



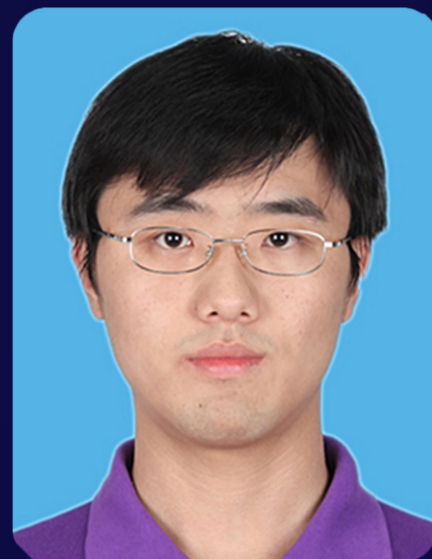
题目: Novel properties due to crystal symmetry in spin-splitting antiferromagnet and topological superconductor

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报告人简介

Prof. Junwei Liu obtained his PhD at Tsinghua University in 2014 and then did his postdoctoral research at MIT. He joined HKUST in 2017 as an assistant professor and was promoted to an associate professor in 2023.

He has a broad interest in condensed matter physics, quantum physics and materials science. His major contributions include (1) theoretical prediction of SnTe-type topological crystalline insulator, WTe₂-type and TaIrTe₄-type quantum spin Hall insulator; (2) discovery of world-first monolayer ferroelectricity in SnTe thin films; (3) proposal of self-learning Monte Carlo methods that can be thousands of times faster than conventional methods without loss of any accuracy; (4) design and realization of the world-first all-optical neural networks; and (5) proposal of crystal-symmetry-paired spin-valley locking and realization of world-first electrical readout and 180° switching of the Néel order in spin-splitting antiferromagnetic materials. He has published more than 60 papers including 2 in *Science*, 3 in *Nature*, 1 in *Nat. Phys.*, 3 in *Nat. Mater.*, 7 in *Nat. Commun.*, 3 in *Phys. Rev. Lett.*, 1 in *Optica*, etc.

报告摘要

I will talk about the novel properties due to crystal symmetry spin-splitting antiferromagnets (AFMs) [*Nat. Commun.* 12, 2846 (2021)] (named as altermagnet in 2022) and in topological superconductor [*Nature* 633, 71 (2024)].

In spin-splitting AFMs, we propose the crystal-symmetry-paired spin-valley/momentum locking (CSVL/CSML), which is enabled by a crystal symmetry and intrinsically exists in AFMs (e.g., V₂Se₂O, V₂Te₂O, MnTe and RuO₂) [*Nat. Commun.* 12, 2846 (2021)]. CSML enables

feasible controls of spin in AFMs by manipulating the corresponding crystal symmetry. Typically, one can use a strain field to induce net valley polarization/magnetization and use an electric field to generate a noncollinear spin current even without spin-orbit coupling. All the predictions have been confirmed in experiments [*arXiv:2407.19555*; *arXiv:2408.00320* (both accepted in Nature Physics)]. These properties have helped us realize the electric readout and 180° deterministic switching of the Néel order in our experimental work in Mn₅Si₃ [*Sci. Adv.* 10, eadn0479 (2024)] and CrSb [*Nature* 638, 645–650 (2025)].

In topological superconductors, magnetic mirror symmetry can protect multiple Majorana zero modes (MZMs) in a single vortex, which allows feasible controls of hybridization of MZMs simply using an external field. This has been realized in our recent collaborative experimental works with Prof Jin-Feng Jia's group [*Nature* 633, 71 (2024); *Quantum Frontiers* 3, 20 (2024)]. Similar properties can also be realized in superconducting CSVL/CSML materials.

