MAR05-2004-001723

Abstract for an Invited Paper
for the MAR05 Meeting of
the American Physical Society

Evolution of superconducting order in $\mathbf{Pr(Os_{1-x}Ru_x)_4Sb_{12}}$

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The filled skutterudite $PrOs_4Sb_{12}$ is paradoxical, exhibiting heavy-fermion behavior and unconventional superconductivity absent an ion with a magnetic ground state. Related compounds, $PrRu_4Sb_{12}$, $LaOs_4Sb_{12}$, and $LaRu_4Sb_{12}$ (the last two reported at this conference) are conventional BCS superconductors. To explore the change from unconventional ^{3}He like order to fully-gapped conventional order we have measured, with high precision, the penetration depth of the series $Pr(Os_{1-x}Ru_x)_4Sb_{12}$ to low temperatures. We find a persistence of the T^2 temperature dependence, found for $x = 0$, below a temperature we label $T_{c3}(x)$. The cross over temperature $T_{c3}(x)$ decreases linearly from 0.6 K at $x = 0$, appearing to vanish near $x = 0.26$. The data above $T_{c3}(x)$, and over the entire range for $x \geq 0.3$, are well represented by weak-coupling ($0.1 \leq x \leq 0.6$) or intermediate-coupling ($x \geq 0.8$) BCS expressions. The results are discussed in terms of proposed mechanisms for unconventional behavior based on the proximity of a triplet excited state to the ground state singlet of the Pr ion.

Work performed with Elbert E. M. Chia, D. Vandervelde, K. Kikuchi, H. Sugawara and H. Sato and supported by the Department of Energy through the Illinois Materials Research Laboratory