Abstract Submitted
for the 4CF15 Meeting of
The American Physical Society

Noise of 1/f type in a constrained Heisenberg spin model BRYCE DAVIS, RALPH CHAMBERLIN, Arizona State University Department of Physics — A variety of systems and materials have been seen to undergo fluctuations with a power spectral density that depends upon frequency as approximately 1/f: electronic and magnetic devices, graphene and carbon nanotubes, and biological molecules. However, there is no agreed upon mechanism for this 1/f noise. Many explanations depend upon heterogeneity in the dynamics of the system yielding a distribution of relaxation times. Presented here is a Heisenberg spin model with dipolar anisotropy, simulated with the Metropolis algorithm using the standard Boltzmann factor as well as an entropic constraint to impose heterogeneity. The constraint simulates heterogeneity by determining transition probabilities not just by the availability of heat from the bath through the standard Boltzmann factor, but by the availability of entropy in the local environment such that the larger system becomes an ensemble of local regions with their own dynamics and time constants, consistent with the dynamic heterogeneity observed in many materials. The noise spectra of magnetization in these simulations is found to depend on frequency as $1/\mathrm{f}^{\alpha(\mathrm{T})}$ over a range of frequencies, where $\alpha(\mathrm{T})$ is an exponent depending upon temperature.

Bryce Davis
Arizona State University Department of Physics

Date submitted: 11 Sep 2015 Electronic form version 1.4