

MAR17-2017-020830

Abstract for an Invited Paper  
for the MAR17 Meeting of  
the American Physical Society

**Unconventional Fermi surface associated with novel quasiparticles in the Kondo insulator SmB<sub>6</sub>**

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The search for a Fermi surface in the absence of a Fermi liquid has endured for decades. We present evidence for the realisation of such a state in the Kondo Insulator SmB<sub>6</sub>, which is an extreme example of Fermi liquid breakdown. Experimental results are presented from complementary techniques including quantum oscillations, specific heat capacity, thermal conductivity, and oscillatory entropy down to low temperatures. An experimental comparison is made with alternative theoretical models that associate novel quasiparticles with the unconventional Fermi surface we uncover in SmB<sub>6</sub>. A new paradigm for the realisation of a Fermi surface in the absence of conventional quasiparticles is proposed in the vicinity of a Kondo insulator transition.

\*This work was performed in collaboration with M. Hartstein, W. H. Toews, Y.-T. Hsu, B. Zeng, X. Chen, M. Ciomaga Hatnean, Q. R. Zhang, S. Nakamura, A. S. Padgett, G. Rodway-Gant, J. Berk, M. K. Kingston, G. H. Zhang, M. K. Chan, S. Yamashita, T. Sakakibara, Y. Takano, J. -H. Park, L. Balicas, N. Harrison, N. Shitsevalova, G. Balakrishnan, G. G. Lonzarich, R. W. Hill, and M. Sutherland