Abstract Submitted
for the 4CS19 Meeting of
The American Physical Society

Modeling Magnetic Correlations in Magnetite Nanoparticle Assemblies Using X-ray Magnetic Scattering Data JOHNATHON RACKHAM, KARINE CHESNEL, MARK TRANSTRUM, Department of Physics and Astronomy, Brigham Young University, ROGER HARRISON, Department of Chemistry, Brigham Young University, ALEX REID, SLAC National Accelerator Laboratory, BRITTNI NEWBOLD, STEVE KOTTER, DALLIN SMITH, DALTON GRINER, Department of Physics and Astronomy, Brigham Young University — Magnetic nanoparticles are increasingly used in nanotechnologies and biomedical applications, such as drug targeting, MRI, and bio-separation. Magnetite (Fe3O4) nanoparticles stand to be effective in these roles due to the non-toxic nature of magnetite and its ease of manufacture. To be more effective in these applications, a greater understanding of the magnetic behavior of the individual magnetite nanoparticles is needed when a collection of them is used. This research seeks to discover the local magnetic ordering of ensembles of magnetite nanoparticles occurring at various stages of the magnetization process. To complete this study, we use resonant x-ray magnetic scattering, which provides information about the magnetic orders in the material. Here we discuss the modeling of the magnetic scattering data using a one-dimensional chain of nanoparticles with a mix of ferromagnetic, anti-ferromagnetic, and random order. The model utilizes twelve variable parameters and we used a Levenberg-Marquardt algorithm to find the best fit parameters. By fitting the model to the experimental data, we extracted information about the magnetic correlations in the nanoparticle assembly.

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Date submitted: 12 Sep 2019 Electronic form version 1.4