Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Ultrafast terahertz spectroscopy study of Kondo insulating thin film SmB_6: evidence for an emergent surface state[1] JINGDI ZHANG, Univ of California - San Diego, JIE YONG, ICHIRO TAKEUCHI, RICHARD GREENE, University of Maryland, College Park, RICHARD AVERITT, Univ of California - San Diego — We utilize terahertz time domain spectroscopy to investigate thin films of the heavy fermion compound SmB_6, a prototype Kondo insulator. Temperature dependent terahertz (THz) conductivity measurements reveal a rapid decrease in the Drude weight and carrier scattering rate at ˜T*=20 K, well below the hybridization gap onset temperature (100 K). Moreover, a low-temperature conductivity plateau (below 20K) indicates the emergence of a surface state with an effective electron mass of $0.1m_e$. Conductivity dynamics following optical excitation are also measured and interpreted using Rothwarf-Taylor (R-T) phenomenology, yielding a hybridization gap energy of 17 meV. However, R-T modeling of the conductivity dynamics reveals a deviation from the expected thermally excited quasiparticle density at temperatures below 20K, indicative of another channel opening up in the low energy electrodynamics. Taken together, these results suggest the onset of a surface state well below the crossover temperature (100K) after long-range coherence of the f-electron Kondo lattice is established.

[1]JZ and RDA acknowledge support from DOE - Basic Energy Sciences under Grant No. DE-FG02-09ER46643, under which the THz measurements and data analysis were performed. JY, IT and RLG acknowledge support from ONR N00014-13-1-0635 and NSF DMR 1410665.

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Date submitted: 01 Dec 2015 Electronic form version 1.4