Efficient calculation of low energy configurations of nanoparticle ensembles for magnetoresistive sensor devices by means of stochastic spin dynamics and Monte Carlo methods

L. Teich,1 C. Schröder,1 C. Müller,1 A. Patel,1 J. Meyer,2 and A. Hütten2

1University of Applied Sciences Bielefeld,
Department of Engineering Sciences and Mathematics, Bielefeld, Germany
2Bielefeld University, Department of Physics,
Thin Films and Nanostructures, Bielefeld, Germany

By dispersing magnetic nanoparticles in conductive gel-like matrices, magnetoresistive sensors with promising features can be developed [1][2]. Moreover, theoretical investigations of the magnetic nanoparticle ensembles reveal sophisticated magnetic behaviour. While Monte Carlo simulations [3] show a transition between a disordered state and a paramagnetic state, a multitude of low energy configurations is revealed by stochastic spin dynamics simulations [3], both resembling dipole glass behaviour. Here, we present strategies to find these low energy configurations efficiently by simulating demagnetization protocols.

References: