Phonon anomalies and pressure temperature phase diagram of CsV_3Sb_5

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Abstract

The recent discovery layered Kagome superconductors AV_3Sb_5 (A=K, Cs, Rb) has sparked considerable excitement. These materials are characterized by an electronic structure featuring flat bands, van Hove singularities (vHs), Dirac cones, and non-trivial band topology, and offer a unique platform for exploring novel electronic states of matter with intertwined orders. At temperatures well above their superconducting T_c (2.7K in CsV_3Sb_5), an electronic superlattice commonly associated with a CDW. To date, no Kohn-anomalies associated with the formation of this CDW have been observed in their phonon dispersion, whereas chirality, time-reversal symmetry breaking or electronic nematicity have been reported, indicating that the underlying electronic order might be substantially more complex. High pressure studies have revealed a double superconducting dome structure associated with the changes in the nature and disappearance of the CDW inferred from indirect measurements.

I will present a detailed high pressure x-ray diffraction study of these materials showing in detail how the lattice superstructures evolve across the phase diagram. Previously unreported anomalies in the lattice dynamics across the CDW formation will also be presented. These results bring novel insights on the nature and origin of the CDW, challenging in particular scenario in which it arises from a Peierls-like nesting of occupied van Hove Singularities.

References

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