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Magnetic Interactions in Binary Nanocrystal Superlattices[1] JING CAI, JUN CHEN, ANGANG DONG, XINGCHEN YE, YIJIN KANG, CHRISTOPHER B. MURRAY, JAMES M. KIKKAWA, University of Pennsylvania — The recent development[2] of highly ordered three-dimensional assemblies of magnetic nanocrystals (NCs) poses new questions for the study of collective magnetic dipolar interactions. Prior literature has focused on changes in blocking temperature in infinite, random assemblies. Here, we study ordered assemblies with two different magnetic NCs and complex superlattice unit cells. Monte Carlo simulations are compared with data to clarify magnetic behaviors in AB_{13} superlattices consisting of two different-sized (14.3 nm and 7.2 nm) Fe_3O_4 NCs, which are superparamagnetic in isolation. This strategy illuminates the individual sublattice properties and their interaction. We show that under certain circumstances, the magnetic response of smaller magnetic NCs may be quenched by the random magnetic field of larger magnetic NCs,[3] and that trends in blocking temperature with interaction strength depend strongly on both unit cell geometry and boundary conditions.

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