The Alabama Collaborative for Materials Exploration (ACME)

Research Seminar Series

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Tuesday, February 1, 2022
10:00 AM CST
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Unconventional charge density wave in kagome superconductor AV_3Sb_5 (A=K, Cs, Rb)

The combination of nontrivial band topology and symmetry-breaking phases gives rise to novel quantum states and phenomena such as topological superconductivity, quantum anomalous Hall effect, and axion electrodynamics. The charge density wave (CDW), a translational symmetry breaking fluid, plays a crucial role in unconventional superconductors and intertwined electronic orders. While CDWs have been isolated from topological excitations, recently experimental evidence of a topological CDW with chiral flux phase has been observed in a new kagome metal AV_3Sb_5 (A=K, Rb, Cs) [1,2]. The formation of this CDW state breaks the time-reversal symmetry and is possibly responsible for the novel superconductivity with roton pair density wave [3] and electronic nematicity [4]. In this talk, I will present our experimental work on the CDW state in AV_3Sb_5 combining result from inelastic and elastic X-ray scattering and angle-resolved photoemission spectroscopy (ARPES) [5,6]. Our result demonstrates an unusual 3D-CDW consisting of two intertwined charge orders with the absence of acoustic phonon anomalies that firmly exclude electron-phonon coupling. This result points to an electronically driven CDW of chiral flux phase [2] that arise from the sublattice interference with the electronic filling close to the van Hove singularity.

1. *Nat. Mater.* **20,** 1353–1357 (2021)
2. *Phys. Rev. Lett.* **127**, 217601(2021)
3. *Nature* **599,** 222–228 (2021).
4. *Nature* **599,** 216–221 (2021).
5. *Phys. Rev. X* **11**, 031050 (2021).
6. arXiv:2109.03418 (2021)

Biography: Haoxiang Li, Ph.D., is currently a postdoctoral researcher at Oak Ridge National Laboratory. He received his Ph.D. degree from the University of Colorado Boulder. His research work focuses on probing quantum many-body states that emerge from charge, spin, and lattice interactions using various X-ray scattering techniques and angle-resolved photoemission spectroscopy. His current research interest focused on the intersection of strong correlation and non-trivial band topology, such as topological flat band state in frustrated lattice systems, spin-lattice interactions in quantum spin liquid materials and the intertwine orders in novel kagome lattice systems.

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