Anomalous Conductivity Tensor and Quantum Oscillations in the Dirac Semimetal Na$_3$Bi

JUN XIONG, SATYA KUSHWAHA, JASON KRIZAN, TIAN LIANG, ROBERT J. CAVA, NAI PHUAN ONG, Princeton University — Na$_3$Bi is a 3D Dirac semimetal with protected nodes. Angle-resolved photoemission experiments have observed these massless Dirac fermions in the bulk band, but transport experiments have been hampered by the extreme air sensitivity of Na$_3$Bi crystals. Transport experiments can potentially address interesting issues such as charge pumping between the separated Weyl nodes when the time-reversal symmetry is broken by a strong magnetic field. Here we report a transport measurement that reveals robust anomalies in both the conductivity and resistivity tensors. The resistivity $\rho_{xx}$ is B-linear up to 35 T, while the Hall angle exhibits an unusual profile approaching a step-function. In addition, we have also observed a prominent beating pattern in the Shubnikov de Haas (SdH) oscillations indicating the existence of two nearly equal SdH frequencies when the Fermi energy falls inside the non-trivial gap-inverted regime.

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Jun Xiong
Princeton University

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