Abstract title:

Purely experimental determination of electron-phonon coupling strength in FeSe superconductors

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Abstract:

Electron-phonon coupling (EPC) is the key driving force for various symmetry-breaking ground states such as conventional superconductivity and charge-density waves. Measuring the EPC strength is crucial to understanding these exotic phenomena in strongly correlated materials. While dispersion kinks in angle-resolved photoemission and discontinuities in tunneling spectra can be used to determine the coupling strength, these methods are often based on assumptions of bare-band dispersions or indirect numerical techniques. By combining time-resolved photoemission and time-resolved X-ray diffraction, we demonstrate a novel way to extract the Se A_{1g} mode coupling strength in FeSe thin films. Time-resolved photoemission tracks the amplitude of the band energy oscillation; time-resolved X-ray diffraction determines the corresponding lattice movement. The two measurements together yield a coupling strength of 0.5 ± 0.2, which is solely based on measured quantities. Our study not only reveals the important role of EPC in FeSe superconductors, but also provides a new route to measure EPC strengths in a broad range of quantum materials.