

Xiaoguang Zhang
Professor of Physics
Department of Physics and the Quantum Theory Project
University of Florida Gainesville, FL 32611
(352)-392-6971 (Office)
(352)-392-8722 (Fax)
xgz@qtp.ufl.edu

Theory of Classical Magnetoresistance in AU Thin Films

Classical magnetoresistance (MR) in nonmagnetic metals are conventionally understood in terms of the Kohler rule, which specifies a scaling relationship between MR and the resistivity, with violation usually viewed as anomalous electron transport, in particular as evidence of non-Fermi liquid behavior. Band calculation of MR for Au thin films however yields results opposite in sign to experimental data, and cannot account for the observed dependence on temperature and film thickness. Experimental data also shows clear violation of the Kohler rule. Using a model of random resistor network, we show that this result can be explained if the MR arises entirely from inhomogeneity due to grain boundary scattering and thermal activation of grain boundary atoms. Consequently the Kohler rule should not be used to distinguish normal and anomalous electron transport in solids.