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Evidence for an impurity band in the anomalous low carrier density superconductor $Pb_{1-x}Tl_xTe$ PHILIP WALMSLEY, Stanford University, PAULA GIRALDO-GALLO, National High Magnetic Field Laboratory, BORIS SANGIORGIO, ETH Zurich, DEANNA ABRAMS, Stanford University, MICHAEL FECHNER, ETH Zurich, LISA BUCHAUER, BENOIT FAUQUE, ESPCI, Paris, SCOTT RIGGS, National High Magnetic Field Laboratory, ROSS MCDONALD, Los Alamos National Laboratory, THEODORE GEBALLE, Stanford University, NICOLA SPALDIN, ETH Zurich, KAMRAN BEHNIA, ESPCI, Paris, IAN FISHER, Stanford University — The narrow-band-gap semiconductor PbTe superconducts with a Tc an order of magnitude greater than comparable low-density metals, but only when it is doped with the specific element thallium. Here we present a comprehensive study of the evolution of the Fermi surface of hole doped PbTe as derived from Shubnikov de Haas quantum oscillations, combined with measurements of the evolution of the electrical transport and specific heat. We compare cases for dopants that cause superconductivity (thallium) and those that dont (sodium), and identify the presence of a Tl-impurity band as the key feature associated with the presence of superconductivity. These results give the clearest description of the fermiology of PbTe to date, relevant for understanding both to its superconducting ground state and its high thermoelectric figure of merit.

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