恭賀本中心朱明文研究員實驗室 量子材料研究刊登於 Nature Communications

Abstract:

Charge density waves (CDWs) are pervasive orders in solids that usually enhance the effective mass (m*) and reduce the Fermi velocity (vF) of carriers. Here, we report on the inverse — a reduced m* and an enhanced vF correlated with the growth of the CDW order in CuTe with gapped, practically linearly dispersing bands — reminiscent of emergent CDW-gapped topological semimetals. Using momentum-dependent electron energy-loss spectroscopy (q-EELS), we simultaneously capture m* and vF of the CDW-related, practically linearly dispersing electrons by plasmon dispersions across the transition (335 K, TCDW), with m* of 0.28 m0 (m0, the electron rest mass) and vF of ~ 0.005c (c, the speed of light) at 300 K. With the growth of the CDW order-parameter strength toward 100 K, the electrons become lighter and move faster by ~ 20%. Thorough inspection below TCDW unveils the essential role of the increasing opening of the CDW gap. CuTe is a rich platform for the exploration of CDW/correlation physics with q-EELS established as a useful probe for this type of physics.