TRANSPORT AND MAGNETORESISTANCE IN LOW CARRIER DENSITY FERROMAGNETS

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In metallic magnets, scattering from magnetic fluctuations above and near T_c may provide a substantial contribution to the electrical resistance $\rho(T)$. However, this effect is usually small because the dominant fluctuations ar near $q \approx 0$, which does not produce substantial backscattering across the Fermi surface unless $2k_F$ is itself small; such a situation can be realised in metallically-doped ferromagnetic semiconductors, examples being the Mn pyrochlores, $EuSe$ and $CdCr_2Se_4$. A simple adaptation of old theory (deGennes and Friedel, Fisher and Langer) shows the low field magnetoresistance scales with the ratio of field induced magnetisation $m(H)$ to the saturation magnetisation m_{sat}: $\Delta\rho/\rho \approx C(m/m_{sat})^2$, where $C \approx x^{-2/3}$, with x the number of charge carriers per magnetic unit cell. Comparison to data on very different ferromagnetic metals and doped semiconductors is in broad quantitative agreement with this trend, with the prime exception of the perovskite manganese oxides, already understood to involve the extra physics of dynamic lattice distortions. At very low doping, the physics should involve ferromagnetic polarons, and polaron formation and transport will be discussed.

9.7 cm

13.4 cm

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