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Single and double layered square arrays of magnetic nanoparticles

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Ordered nanostructures of magnetic nanoparticles are interesting both due to potential applications, *e.g.* in information technology and spintronics [1, 2], and for the fundamental investigation of dipolar coupling [3, 4]. In particular stacked structures of ordered magnetic nanoparticle monolayers are interesting due to their potential for highly structured 3D devices and as model systems for the study of nanoscale magnetism. Here, we present our recent studies on the preparation and characterization of single domain magnetic nanoparticles arranged in a dense square lattice as monolayer and as double layer with tunable interlayer distance. The work presents an easy way to prepare high quality model systems of layered nanoparticle arrays. The nanostructures are characterized structurally by electron microscopy, grazing-incidence small-angle scattering and reflectometry, and magnetically by vibrating sample magnetometry and polarized neutron scattering. The experimental results are compared to the properties of the non-interacting nanoparticles in order to elucidate the impact of dipolar interaction in different structural hierarchies. Our approach and the new high quality model systems of layered nanoparticle arrays allow access to systematic studies of dipolar magnetic interactions of nanostructures across well-defined length scales.

References

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