

Extracting magnetic domain configurations from magnetic force microscopy data

William Perry, Jun Jiang, Xiaoguang Zhang

University of Florida, Quantum Theory Project, Gainesville, FL 32611

Magnetic force microscopy (MFM) is a measurement technique which detects either the first or second derivative of the magnetic field at a fixed distance above a magnetic sample. Except in the case of very simple domain configurations, it is usually impossible to make a reasonable guess about the magnetic structure of the sample which generated any particular MFM reading by simply observing the experimental data as an image. We develop an efficient technique to generate magnetic sample configurations that reproduce an experimental MFM image at the same resolution as the experimental MFM data. However, the solution for using a single MFM image is not unique due to the 2D nature of the data and the 3D nature of the unknown magnetic configuration of the sample. This poses a problem for using MFM data to infer the underlying magnetic state of the any sample, especially for new materials. We attempt to ameliorate this issue by examining the effect of multiple combined measurements on the stability of the magnetic configuration solution.