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The Kubo-Greenwood expression and 2d MIT transport

THEODORE CASTNER, Univ. of Rochester — The 2d MIT in GaAs heterostructures (p- and n-type)features a mobility that drops continuously as the reduced density x= n/n_c-1 is decreased. The Kubo-Greenwood result [1] predicts μ = ($e\epsilon_h/hn_c$)α^2(x) where α is a normalized DOS. α(x)is obtained from the data [p-type, Gao et al. [2]; n-type Lilly et al. [3]]. Interact -ion corrections yield a Fermi energy E_F=E_c[x-A_{HF} $x^{1/2}/\gamma$+$A_{CT,ic}x^{1/4}/\gamma^{3/2}$] where E_c = n_c/a_2 with a_2 the non-interacting DOS and $\gamma = (2\pi n_c)^{1/2}a^*$, A_{HF} is a Hartree -Fock term, while $A_{CT,ic}$ is a repulsive interaction term between the charged traps (CT) and the itinerant carriers (ic) that are confined in conducting filaments. N(E_F,x)is determined using N(E)dE=2kdk/2π where k_F=($2\pi n_c$ x)$^{1/2}$. The data determines the "self-energy" terms A_{HF} and $A_{CT,ic}$. The effective mass m*(x) is given by m*(x)/m_b* = 1/α(x) and diverges as $x^{-3/4}$ as x goes to zero at T=0. α(x) goes to 1 for large x. The interaction approach will be compared with the percolation approach. [1] Mott and Davis, Elect. Prop. in Noncryst. Mat. [Clarendon Press 1971]; [2) Gao et al. PRL93,256402 (2004);[3] Lilly et al.PRL90,056806 (2003)

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