Heavy Fermion and non-Fermi Liquid Properties vs Size: From the Micro to the Nano

G.R. STEWART, J.S. KIM, Physics/University of Florida, K. SAMWER, Physikalisches Institut, Universitaet Goettingen — Y. Y. Chen et al. have studied nanoparticles of several systems, including CePt$_2$ [1]. We report here the specific heat, C, down to 0.05 K and $\chi$ to 2 K as a function of size for several Ce- and U-heavy Fermion and non-Fermi liquid (nFl) systems, including UBe$_{13}$ and Rh-doped CeRu$_2$Si$_2$. Using dry sieves (for larger particles) and aqueous suspension/filtration techniques using Isopore$^TM$ filters (for smaller particles), size gradations from 45-53 $\mu$m (essentially bulk) down to 0.6-1.2 $\mu$m were studied. One goal was to study the evolution of nFl behavior vs decreasing size at a Quantum Critical Point, where the spatial extent of the fluctuations should become infinite, or at least larger than the particle at some size. Ce-systems showed the beginning of Kondo peak behavior in C below 3 $\mu$m, however it was still possible to determine the evolution of the intrinsic low temperature nFl $C/T \sim \log T$ in Rh-doped CeRu$_2$Si$_2$ as a function of decreasing size to address this goal. The effect of size on superconductivity and $m^*$ in UBe$_{13}$ will also be discussed.


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