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Temperature-driven Topological Phase Transition in $MoTe_2$

AYELET NOTIS BERGER, ERICK ANDRADE, ALEX KERELSKY, Columbia University, SANG-WOOK CHEONG, Rutgers University, JIAN LI, B. ANDREI BERNEVIG, Princeton University, ABHAY PASUPATHY, Columbia University

— The discovery of several candidates predicted to be weyl semimetals has made it possible to experimentally study weyl fermions and their exotic properties. One example is $MoTe_2$, a transition metal dichalcogenide. At temperatures below 240 K it is predicted to be a type II Weyl semimetal with four Weyl points close to the fermi level. As with most weyl semimetals, the complicated band structure causes difficulty in distinguishing features related to bulk states and those related to topological fermi arc surface states characteristic of weyl semimetals. $MoTe_2$ is unique because of its temperature-driven phase change. At high temperatures, $MoTe_2$ is monoclinic, with trivial surface states. When cooled below 240K, it undergoes a first order phase transition to become an orthorhombic weyl semimetal with topologically protected fermi arc surface states. We present STM and STS measurements on $MoTe_2$ crystals in both states. In the orthorhombic phase, we observe scattering that is consistent with the presence of the Fermi-arc surface states. Upon warming into the monoclinic phase, these features disappear in the observed interference patterns, providing direct evidence of the topological nature of the fermi arcs in the Weyl phase

Ayelet Notis Berger
Columbia University

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