Jiayi Dong — Physics

1220B Engineering V. – UCLA – California, United States

+1 4244734859 • jdongphys@g.ucla.edu • judydjy.github.io//

Final year undergraduate at University of Science and Technology of China pursuing a major in Physical Sciences, applying for Ph.D.s in Photonics and Materials Sciences

Education

Bachelor of Science 2020.09-2024.07

Photoelectric Information Science and Engineering, School of Physical Sciences

Weigted Average Score: 86.78 (3.64/4.3) Top 28%

Upperclass Score(including major courses): 89.22 (3.81/4.3) Top 10%

Core Physical Courses: Fundamentals of Modern Optics(90), Optoelectronic device processing technology(89), Atomic Physics A(90), Quantum Mechanics A(90), Solid States Physics A (88), Thermodynamics and Statistical Physics A(88), Computational Physics A(94)
Core Mathematical Courses: Computational Method(91), Equations of Mathematical Physics A(94), Digital Logic Circuits(89), Probability Theory and Mathematical Statistics(85)

Paper in Preparation

Diamond Spin Microscopy on a Dual Quasi-BIC Dielectric Quantum Metasurface Expected: 2024.01

Abstract: This first all dielectric "quasi-BIC(Bound States in the Continuum) quantum sensing metasurface" supports Guided-Mode Resonances, which achieves dual BIC at both the pump and illumination wavelength of NV(Nitrogen Vacancy) centers. This greatly enhances the integration of utilizing NV centers for quantum sensing, and due to the ultra high field enhancement and Q factor of the BICs, this dielectric metasurface greatly facilitates the readout and detection of the OMDR(optically detected magnetic resonance) of NV centers.

(I'm preparing this corresponding research paper with *Prof. Laura Kim* to tell the story as the *First Author*.)

Research Experiences

Quasi-BIC(Bound States in the Continuum) Quantum Metasurface Design and Characterization
Advisor: Prof. Laura Kim, MSE, UCLA *2023.04-*

- Aimed to utilize an all-dielectric metasurface to greatly confine electromagnetic energy in the diamond for illumination of the NV centers to enable a new form of microscopic ODMR sensing with infrared readout near the spin-projection-noise-limited sensitivity
- Proposed innovative grating structure designs to achieve Guided-Mode Resonances and Bound States in the Continuum, creatively blending materials to realize the desired physical phenomena with a strong foundation in physical intuition
- Independently formulated theories to explain the combination of Guided-Mode Resonances in the waveguide and various orders of diffracted light in the grating structure to create BICs. Additionally, develop MATLAB code for precise calculations of the derived equations
- Modeling the characteristic of the NV centers including the concentration, target linewidth, etc to calculate both the AC and DC sensitivity of the NV sensors
- Designing experimental characterization specifically using gas tuning at room temperature to ensure the metasurface resonance at the target wavelength

---

Fluorescence Emission Manipulation Based on Bound States in the Continuum:
Advisor: Prof. Yang Chen, School of Engineering Sciences, USTC *2023.02-*

- Aimed to employ a meta-atoms metasurface to boost the effective nonlinear susceptibility of a WS_2 monolayer
- Investigated Planar chiral metasurfaces to study their ultra high Q, band structure diagram and circular dichroism
- Explored the SHG(Second-harmonic generation) of WS_2 and engineered the quasi-BIC to the target wavelength aligning with the point where the intrinsic nonlinear susceptibility reaches a local maximum without resonance
- Investigating on the engineering of quasi-BIC to modulate other nonlinear optical response of a WS_2 Monolayer
- Enhanced the understanding of BIC formation in periodic structures, inspiring a more precise theory derivation for locating BIC in upcoming projects

Investigation on Advanced Scientific Machine Learning: Normalizing Flow Models
Advisor: Xu Wu, Department of Nuclear Engineering, NC State University *2023.01-2023.02*

- Aimed to expand the research background in Photonics and explore the possibility of merging artificial intelligence and science to develop innovative simulation technology
- Investigated papers on Normalizing Flow Models and understood the basic principles of machine learning
- Conducted demonstrations on Normalizing Flow Models including using this method to train machine to learn some simple joint distributed samplings models
- Engaged in a completely new research area, significantly enhancing coding and communication skills through collaborative group research.

Simulation and Design of High-performance Photodetectors Based on Plasmonic Resonances
Advisor: Liang Wang, Department of Physical Sciences, USTC *2022.07-2023.02*

- Aimed to explore the coupled enhancement of Localized Surface Plasmonic Resonances(LSPR) and Fabry-Perot cavity for further design of Photodetecters
- Investigated Localized Surface Plasmonic Resonances, with a specific focus on simulating nanorod arrays on Black Phosphorus structures
- Utilized the metal-on-dielectric model and other approaches to understand the picture of the Single Photon Avalanche Photodiodes and other high-performance photodetector

Awards

- Zhang Zongzhi Science and Technology Innovation Scholarship(4/310)
- Endeavor Student Scholarship(7/310)
- Shang-Guang Scholarship(Photonics Innovation Gifted Class Scholarship)
- Wang Dayan Scholarship(Photoelectric Information Innovation Gifted Class Scholarship)
- Excellent Teaching Assistant in USTC
- Grand Prize for Undergraduate Entrereneurship and Innovators
- USTC Fellowship(Outstanding Award for Overseas Academic Research)
- Chuang-Pu Scholarship and CGN Scholarship(USTC Distinguished Undergraduate College Scholarship)

Technical Strengths

- **Programming Languages:** C/C++, Python, MATLAB, LaTeX, Java,
- **Utility Software:** Ansys Lumerical, COMSOL, Mathematica

Teaching Experience

Teaching Assistant for Optics
Professor: Prof. Peijun Yao, Department of Physical Sciences, USTC *2023.03-2023.07*

Teaching Assistant for Atomic Physics
Professor: Prof. Peijun Yao, Department of Physical Sciences, USTC *2023.03-2023.07*

Positions of Responsibility

- **Volunteers in Social Activities**: Participated in several medical volunteer activities, charity club initiatives, and campus-level recruitment events.