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Observation of spin-wave mediated Altshuler-Aronov and weak localization corrections to the conductivity in thin films of gadolinium RAJIV MISRA, ARTHUR F. HEBARD, KHANDKER MUTTALIB, University of Florida, Gainesville, FL, USA, PETER WOELFLE, ITKM, Universität Karlsruhe, Germany — We present a study of quantum corrections to the conductivity tensor of thin ferromagnetic gadolinium films. Using the sheet resistance as a measure of disorder, *in situ* magnetotransport studies were performed on a series of gadolinium films deposited onto sapphire substrates having sheet resistance $R_0 \equiv R_{xx}$ (5K) varying over the range 428 Ω (∼135Å) to 4011 Ω (∼35 Å). For temperatures $T < 30$ K and $R_0 < 4011$ Ω, we observe the simultaneous presence of two types of quantum correction to the Drude conductivity, $\sigma = \sigma_{Drude} + \Delta\sigma_{SpinWaveMediated} + \Delta\sigma_{WL}$. The characteristic feature of the first correction is an approximately linear increase with temperature of conductivity, and we attribute this as a spin-wave mediated Altshuler-Aronov correction to conductivity. The second correction to the Drude conductivity comes from weak localization, with a characteristic logarithmic temperature dependence of conductivity with a prefactor $e^2/2\pi^2\hbar$ in 2D. We observe a breakdown of this behavior at a sheet resistance R_0 =4011 Ω, which is very close to the quantum of resistance, $\hbar/e^2 \approx 4100\Omega$.

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