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Evidence for a disorder-dependent localization correction to the anomalous Hall conductance of ultrathin Fe films RAJIV MISRA, ARTHUR F. HEBARD, Department of Physics, University of Florida, FL 32611 — We present an experimental study of quantum corrections to the conductivity tensor of thin ferromagnetic films when the disorder is systematically varied. Using the sheet resistance as a measure of disorder, *in situ* magnetotransport studies were performed on a series of thin iron films deposited onto sapphire substrates having sheet resistance $R_0 \equiv R_{xx}(5\mathrm{K})$ varying over the range 140 Ω (60Å) to 6250 Ω (<20 Å). For temperatures $T < 20$ K, a logarithmic temperature dependence of the longitudinal R_{xx} and anomalous Hall resistances R_{xy}^{AH} is observed. In the low disorder limit ($\mathrm{R_0} < 150$ Ω), we find that relative changes in the anomalous Hall conductivity $\delta\sigma_{xy}^{AH}/\sigma_{xy}^{AH}$exhibit a temperature independent behavior implying that there are no quantum corrections to σ_{xy}^{AH}. As disorder increases, a finite logarithmic temperature dependence to $\delta\sigma_{xy}^{AH}/\sigma_{xy}^{AH}$ appears and then evolves toward a universal weak localization correction defined by the equality $\delta\sigma_{xy}^{AH}/\sigma_{xy}^{AH} = -\delta R_{xy}^{AH}/R_{xy}^{AH}$ [1]. Thus with increasing disorder, we see a crossover from a region where there are no quantum corrections to σ_{xy}^{AH} to a region dominated by weak localization corrections. These results for iron, where spin is carried by itinerant electrons, will be compared with data on thin films of gadolinium, a localized moment system. [1]. Mitra P. et al. *cond-mat 0606215* (2006)

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