Boqin (Justin) Zhao

Current Address: 402 E Peltason Dr, Irvine, CA 92617
Tel# upon request zhaoboqin58@tamu.edu

SUMMARY

Ph.D. candidate in the field of nanophotonics and plasmonics with 5+ years of hands-on experience in spectroscopic and opto-electrical characterization of plasmonic Au nano-devices uncovering new physical processes. Strong programming skills in instrument automation, data processing and physics modeling in combination with extensive experience with Lumerical FDTD simulation package for comprehensive device analyses. Knowledge and practical experience in E-beam lithography and evaporative deposition methods for photonic device fabrication.

EDUCATION

B.Sc. in Chemistry, Peking University, Beijing, China Sep. 2015 – Jun. 2019
Major GPA: 3.50/4.00

Ph. D. candidate in Physical Chemistry, Texas A&M University / UC Irvine Aug. 2019 – Jun. 2025 (expected)
Graduate GPA: 4.00/4.00

SKILLS

- **Experimental Techniques**: Confocal spectroscopy/microscopy, opto-electrical device characterization, glove box, evaporative deposition, E-beam lithography, ultrafast spectroscopy
- **Computational Modeling**: Finite Difference Time Domain (FDTD), COMSOL Multiphysics
- **Programming Skills**: Instrument automation, data processing, physics modeling in MATLAB, Python and C++

RESEARCH EXPERIENCE

Plasmonics | Department of Chemistry, Texas A&M University | Graduate Researcher
Advisors: Prof. Matthew Sheldon, Prof. Dong Hee Son Oct. 2019 – Present

Project 1. Investigation of the Plasmoelectric Power Conversion

- Proposed a new mechanism for optical energy to electricity conversion on all-metal plasmonic nanostructures which could eventually be converted into technologies producing all-metal solar cell devices.
- Designed Au nano-devices via **FDTD simulation** and fabricated the devices with **E-beam lithography and deposition**.
- Built an **opto-electronic device characterization setup** and **wrote instrument automation code (4000+ lines)** from scratch for automating experiment testing routines.
- Experimentally observed photo-voltage generation on photonically-engineered Au nanostructure devices, providing crucial evidence supporting the hypothesis.
- Served as the sole graduate student on this **Lockheed Martin-funded project** of $150K/yr, leading to two consecutive renewals of the contract.

Project 2. Active Tuning of Plasmon Damping via Light Induced Magnetism

- Demonstrated a new mechanism for the reversible modulation of plasmon damping by up to 30% in the plasmonic metal nanostructures via the Inverse Faraday Effect (IFE) under circularly polarized (CP) optical excitation.
- Conducted **confocal spectroscopic measurements** taking advantage of the recently developed Raman thermometry method and observed simultaneous 35% increase in temperature and 8% increase in reflectance on the nanostructure under CP excitation, the result of reduced plasmon damping.
- Produced effective magnetic field generation of up to 0.2 T during the IFE effect.
- Performed **FDTD simulations** and reproduced the main observations in the experiment.

Project 3. The Anisotropic Complex Dielectric Function of $CsPbBr_3$ Perovskite Nanorods

- Developed a **theoretical model in MATLAB** to compute, for the first time, the anisotropic complex dielectric function of perovskite quantum dots from experimental optical anisotropy measurements.

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SELECTED PUBLICATIONS

1. Cheng, O. H.-C.*; **Zhao, B.***; Brawley, Z.; Son, D. H.; Sheldon, M., Active Tuning of Plasmon Damping via Light Induced Magnetism. *Nano Lett.*, **2022**, 22(13), 5120-5126. (***co-first author**)

2. Rodríguez Ortiz, F. A.; **Zhao, B.**; Wen, J. R.; Yim, J. E.; Bauer, G.; Champ, A.; Sheldon, M. T., The Anisotropic Complex Dielectric Function of CsPbBr3 Perovskite Nanorods Obtained via an Iterative Matrix Inversion Method. *J. Phys. Chem. C*, **2023**, 127(30), 14812-14821.

3. Tremblay, M.-H.; Bacsa, J.; **Zhao, B.**; Pulvirenti, F.; Barlow, S.; Marder, S. R., Structures of (4-Y-C6H4CH2NH3)2PbI4 {Y = H, F, Cl, Br, I}: Tuning of Hybrid Organic Inorganic Perovskite Structures from Ruddlesden–Popper to Dion–Jacobson Limits. *Chem. Mater.* **2019,** *31* (16), 6145-6153.

4. Wu, S.; Cheng, O. H.-C.; **Zhao, B.**; Hogan, N.; Lee, A.; Son, D. H.; Sheldon, M., The connection between plasmon decay dynamics and the surface enhanced Raman spectroscopy background: Inelastic scattering from non-thermal and hot carriers. *J. Appl. Phys.* **2021,** *129* (17).

5. Lee, A.; Wu, S.; Yim, J. E.; **Zhao, B.**; Sheldon, M. T, Hot Electrons in a Steady State: Interband vs Intraband Excitation of Plasmonic Gold. *ACS Nano,* **2024**, 18, 19077–19085.

PUBLIC PRESENTATIONS

95th ACS Colloid and Surface Science Symposium (virtual) Jun. 2021
Title: Active Tuning of Plasmon Damping Through Light Ellipticity (poster presentation)

2021 ACS Southwest Regional Meeting, Austin, TX Nov. 2021
Title: Active Tuning of Plasmon Damping Through Light Ellipticity (poster presentation)

2022 GRC Nobel Metal Nanoparticles, South Hadley, MA Jun. 2022
Title: Active Tuning of Plasmon Damping via Light Induced Magnetism (poster presentation)

SPP 10, Houston, TX May 2023
Title: Investigation of the Plasmoelectric Power Conversion (poster presentation)

2024 Plasmonics and Nanophotonics GRC, Newry, ME Jul. 2024
Title: Investigation of the Plasmoelectric Power Conversion (poster presentation)

MENTORSHIP AND TEACHING

Teaching Assistant, Chemistry First Year Program Labs (CHEM 119 and 120) Aug. 2019 – Jul. 2021
Teaching Assistant, Quantitative Analysis (CHEM 316) Aug. 2021 – Dec. 2021
Teaching Assistant, Physical Chemistry Labs (CHEM 325) Jan. 2022 – Dec. 2022
Mentored 3 undergraduate students for research in the group 2022 - Present

LEADERSHIP & ACTIVITIES

Chemistry Open House Oct. 2022
- Organized an exhibition booth for scientific demonstrations

Research Group Facility Management 2022 - Present
- Designed and built various IT infrastructures in the research group, including the rack server, data storage and data backup.
- Manager of the confocal Raman microscope

AWARDS

- Honors Students, College of Chemistry and Molecular Engineering, Peking University 2018
- Departmental Travel Award, Department of Chemistry, Texas A&M University 2022
- Jack H. Lunsford ’57 Endowed Fellowship, Department of Chemistry, Texas A&M University 2024