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Magnetic Field Dependence of Spin Glass Free Energy Barriers[1]
SAMARESH GUCHHAIT, Laboratory for Physical Sciences, College Park, Maryland 20740, RAYMOND ORBACH, Texas Materials Institute, The University of Texas at Austin, Austin, Texas 78712 — Thin film spin glasses at mesoscopic thicknesses $\mathcal{L}$ achieve quasi-equilibrium conditions when the spin glass correlation length $\xi(t,T)$ grows with time t to $\mathcal{L}$ for times $t \geq t_{co}$, where T is the temperature and t_{co} is defined by the condition $\xi(t_{co},T) = \mathcal{L}$. Because the spin glass lower critical dimension $d_\ell \approx 2.5 > 2$, no further growth of $\xi(t > t_{co},T)$ takes place at constant temperature, generating a largest free energy barrier, Δ_{max}. A barrier model predicts that Δ_{max} increases as a magnetic field H decreases, proportional to the change in magnetic field $(\delta H)^2$. Experiments on a Ge:Mn thin film spin glass are reported that exhibit this proportionality, together with a small $(\delta H)^4$ term. The observed magnitude of the change of the spin glass free energy barriers is in near quantitative agreement with the predictions of a barrier model. Comparison is made with very recent numerical simulations on Janus and Janus II computers. The scaling laws that are derived from these simulations are of the same form as the results of our experiments.

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