



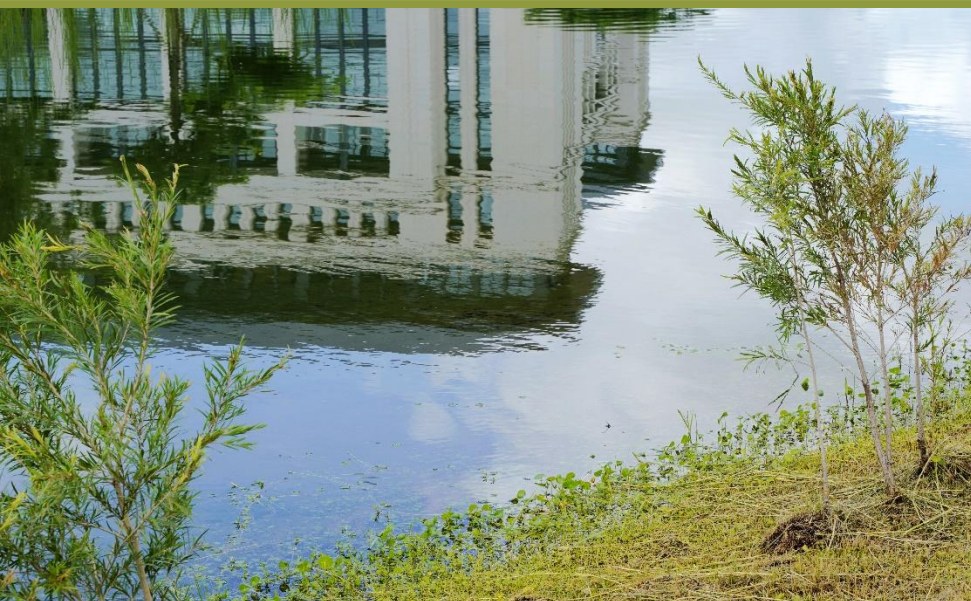
澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU



應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

IAPME Newsletter

<https://iapme.um.edu.mo/>



ISSUE 60

12 November 2025

◇ Content

1. Research Highlights

- a. Publications
- b. Research Stories

2. News and Events

- a. Seminars

3. Community News

4. Upcoming Events



澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU



應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

❖ Publications (IF $\geq$ 8, and Nature Index; *corresponding author)

1. **Guodan Wei**, **Rui Duan***, Yuan Wang, Tairan Yang, Tianhua Ren, Junzi Li, Yanyan Cui, Tesen Zhang, and **Handong Sun***. Electrically Tunable Flexible Circularly Polarized Laser with Ultrahigh Asymmetry Factor. *ACS Nano*, (2025). DOI: 10.1021/acsnano.5c13435. [2024 IF = 16.1]



Open Access

This article is licensed under [CC-BY 4.0](#)

www.acsnano.org

Electrically Tunable Flexible Circularly Polarized Laser with Ultrahigh Asymmetry Factor

Guodan Wei,[#] Rui Duan,^{*,#} Yuan Wang, Tairan Yang, Tianhua Ren, Junzi Li, Yanyan Cui, Tesen Zhang, and Handong Sun*



Cite This: *ACS Nano* 2025, 19, 37364–37372



Read Online

ARTICLE

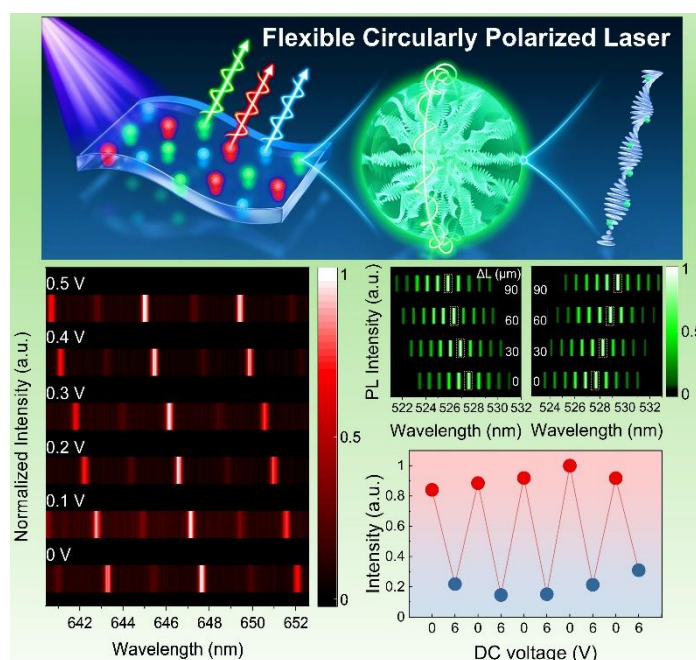
❖ Research Stories

UM research team developed multicolor, electrically tunable, flexible circularly polarized lasers with ultra-high asymmetry factors

- Circularly polarized (CP) laser emission delivers considerable promise for future photonic applications of chiral light sources and investigation of chiral light-matter interactions. However, the low asymmetry factor (g_{lum}) and lack of effective tuning have significantly hindered the development of such chiral light sources.
- The research team developed multicolor flexible CP lasers that are demonstrated based on dyedoped cholesteric liquid crystal (CLC) microdroplets embedded in a polydimethylsiloxane (PDMS) elastomer. The CLC microdroplets, characterized by their left- or right-handed helical superstructures, serve as chiral cavities, facilitating the realization of CP lasing. By integrating chiral coating, CP lasing with opposite handedness is further effectively separated, notably enhancing the circular polarization degree and enabling an ultrahigh asymmetry factor ($g_{lum}=1.72$).
- Importantly, these flexible CP lasers exhibit both electrically and mechanically tunable emission, demonstrating excellent wavelength tunability. In addition, the applied electric field allows dynamic control over the laser emission intensity, enabling fully reversible on/off switching. This work represents an important step forward to the development of high-performance chiral light sources with facile tunability and offers valuable insights for future chiroptical device design.



(from left): Mr. Guodan Wei (韋國丹)
Dr. Rui Duan (段瑞)
Prof. Handong Sun (孫漢東)



A schematic diagram of electrically tunable flexible circularly polarized lasers

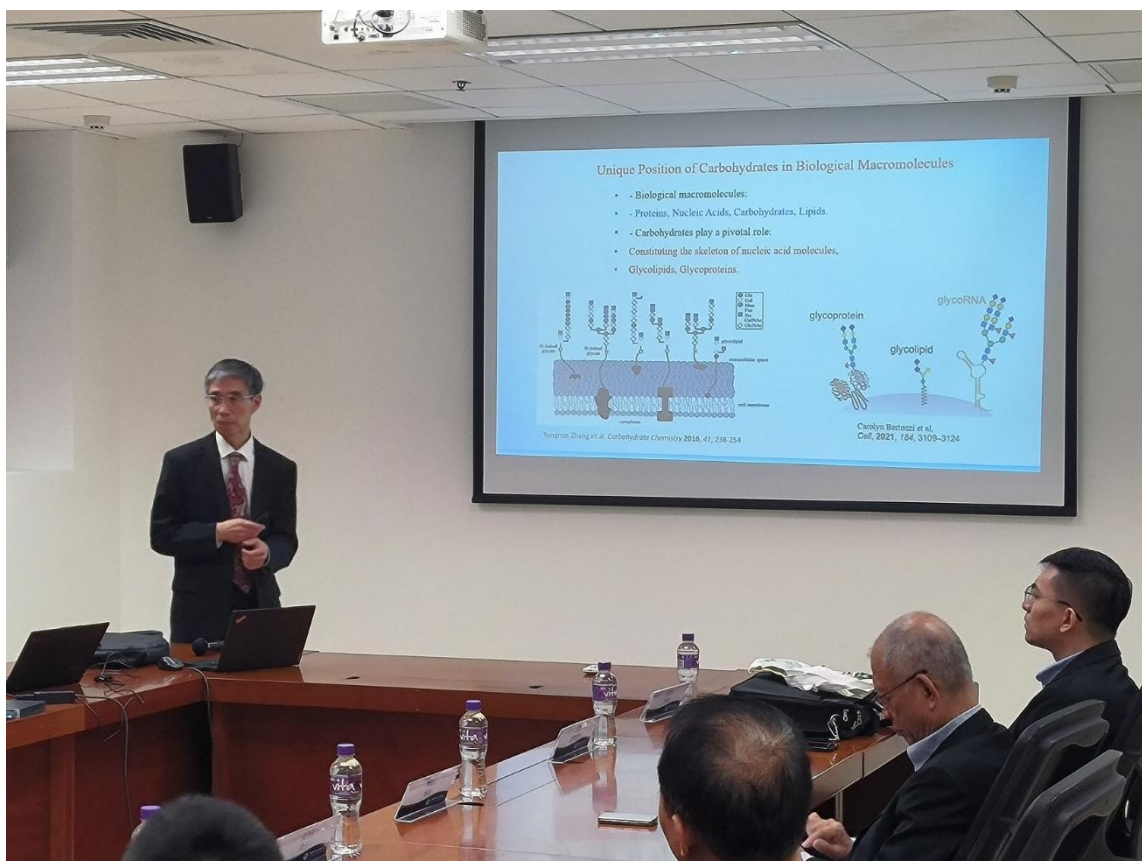
Guodan Wei, Rui Duan*, Yuan Wang, Tairan Yang, Tianhua Ren, Junzi Li, Yanyan Cui, Tesen Zhang, and **Handong Sun***. Electrically Tunable Flexible Circularly Polarized Laser with Ultrahigh Asymmetry Factor. *ACS Nano*, (2025). DOI: 10.1021/acsnano.5c13435. [2024 IF = 16.1]

Prof. Handong Sun and Dr. Rui Duan are the corresponding authors of this study. The first authors are Mr. Guodan Wei (Ph.D. student), Dr. Rui Duan (postdoctoral researcher) at IAPME. This work was supported by CPG2025-00034, SRG2023-00025, and the Science and Technology Development Fund (FDCT), Macao SAR (File no. 0002/2024/TFP). Rui Duan acknowledges the support from National Natural Science Foundation of China (62505201).

❖ Seminar

Invited by Prof. Songnan Qu, the Institute of Applied Physics and Materials Engineering (IAPME) hosted a distinguished lecture titled **“Sweet Science – A New Track for Innovative Drug Research and Development”**, delivered by Prof. Yongmin Zhang (張勇民). The event welcomed both IAPME members and external attendees, highlighting cutting-edge developments in pharmaceutical science.

Prof. Zhang, a globally recognized figure in drug research, currently serves as an Academician of the French National Academy of Pharmacy and a doctoral supervisor at Sorbonne University. He also holds prestigious appointments as a Chair Scholar under China’s “Changjiang Scholars Program” and as a Distinguished Professor at Zhejiang University of Traditional Chinese Medicine. With over 340 high-impact publications and an H-index of 50 (Scopus), Prof. Zhang’s contributions to the field are both prolific and influential.



In his lecture, Prof. Zhang explored the promising frontier of carbohydrate-based drug development. He presented recent findings on the role of carbohydrates in anti-tumor and antibacterial therapies, as well as in the design of novel tuberculosis vaccines. His research underscores the critical role of carbohydrate interactions in biological processes such as cell adhesion, immune recognition, inflammation, and cancer metastasis. “Cell-to-cell communication and pathogen invasion are often mediated by carbohydrate molecules or their interactions with proteins,” Prof. Zhang explained. “By targeting these mechanisms, we can intervene in key physiological and pathological pathways.”

The talk offered valuable insights into how oligosaccharides on cell surfaces influence disease progression and immune responses, reinforcing the potential of carbohydrate-focused strategies in next-generation drug development. Prof. Zhang’s visit and lecture mark a significant moment for IAPME’s ongoing commitment to fostering international collaboration and advancing biomedical innovation.



❖ IAPME Professor Participated in Executive Meeting for Shenzhen Advanced Light Source Facility

On October 22, 2025, Prof. Handong Sun represented the University of Macau (UM) at the second executive meeting of the Institute of Shenzhen Advanced Light Source Facility, serving as an executive committee member. The meeting focused on key agendas related to the institute's development, including regulatory frameworks, budget planning, committee recommendations, manpower allocation, and infrastructure construction. Committee members expressed satisfaction with the preparatory work for the construction of advanced free electron lasers and commended the institute's efforts during the initial stages. In addition to endorsing the proposed agendas, members provided constructive suggestions on facility construction, human resource planning, financial management, and future applications of the facility. The committee concluded by wishing success for the timely completion of the advanced light source project.

Established in 2020, the Institute of Shenzhen Advanced Light Source Facility aims to build a world-class research platform, with a particular focus on high-power free electron laser systems. Following five years of technology verification and preparatory work, the facility is now fully ready for construction. Once it enters the operational phase, it is expected to deliver significant capabilities for cutting-edge scientific research and industrial innovation.





澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU



應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

IAPME Newsletter

ISSUE 60

12 November 2025

❖ Upcoming Events



澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU



應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

IAPME Seminar

The physical origin of intrinsic low thermal conductivity in crystal



14 November 2025

Prof. Jiaqing HE

Southern University of Science and Technology

Venue: N23-4018

Time: 11:00 – 12:00

Hosted by: Prof. Haifeng LI

Abstract

The pursuit of materials with ultra-low, glass-like thermal conductivity (κ_l) is driven by critical applications in thermoelectrics and thermal barrier coatings. While strategies like alloying and defect engineering can suppress κ_l by disrupting structural order, a fundamental puzzle remains: the emergence of this phenomenon in highly symmetric single crystals, where long-range order is preserved. This report explores the underlying physical mechanisms that lead to ultra-low, glass-like thermal conductivity in high-symmetry single crystals, using materials like AgCrSe_2 , AgI , and BaTiS_3 as key examples. We identify that phonon flat bands are the fingerprints of strong four-phonon Fermi resonance scattering, which operates beyond the framework of the classical Boltzmann transport equation. Furthermore, we provide a comprehensive analysis of the interplay between non-degenerate electronic states, spontaneous symmetry breaking, and abnormal glass-like thermal conductivity behavior, all within the framework of orbital-lattice coupling theory.

Biography

Prof. Jiaqing HE is a Chair Professor in the Department of Physics at Southern University of Science and Technology and the Director of the Research Department. He is also a Fellow of the American Physical Society. He obtained his Bachelor's degree in Physics from Wuhan University in 1998 and his Ph.D. in Physics from a joint program between Wuhan University and the Jülich Research Centre in Germany in 2004. From 2004 to 2012, he worked at Brookhaven National Laboratory and Northwestern University in the United States. His primary research focuses on transmission electron microscopy, thermoelectric materials, and the correlation between structure and properties. He has published over 400 high-impact SCI journal papers, including eight in Science and three in Nature, with nearly 46,000 citations and an H-index of 100. He has applied for 52 domestic and international patents, of which 32 have been granted.

Enquiry: iampe.enquiry@um.edu.mo



澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU



應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

IAPME Newsletter

ISSUE 60

12 November 2025



澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU



應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

IAPME Seminar

Design and Optimization of Polymer-Based Electrolytes for Solid-State Batteries

17 November 2025



Prof. Liangliang LI
Lingnan University
Venue: N23-4018
Time: 16:30 - 17:30
Hosted by: Prof. Kwun Nam HUI

Abstract

Solid-state batteries (SSBs) are widely regarded as promising candidates for next-generation energy storage due to their high safety, high energy density, and wide operating temperature range. Solid electrolytes are key components in SSBs. Among them, polymer-based electrolytes, such as those based on polyvinylidene fluoride (PVDF), have recently attracted significant interest because of their flexibility, low cost, facile processing, and scalability. However, current polymer-based electrolytes suffer from low ionic conductivity, limited oxidative stability, and poor interfacial stability against lithium (Li) metal anodes. To address these challenges, we developed several strategies to enhance the electrochemical properties of PVDF-based polymer electrolytes. First, we tailored the structure of Li-solvent complexes to promote Li-ion transport facilitated by PVDF chains. Next, we optimized polymeric components and additives to simultaneously improve ionic conductivity and interfacial stability between the electrolyte and the anode. We then introduced a thermo-electrochemical treatment that stabilizes the PVDF-Li metal interface. Finally, we designed and fabricated a composite electrolyte comprising electrospun PVDF and an argyrodite sulfide, which delivered excellent electrochemical performance and enabled all-solid-state batteries with a cycle life exceeding 20,000 cycles. Collectively, these strategies significantly improved the overall performance of PVDF-based electrolytes, highlighting their strong potential for use in SSBs.

Biography

Prof. Liangliang LI is an Associate Professor in the School of Interdisciplinary Studies at Lingnan University. Before joining Lingnan, he spent two years in industry at Applied Materials Inc. (U.S.) and 15 years as a faculty member at Tsinghua University. He received a B.Eng. in Materials Science and Engineering from Tsinghua University and an M.S. in Electrical Engineering and a Ph.D. in Materials Science and Engineering from Stanford University. His research focuses on solid-state electrolytes and batteries. He has published in high-profile, peer-reviewed journals, including *Advanced Materials*, *Advanced Energy Materials*, and *Nano Energy*. He has authored over 100 academic papers and holds eight granted patents. Prof. Li received the Outstanding Young Engineer Award from the IEEE Electronics Packaging Society in 2015 and is a Senior Member of the IEEE.

Enquiry: iampe.enquiry@um.edu.mo

Contact Us



Email
iampe.enquiry@um.edu.mo



<https://iapme.um.edu.mo/>