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IAPME Seminar

Centrosymmetric metamaterials for discerning chiral light based on metasurface-assisted Valleytronics

20 March 2025

Prof. Weibo GAO
Nanyang Technological University

Venue: N23-4018
Time: 10:00 - 11:00
Hosted by: Prof. Shen LAI

Abstract

The full-range, high-sensitivity, and integratable detection of circularly polarized light (CPL) is critically important for quantum information processing, advanced imaging systems, and optical sensing technologies. However, the mainstream CPL detectors rely on chiral absorptive materials, and thus suffer from limited response wavelengths, low responsivity and poor discrimination ratio. Here, we present a chiral light detector by utilizing valley materials to observe the spin angular momentum (SAM) carried by chiral light. Delicately designed centrosymmetric metamaterials that can preserve the sign of optical SAM and highly enhance its intensity in the near field are harnessed as a medium to inject polarized electrons into valley materials, which are then detected by the Valley Hall effect. This enables high sensitivity infrared CPL detection at room temperature by valleytronic transistors, and the detection wavelength is extended to the infrared. This approach opens pathways for chiral light detection and provides insights into potential applications of valleytronics in optoelectronic sensing.

Biography

Prof. Weibo GAO, received his Bachelor in 2005 from University of Science and Technology of China, and PhD from the same university in 2010. From 2010 to 2014, he worked as a Postdoc and Marie Curie Fellowship in ETH, Zurich. He joined Nanyang Technological University (NTU) as an Assistant Professor in 2014. The same year, he has won National Research foundation fellowship award. From 2019, Prof. Gao serves as Tenured Professor and provost's Chair Professor in Physics in NTU. Since 2024, he serves as Endowed Professor in EEE&SPMS in NTU. His current research interest is quantum photonics and condensed matter physics based on solid state systems. He published on high impact publications including more than 50 Nature/Science series journals and Phys. Rev. Letters. He has won several awards for his creative work, including 2017 Singapore President's Young Scientist Award (YSA), 2023 NTU Nanyang Award (YSA).