# Yujia Sun

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## EDUCATION

**Zhejiang University** **Zhejiang, China**
*B.S. in Optoelectronic Information Science and Engineering* *Sept.2021-Jun.2025(expected)*

- **GPA** (overall): 3.88/4.0 **Rank**: 2% **TOEFL**: 100
- **Awards:** First Prize, 11th National College Student Optical Design Competition
  First Prize, 12th National College Student Optical Design Competition
- **Publication**: **Y. Sun**, Y. Lai, Y. M. Yang, Progress of Hole-Transport Layers in Mixed Sn-Pb Perovskite Solar Cells. *Small* 2024, 2406991. https://doi.org/10.1002/smll.202406991

**Boston University** **Boston, US**
*Visting researcher* *Jul.2023-Sept.2023*

**Virginia Tech** **Blacksburg, US**
*Research assistant* *Jul.2024-Now*

## RESEARCH EXPERIENCES

**Yang (Michael) Yang lab, Zhejiang University**

➢ **Topic:** ***Progress of hole-transport layers in Sn-Pb mixed perovskite solar cells***

*Undergraduate Research Assistant*, Advisor: Prof. Yang (Michael) Yang *Nov.2023-Now*

- Published a comprehensive review on progress of hole transport layers in Sn-Pb mixed perovskite solar cells, systematically examining the progress, challenges, and strategies for optimizing hole transport layers (HTLs) in Sn-Pb mixed perovskite solar cells to enhance their stability and efficiency.
- Engaged in experimental research focused on buried surface passivation techniques in inverted narrow bandgap perovskite solar cells, gaining proficiency in synthesizing high-quality perovskite materials and mastering essential optical characterization techniques.

**Lina Quan lab, Virginia Tech**

➢ ***Topic: Manganese doping for circular polarization control of dark excitons in chiral lead perovskite***

*Undergraduate Research Assistant*, Advisor: Dr. Lina Quan *Jul.2024-Now*

- Synthesized high-quality novel paramagnetic Ruddlesden-Popper chiral lead perovskites with manganese doping, including thin films and single crystals, with plans to investigate their magneto-optical properties to study the magnetically brightened excitonic luminescence resulting from interactions with isolated $Mn^{2+}$ ions.
- Applied transient absorption spectroscopy to explore spin-dependent exciton dynamics shortly after excitation, providing insights into a manganese-mediated spin-flip process.

**Jixin Cheng lab, Boston university**

➢ ***Topic: A highly efficient photoacoustic(PA) film for neuromodulation***

*Visiting Researcher*, Advisor: Prof. Jixin Cheng *Jul.2023-Sept.2023*

- Conducted research aimed at enhancing the efficiency of photoacoustic (PA) neuromodulation through the design and optimization of a novel three-layer structured CS-PDMS film.

- Developed and implemented a sophisticated computational modeling approach utilizing COMSOL simulation to optimize the design parameters, including the thickness of top and bottom PDMS layers, for maximal PA conversion efficiency.
- Fabricated and experimentally validate the proposed three-layer structured film, demonstrating a twofold increase in PA conversion efficiency compared to conventional two-layer structures.

**Daoxin Dai lab, Zhejiang University**

➢ ***Topic: Feedback Control of Microring-Based Photonic Devices for Monolithic Integration***

*Undergraduate Research Assistant*, Advisor: Prof. Huan Li *Apr.2023-Now*

- Leveraged a novel approach to planar co-integration of photonics and electronics by designing and integrating PID feedback control circuits into a new device structure compatible with standard silicon photonic foundry processes. Developed a two-stage FET-based inverting amplifier circuit for precise and stable locking of the micro-ring modulator's operating point.
- Evaluated the thermal, photonic, and electronic parameters of the microring modulator and its feedback control system. Simulated the system using COMSOL, Lumerical, and MATLAB, achieving picometer-level locking accuracy and sub-microsecond feedback response.
- Feedback circuits, including microrings, photodetectors, and MOSFETs, are in the MPW fabrication phase, with experimental validation pending.

## PUBLICATION AND ACADEMIC ACTIVITIES

➢ **Review Article**

**Y. Sun**, Y. Lai, Y. M. Yang, Progress of Hole-Transport Layers in Mixed Sn-Pb Perovskite Solar Cells. *Small* 2024, 2406991. https://doi.org/10.1002/smll.202406991

**Abstract:** Hybrid organic-inorganic lead halide perovskite solar cells (PSCs) have rapidly emerged as a promising photovoltaic technology, with record efficiencies surpassing 26%, approaching the theoretical Shockley-Queisser limit. The advent of all-perovskite tandem solar cells (APSCs), integrating Pb-based wide-bandgap (WBG) with mixed Sn-Pb narrow-bandgap (NBG) perovskites, presents a compelling pathway to surpass this limit. Despite recent innovations in hole transport layers (HTLs) that have significantly improved the efficiency and stability of lead-based PSCs, an effective HTL tailored for Sn-Pb NBG PSCs remains an unmet need. This review highlights the essential role of HTLs in enhancing the performance of Sn-Pb PSCs, focusing on their ability to mitigate non-radiative recombination and optimize the buried interface, thereby improving film quality. The distinct attributes of Sn-Pb perovskites, such as their lower energy levels and accelerated crystallization rates, necessitate HTLs with specialized properties. In this study, we systematically examine the latest advancements in HTLs for Sn-Pb PSCs, encompassing organic, self-assembled monolayer (SAM), inorganic materials, and HTL-free designs. The review critically assesses the inherent limitations of each HTL category, and finally proposes strategies to surmount these obstacles to reach higher device performance.

➢ **Oral Presentation**

***A Highly Efficient 3-Layer Photoacoustic (PA) Film for Neuromodulation***

**Conference:** 2024 International Conference on Acoustics, Vibration, and Noise (ICAVN 2024)

**Authors: Yujia Sun**, Yueming Li, Chen Yang, and Jixin Cheng

**Abstract:** Presented a novel approach to enhancing PA conversion efficiency using a three-layer structure consisting of a candle soot-PDMS absorber layer, a PDMS Ⅰ layer for improved thermal expansion, and a PDMS Ⅱ layer to maximize the superposition of ultrasound waves. COMSOL simulations were used to optimize the thickness of the layers, resulting in a PA conversion efficiency twice as high as that of a two-

layer structure. This advancement significantly benefits neuromodulation research by reducing heat accumulation in biological tissues while maintaining high precision and non-invasiveness.

## SKILLS AND OTHERS

- **Foundational Knowledge & Experimental Skills:**
  Proficient in designing wanted electric circuits with high performance; Extensive experience in nanomaterials and polymers, with a strong track record of innovation in optical system design; Proficient in a wide range of characterization techniques, including XRD, PL, UV-vis, and Transient Absorption Spectroscopy (TAS); Skilled in synthesizing high-quality thin films and single crystals, enabling precise material control and advanced device fabrication;
- **Analytical & Writing Skills:** Excellent problem-solving and critical thinking, with proven ability in technical writing and research documentation.
- **Communication & Collaboration:** Effective communicator with experience in presentations, reports, and collaborative projects.