JITCP Seminar

THE UNIVERSITY OF HONG KONG
HKU-UCAS JOINT INSTITUTE OF THEORETICAL AND COMPUTATIONAL PHYSICS
[Thursday afternoon, 4:00 pm, In Person]

Giant piezomagnetism and noncollinear spin current from C-paired spin valley locking

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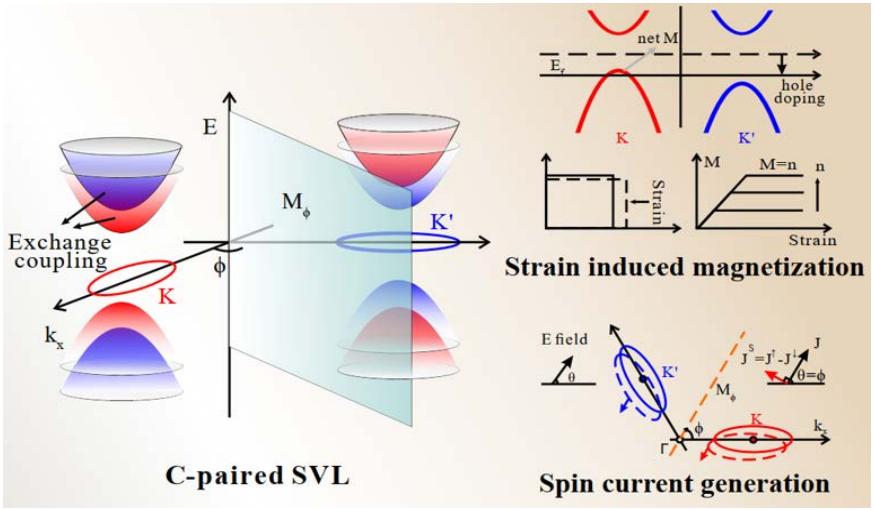

In this talk, I will take our recently proposed new type of spin-valley locking (SVL), named C-paired SVL, in antiferromagnetic systems. It directly connects the spin/valley space with the real space, and hence enables both static and dynamical controls of spin and valley to realize a multifunctional antiferromagnetic material. The new emergent quantum degree of freedom in the C-paired SVL is comprised of spin-polarized valleys related by a crystal symmetry instead of the time-reversal symmetry. Thus, both spin and valley can be accessed by simply breaking the corresponding crystal symmetry. Typically, one can use a strain field to induce a large net valley polarization/magnetization and use a charge current to generate a large noncollinear spin current. We predict the realization of the C-paired SVL in monolayer V2Se2O, which indeed exhibits giant piezomagnetism and can generate a large transverse spin current. Based on symmetry analysis and first-principles calculations, we also found C-paired SVL can exist in the following experimentally verified AFM materials, $NaOsO_3$, $LaMnO_3$, $LaCrO_3$, $TbFeO_3$, MnTe, RuO_2, MnF_2, FeF_2, CoF_2, and NiF_2. Our findings provide new opportunities to integrate various controls of spin and valley with nonvolatile information storage in a single material, which is highly desirable for versatile fundamental research and device applications.

References: Nature Communications 12, 2846 (2021)

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