Detailed Study

We have performed an extensive study based on the different morphologies of plasmonic nanoparticles including nanospheres, nanocubes, nanocylinders, nanorods, nanotriangular plates embedded within the film. This geometric

study is extended to the different orientations of a particle within the film, with respect to the source of light. The entire study is based on the Finite Difference Time Domain (FDTD) method of simulation.

3. Investigation of Solar absorbance enhancement with the inclusion of dielectric coated plasmonic copper nanoparticles within hybrid organic-inorganic halide perovskite solar cell

In this work, a detailed theoretical study was conducted to elucidate the impact of coreshell Copper nanoparticles with different dielectric coatings. A comparative study based on finite difference time domain method, has been done to analyze the influence of embedding dielectric coating of high and low refractive index. Interestingly, the results portray that as the thickness of the shell increases, a higher absorption reduction is observed with the nanostructure coated with the shell of lower refractive index as compared to the nanostructures with dielectric shell of higher refractive index.

4. Impact of embedding Coreshell Nanoparticles within the Perovskite solar cells

The influence of embedding coreshell copper nanoparticles within the perovskite solar cells is further analyzed. Various potential metal and dielectric materials are investigated. The thickness of the shell is examined to enhance the solar absorbance enhancement. The entire study is based on Finite Difference Time Domain method of simulation.

5. μ -Ring Resonator: A Comparative study based on their parameters.

A comparative study and FDTD simulation of micro-ring resonator based on their various parameters like coupling length, the radius of the ring and the coupling gap along with detailed analysis of their impact on the transmission spectrum and various other spectrums.

6. Designing of Slot waveguide-based Urine biosensor: Detection of critical Diseases

Optical biosensor is designed for the detection of health issues using urine quantitatively. The proposed biosensor employs a cascaded, slot waveguide based μ -ring resonator to enhance its sensitivity to its core. All the results are based on the FDTD method. The proposed biosensor is not only efficient but also cost effective, thus can be utilized for the detection deadly diseases.

7. Integration of μ -Ring Resonator with metallic nanoparticles

The sensitivity of all silicon micro ring resonator is analyzed in the absence and presence of the different nanoparticles. Based on their optical properties, it is further classified into a detailed study based on their different parameters like materials, sizes, shapes. The study can be promoted to design a device which would be useful in detection and sensing applications.

Jaypee Institute of Information Technology

Undergraduate Researcher

Advisor: Prof. Yogesh Kumar

Topic: Light fidelity (Li-Fi) Based Text Transmission

Developed an Arduino based model for text transmission through light. The project was based on Python language for coding and decoding of binary text transmitted through light and hence proposed a compact, cost-effective model for the transmission of data.

Noida, India

January, 2018 - May, 2018

VOLUNTEER EXPERIENCE

University of Florida

Community Assistant

Serving as a peer educator and helper to facilitate the personal and academic growth and development of residential students. Being a CA Corry Village, I organize events for the community and help maintain law and order within the area. It helps me to be team centered, innovative, responsible, and aware of multifaceted life at UF. I also provide a supportive, encouraging, and non-judgmental environment for residents while recognizing personal limits.

Gainesville, FL

May, 2021 – Present

RELEVANT COURSES UNDERTAKEN

- Fundamentals of Photonics
- Introduction of Electromagnetism
- Introduction of Nanodevices
- Micro and Nanotechnologies for Medicine, Biology, and Agriculture
- Semiconductor Fabrication lab

PROFESSIONAL MEMBERSHIPS

- Student SPIE Member
- Student OSA Member

SKILLS AND KNOWLEDGE

- Software proficiency - FDTD, COMSOL, MATLAB
- Programming Language – JAVA, C, C++, Python

REFERNCES

Dr. Yoon, Department of Electrical and Computer Engineering, University of Florida

Dr. Anshu Varshney, Department of Physics and Material Science and Engineering, Jaypee Institute of Information Technology, Noida