UNL Department of Physics and Astronomy presents:

Discovery of New Spin Current Phenomena in Quantum Materials

PRESENTED BY
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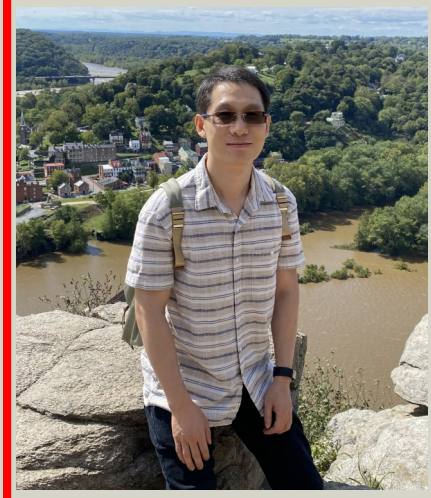

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ABSTRACT

Spin provides attractive means to manipulate and detect quantum materials. A pure spin current delivers spin angular momentum with the fewest carriers in metals and no carriers in insulators. Spin current phenomena have mostly been established in collinear ferromagnets (FMs) with a large magnetization **M**, and not in antiferromagnets (AFs) with **M** = 0. In this talk, I will describe the observation of new pure spin current phenomena in non-collinear AFs, that are absent in collinear FMs and AFs. We have observed vector spin Seebeck effect (SSE) in $LuFeO_3$ and $LaFeO_3$ [1-3], including the transverse SSE, which has always been absent in collinear FMs and AFs. Furthermore, the transverse SSE is the realization of the theoretically predicted spin swapping effect [4]. Non-collinear AFs also offer attractive features for low-field AF spintronics.
I will also discuss spin-triplet superconductors (SCs) and the prospects of spin supercurrent. Most SCs (e.g., Nb, cuprates) are spin-singlet, where the Cooper pairs have spin 0. Spin triplet SCs with spin 1 Cooper pairs are essential for Majorana fermions, quantum computing and also spin supercurrent. But triplet SCs are rare and require special methods for identification. I will describe some of these phase and spin-sensitive methods to identify triplet SC (*b*-Bi_2Pd) and the prospects for spin supercurrent.

Reference

[1] Jinsong Xu et al., *Phys. Rev. Lett.* **129**, 117202 (2022)
[2] Weiwei Lin et al., *Nat. Phys.* **18**, 800-805 (2022)
[3] Jinsong Xu et al., *APL Mater.* **11**, 091102 (2023)
[4] M. B. Lifshits, and M. I. Dyakonov, *Phys. Rev. Lett.* **103**, 186601 (2009).