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Power-law temperature dependence of the conductivity of disorder-tuned magnetic thin films[1] S. GHOSH, University Florida, R. MISRA, Penn State, A.F. HEBARD, University of Florida — Using a specialized high vacuum deposition/characterization chamber, we study the *in situ* temperature-dependent conductivity $\sigma(T,R_0)$ of thin magnetic films (Fe, Gd and Cr) prepared at different stages of disorder where disorder is characterized by the sheet resistance R_0 measured at $T = 5$ K. Our observation of power-law dependences of the form, $\sigma(\mathrm{T,R_0}) = \mathrm{A} + \mathrm{BT}^P$, has also been noted in numerous experiments on other materials including indium oxide, 2D Si inversion layers and amorphous NiSi alloys. For our samples, the fitting parameters A, B and P vary systematically with increasing disorder. We discuss two regimes of behavior: In the first weak disorder regime, the power-law dependence represents a quantum correction to the classical Boltzmann conductivity due to spin-wave scattering. This contribution can appear either alone (Cr) or simultaneously (Gd) with the well-known logarithmic corrections due to weak localization. In the second regime with greater disorder, we utilize T-dependent reduced activation energy plots of $\sigma(T)$ for sets of films spanning a large range of disorder strengths to show that there are narrow regions of disorder strength where pure power-law behavior ($\mathrm{A} = 0$) dominates.

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