

CSU PHYSICS COLLOQUIUM

“Novel Magnetic Interfaces for New Paradigm of Memory and Logic ”

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120 Engineering (Hammond Auditorium)

Abstract

Significant progress has been made in conceptualizing geometric aspects of condensed matter [1]. Intertwining topology and low-dimensional magnetism, particularly at intrinsic/hybrid interfaces leveraging disparate quantum features, offers an exciting arena for exploiting novel magnetic phenomena towards disruptive energy efficient memory, logic and information technologies. Here in this talk, we introduce MBE grown magnetic transition metal chalcogenide Cr₂Te₃ as an emerging platform for exploring spin-orbit driven Berry phenomena [2]. A unique temperature and strain modulated sign reversal of the anomalous Hall effect has been uncovered, resulting from nontrivial Berry physics. The versatile interface tunability of Cr₂Te₃, hybridized with topological insulator, offers new routes for topological devices. Furthermore, we observe nonreciprocity in supercurrent transport and demonstrate strong field-free superconducting diode effect in magnetic insulator/superconductor bilayers [3]. These heterostructures enable new computing regime with intrinsically low energy cost, mitigating Joule heating with dissipationless supercurrent, leading to a cold computing scheme well suited for high-performance supercomputing and data centers. The discovery-rich magnetic surface and interface are key in further advancing quantum materials in the exciting fields of topological and superconducting spintronics.

Biography

Dr. Hang Chi obtained his B.S. in Physics from Peking University, China and Ph.D. in Physics from the University of Michigan, Ann Arbor, working on advanced thermoelectrics. He joined MIT in 2018 holding an Army Research Laboratory Fellowship and is currently a Research Scientist building magnetically proximitized quantum interfaces towards practical magnetic memory and logic devices with superior performance and efficiency as well as non-reciprocal superconducting devices and quantum information. He is interested in energy materials marrying topology and magnetism that leads to fascinating Berry physics in both real and momentum spaces, combining ab initio simulations; crystal growth, thin film deposition and nano-device fabrication; structural, magnetic, transport, advanced neutron, muon, STM characterizations of extraordinary surface and interfaces.

[1] "Progress and prospects in the quantum anomalous Hall effect", H. Chi and J. S. Moodera, APL Materials 10, 090903 (2022). <https://doi.org/10.1063/5.0100989>

[2] "Strain-tunable Berry curvature in quasi-two-dimensional chromium telluride", H. Chi, Y. Ou, T. B. Eldred, et al., arXiv:2207.02318 (2022). <https://doi.org/10.48550/arXiv.2207.02318>

[3] "Ubiquitous Superconducting Diode Effect in Superconductor Thin Films", Y. Hou, F. Nichele, H. Chi, et al., arXiv:2205.09276 (2022). <https://doi.org/10.48550/arXiv.2205.09276>