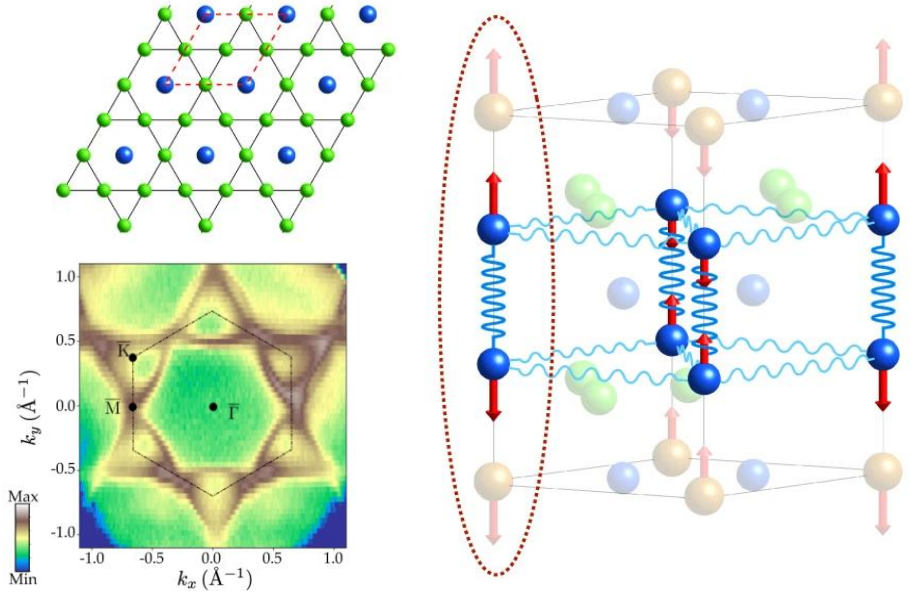
Studying Electronic Behavior and Lattice Dynamics in ScV_6Sn_6

21-ID ESM



Top left: Top view of the kagome net. Green and blue balls denote the V and trigonal Sn atoms, respectively. Red dashed lines mark the unit cell. Bottom left: Fermi surface map of ScV_6Sn_6. Right: Vibrations of the phonon mode between coupled trigonal Sn atoms.

A. Korshunov, H. Hu, D. Subires, Y. Jiang, D. Calugaru, X. Feng, A. Rajapitamahuni, C. Yi, S. Roychowdhury, M.G. Vergniory, J. Strempfer, C. Shekhar, E. Vescovo, D. Chernyshov, A.H. Said, A. Bosak, C. Felser, B.A. Bernevig, S. Blanco-Canosa, Nat Commun **14**, 6646 (2023)

Scientific Achievement

Scientists reveal and explain the softening of phonons (vibrations) in the atomic lattice of the Kagome metal ScV_6Sn_6.

Significance and Impact

The hexagonal lattices that characterize Kagome metals carry ordered electronic phases, such as charge density waves (CDWs), that give them potential as quantum materials, but researchers must first study the complex interplay between these phases, phonons, and the lattice geometry.

Research Details

- Researchers used several experimental and theoretical methods, including ARPES at the ESM beamline at NSLS-II, to show and understand phonon "softening" (a decrease in phonon frequency/energy) of a plane in the lattice "kagome net."
- Results reveal that the low-energy longitudinal phonon mode collapses just as the CDW sets in.
- The softening is characterized by out-of-plane vibrations of the trigonal Sc atoms and competes with long-range CDW order found in the material.

This work was performed in part at NSLS-II

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ESRF The European Synchrotron

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