Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

The 2d Kondo effect in p-type Quantum Wells in GaAs

THEODORE CASTNER, University of Rochester — Two groups [Huang et al. [1] and Hamilton et al. [2]] have observed minima in the resistivity ρ(T) at very low T well below ρ_{max} at T_{max} in metallic samples (p>p_c). Minima in [1] were found at 32 mK for p$\sim$ 2.1 p_c, 25 mK for p$\sim$ 1.76 p_c, while no minimum was observed down to 0.5 mK for p$\sim$ 1.24 p_c. Both groups have interpreted their results in terms of a crossover to insulating (nonmetallic) behavior for $T < T_m$ where $d\rho/dT < 0$. An alternative explanation arises from a 2d Kondo effect. Using the Hamann function [3] for the magnetic scattering contribution from localized magnetic moments and a term $\rho(0)CT/T_F$ from screening (interactions) one obtains an expression for T_m(p) which is very close to the Kondo temperature T_K(p) given by (E_F/k)x exp(-1/N($E_F$absJ). The very strong p-dependence of T_m(p) and T_K(p) is dominated by N(E_F) which is shown to approach zero as p approaches p_c because of the pseudogap in the DOS. Good agreement is obtained T_m(p) for both [1] and [2]. The data in [1] supports metallic behavior down to 0.5 mK. The implications for a true 2d MIT as a QPT are discussed. 1) J. Huang et al. Phys.Rev.Lett.98, 226801 (2007); 2) A. R. Hamilton et al. Phys.Rev.Lett.82, 1542 (1999); D. R. Hamann, Phys.Rev.158, 570 (1967).

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Date submitted: 21 Nov 2008 Electronic form version 1.4