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The superconducting pairing states in $CeCu_2Si_2$ H. Q. YUAN, M. B. SALAMON, University of Illinois at Urbana and Champaign, H. S. JEEVAN, C. GEIBEL, F. STEGLICH, Max-Planck-Institute for Chemical Physics of Solids — The prototype heavy fermion superconductor $CeCu_2Si_2$ exhibits very rich physical properties. It has been shown that two distinct superconducting states, one around an AFM QCP at low pressures and the other one around a weak first-order valence transition at high pressures, uniquely exist in the pressurized $CeCu_2(Si/Ge)_2$ [1]. In this talk, I will first briefly review the recent progress on the study of these two superconducting phases. Then I will focus on the superconducting pairing state of $CeCu_2Si_2$ at $p = 0$. Early measurements, e.g., specific heat and μ SR, revealed quite controversial behavior due to the limitations of experimental techniques and sample quality. In order to elucidate the nature of superconductivity in $CeCu_2Si_2$ and to investigate the interplay of AFM and superconductivity, we performed precise measurements of the magnetic penetration depth $\Delta\lambda(T)$ in high quality single crystals down to $T = 80$ mK. A linear temperature dependence of $\lambda(T)$ is observed in both A/S-type and S-type $CeCu_2Si_2$ below $T = 150$ mK, providing uncontroversial evidence for the existence of line nodes in the superconducting energy gap. [1] H. Q. Yuan et al., Science 302, 2104 (2003); Phys. Rev. Lett. 96, 047008 (2006).

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