

Mohsen Rajaei

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Research Interests

- Nano-optics and Nano-imaging
- Atomic Force Microscopy
- Photo-induced Force Microscopy
- Integrated Optics
- Silicon Photonics
- Computational Electromagnetics

Education

- Ph.D., University of California, Irvine, USA 2015 – Present
 - Electrical Engineering – Circuits and Devices
 - * Adviser: Professor H. Kumar Wickramasinghe
- M.S., University of Tehran, Iran 2012 – 2015
 - Electrical Engineering – Fields & Waves, **GPA: 19.03/20**
 - * Thesis: Numerical Analysis of Integrated Microring Resonators Using a Transmission-Line Formulation.
Adviser: Professor Mahmoud Shahabadi
- B.S., Isfahan University of Technology, Iran 2008 – 2012
 - Electrical Engineering – Communications, **GPA: 18.36/20**
 - * Thesis: Design of a High-Power Eight-Way Spatial Power Divider/Combiner
Adviser: Dr. Reza Safian

Publications

- Huang, F., Tamma, V. A., **Rajaei, M.**, Almajhadi, M., & Kumar Wickramasinghe, H. (2017). Measurement of laterally induced optical forces at the nanoscale. *Applied Physics Letters*, 110(6), 063103.
- Serahati, Z., **Rajaei, M.**, & Shahabadi, M. (2015). Analysis of integrated MIM-based plasmonic devices using a transmission-line formulation. *JOSA B*, 32(9), 1843-1850.
- **Rajaei, M.**, & Shahabadi, M. (2015). Analysis of 2-D dielectric-waveguide-coupled optical ring resonators using a transmission-line formulation. *JOSA A*, 32(10), 1797-1804.

Projects

- Design, fabrication, and characterization of chiral metamaterials 2017
 - In this project, we designed and simulated a chiral metamaterial using Lumerical software. The metamaterial shows a huge CD at the visible range, which can be used for detection of chiral biomolecules. We then fabricated the structure using focused-ion beam (FIB), and also characterized the response of the structure with a reflection setup using white light source and spectrometer.
- Detection of DNA oligos with AFM and PiFM 2017
 - In this project, we imaged DNA oligos with AFM and PiFM. We distributed DNAs on mica sheets and fixed them by surface functionalization. We then mapped the single DNA bases, which are as small as 20 nm, with AFM. We were also able to see the response of the DNA to excitation by mid-IR laser at specific wavenumbers by PiFM.

- Detection of molecular bond resonances using PiFM **2017**
 - In this project, using PiFM at mid-IR, we were able to detect specific vibrational resonances of molecules at nano-scale. Taking advantages of PiFM technique, we were able to do spectroscopy at nano-scale.
- Chirality at nanoscale **2016 – Present**
 - In this project, we are working on determination of chirality and handedness of molecules at nanoscale with near-field and far-field measurements.

Academic Experiences

- Research assistant at Nano-Bio Science and Technology Lab **2016 – Present**
 - University of California, Irvine, Adviser: Professor H. Kumar Wickramasinghe
 - * Project: Photo-induced force microscopy at mid-IR
- Research assistant at Photonics Research Laboratory and Optical Table **2013 – 2015**
 - University of Tehran, Adviser: Professor Mahmoud Shahabdi
- Teacher assistant at Microwaves Laboratory **2010**
 - University of Tehran, Adviser: Professor Jalil Rashed-Mohassel
- Intern at Microwaves Laboratory **2008**
 - Isfahan University of Technology, Adviser: Dr. Reza Safian
- Teacher assistant of the course “Fields and Waves” **2008**
 - Isfahan University of Technology, Instructor: Dr. Reza Safian

Experimental Experiences

- Working with Asylum and Molecular Vista (MVI) AFMs
- Characterization of photo-induced force using MVI AFM
- Taking photo-induced force images and spectra of different samples (including silicon slide, PMMA thin film on glass slide, PMMA-PS block copolymer, DNA oligos) at mid-IR using MVI AFM.
- Sample preparation for AFM measurements (i.e. PMMA on glass or Si slide, Au nano-spheres on glass slide)
- Working with mid-IR Block LaserTune, laser diode and visible and mid-IR HeNe lasers
- Working with various optics and electronics on optical table
- Coating Cr, Au, and Si on substrates using sputtering machine
- Working with FEI Quanta for scanning electron microscope (SEM) and focused ion beam (FIB) milling
- Working with FEI Megallex for SEM
- Working with Tescan GAIA3 for SEM and FIB
- Working with Angstrom E-beam evaporator for thin film deposition
- Characterization of S-parameters of different microwave components using network analyzer

Selected Courses

• Applications of Quantum Mechanics (at UCI)	A-	• Nano-imaging (at UCI)	A
• Metamaterials (at UCI)	A	• Antenna II	18.75/20
• Fields and Waves	18.5/20	• Fundamentals of Photonics	18.7/20
• Microwaves	19.8/20	• Active Microwave Circuits	19.4/20
• Antenna I	19/20	• Terahertz Theory and Technology	19.6/20
• Electromagnetic Theory I	18.6/20	• Metamaterials	19.55/20
• Advanced Engineering Mathematics	18.5/20		
• Numerical Methods in Electromagnetics	18.6/20		

Honors and Awards

- Recipient of the UCI Henry Samueli Endowed Fellowship **2015**
- Ranked 1st among all M.S. students in Fields & Waves major at University of Tehran **2015**
- Ranked 24th among 20,000 applicants **2012**
 - Iranian National University Entrance Exam in Electrical Engineering (M.S.)
- Ranked 11th among all B.S. students in Electrical Engineering at Isfahan University of Technology **2012**

- Ranked 431st among 500,000 applicants
Iranian National University Entrance Exam (B.S.) **2008**
- Ranked 1st among all students at Isfahan Province by GPA
Diploma of Mathematics at High-School **2007**

Software Skills

- Electromagnetic Simulation Software
 - Ansoft HFSS
 - Lumerical
 - COMSOL
 - ADS
 - CST
- MATLAB
- Mathematica
- C
- \LaTeX