



Seminar

Spin pumping into atomic layer materials and anisotropic superconductors

Dr. Yuya Ominato

Kavli Institute for Theoretical Sciences at UCAS

Time: 10:00am, Jan. 6, 2023 (Friday)

时间: 2023年1月6日 (周五) 上午10:00

腾讯会议链接: <https://meeting.tencent.com/dm/2V7ffejFrU7g>

腾讯会议ID: 935-568-717

Abstract

Spin pumping (SP) is a phenomenon where excited spins due to the ferromagnetic resonance (FMR) are injected from the magnetic material to the nonmagnetic material via magnetic interaction at the interface. SP is a well-established technique to generate spin currents in various materials. As a back action to SP, the FMR signal is modulated. Since the FMR modulation reflects information about spin excitation in adjacent nonmagnetic materials, FMR can be used as a spin probe. The signal modulation is so sensitive that even the effect of an ultrathin film of only one atom can be detectable. In this talk, I will present our recent theoretical studies on spin pumping into atomic layer materials (transition metal dichalcogenides (TMDC) and graphene) and anisotropic superconductors (SC) (p-wave and d-wave SCs). In SP into TMDCs [1], we theoretically predict that transverse spin accumulation can be induced by longitudinal spin currents when the carrier density is appropriately tuned, and we call this phenomenon the spin current Hall effect. In SP into graphene [2], we show that one can obtain information on the energy spectrum of electrons in a magnetic field and the spin-resolved density of states from the FMR modulation. In SP into anisotropic SCs [3,4], we compare s-wave, p-wave, and d-wave SCs. We show that one can obtain information on the quasiparticle spectral function and the direction of the Cooper pair spins from the FMR modulation. Therefore, one can detect the superconducting symmetry by analyzing the FMR modulation.

[1] Y. Ominato, J. Fujimoto, and M. Matsuo, Phys. Rev. Lett. **124**, 166803 (2020)

[2] Y. Ominato and M. Matsuo, J. Phys. Soc. Jpn. **89**, 053704 (2020)

[3] Y. Ominato, A. Yamakage, T. Kato, and M. Matsuo, Phys. Rev. B **105**, 205406 (2022)

[4] Y. Ominato, A. Yamakage, and M. Matsuo, Phys. Rev. B **106**, L161406 (2022)

About the speaker

Dr. Yuya Ominato earned his PhD from Tohoku University under supervise of Prof. Mikito Koshino in 2016. He worked his postdoc studies in Institute for Material Research (IMR) at Tohoku University (2016-2019), and in Kavli Institute for Theoretical Science (KITS) at UCAS (2019-present). Yuya is interested in spin transport phenomena, Dirac-Weyl electron systems and topological semimetal/ superconductors. He was selected as Top twenty percent postdocs (UCAS January 2022) and 2022 KITS postdoc fellowship.