NSYSU physics 書報討論

Weekly Seminar

From Topological Superconductors to Magnon Transport: Exploring Unconventional Spin-Charge Conversion



黃斯衍 Ssu-Yen Huang

Department Of Physics, National Taiwan University, Taiwan
URL: https://syhgroup.phys.ntu.edu.tw/

URL QR

14:10-15:00 Thu-1/Oct/2026, at 地址: PH2006

Abstract

Recent advances in quantum and topological materials have opened new opportunities for unconventional spin-charge interconversion beyond conventional spin Hall physics. In this work, we explore several emergent spin-current phenomena, including efficient charge-to-spin conversion in the topological superconductor β-Bi_2Pd [1], large heat-to-spin conversion via the spin Nernst effect in NiCu alloys [2], anisotropic spin transport in RuO_2 [3], and long-range magnon-mediated spin transport in ferromagnetic metals [4]. Our studies reveal that crystal symmetry, topology, spin-orbit coupling, and magnon dynamics can strongly enhance spin-current generation and manipulation. In particular, epitaxial β-Bi_2Pd exhibits robust room-temperature spin-orbit torque switching, while $Ni_{70}Cu_{30}$ shows an exceptionally large spin Nernst angle. Furthermore, our investigation of RuO_2 clarifies the dominant role of the spin Hall effect over altermagnetic spin-splitting transport, and the observation of magnon Hall magnetoresistance demonstrates unconventional magnon-mediated charge-spin conversion. These results establish versatile pathways toward efficient and unconventional spintronic functionalities for next-generation quantum and energy-efficient devices.

[1]Yu-Seng Ku et al., Phys. Rev. Applied 24, 034050 (2025)
[2]Wen-Yuan Liet et al., Phys. Rev. B., 111, 054421 (2025)
[3]Yu Chun Wang et al., Nano Letters, 26 2548 (2026)
[4]Shuan-Cheng Mai et al., Phys. Rev. Lett. 136, 116704 (2026)

Designed with help from www.freepik.com

Location 地址: PH2006