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Computational Modeling of Magnetic Nanoparticle Chains
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We study the magnetic properties of nanoparticle assemblies, specifically, magnetite (Fe_3O_4) nanoparticles. My research work is divided in two parts: the experimental measurements, using x-ray magnetic resonant scattering (XRMS) in which the synchrotron x-rays are finely tuned to the resonant frequency of the Fe atoms. At that energy, the magnetic contrast in the scattering signal is enhanced, allowing us to obtain magnetic information. By changing the polarization of the x-rays, we measured the magnetic circular dichroism (XMCD), useful to extract information about spin and orbital moment. We also measured X-ray Resonant Magnetic Scattering (XRMS) patterns from the nanoparticle assemblies. The second part of my work is the computational modeling of the magnetic profiles extracted from the XRMS data. I use MATLAB to model the density function associated with a chain of nanoparticles. By taking the Fourier transform of the density function (whose peak positions corresponds to the spatial periodicity of the nanoparticles), I try to reproduce the XRMS data.

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