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Anderson localization transition in thin films of gadolinium[1] R. MISRA, A.F. HEBARD, K.A. MUTTALIB, University of Florida, Gainesville, FL-32611, USA, P. WOELFLE, ITKM, University of Karlsruhe, Germany — *In situ* temperature-dependent transport studies have been performed on a series of gadolinium (Gd) films deposited onto sapphire substrates having sheet resistance $R_0 \equiv R_{xx}$(5K) varying over the range 4011 Ω ($\sim$35Å) to 132 KΩ ($<$ 20 Å). The disorder strength, as measured by R_0, is sufficiently high so that quantum corrections to the classical Boltzmann conductivity are no longer observed. In this region of moderately strong disorder, we find a temperature-dependent conductivity of the form $\sigma(T) = A + BT^p$ where A and B are disorder-dependent constants and p is a power with value 0.4. We find that A is proportional to (1-$R_0/R_c)^s$ where the conductivity exponent s =1 and the critical resistance R_c= 22.7 kΩ. This change in sign of A with unity exponent at critical disorder describes the critical regime of an Anderson localization transition[1] with the temperature-dependent localization length sufficiently small so that the Gd films can be considered to be in the 3D regime, rather than the 2D regime where metallic behavior does not occur [2].
[1] Lee & Ramakrishnan, RMP 57, 287 (1985); Belitz & Kirkpatrick, RMP 66, 261 (1994) [2] Abrahams, Anderson, Licciardello & Ramakrishnan, PRL 42, 673 (1979)

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