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Self-Assembled Nanomagnets

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The fabrication of high density and high performance magnetic nanodevices requires arrays of nanomagnets with controlled magnetics. Self-assembly of magnetic nanoparticles offers a versatile process for the formation of nanomagnetic arrays. It uses pre-formed monodisperse magnetic nanoparticles as building blocks that self-organize into 2D and 3D superlattices. Because nanoparticles can be synthesized with controlled dimension and surface coating, their self-assembly could yield a nanomagnet array with characteristic dimensions much smaller than those from the lithographic approaches. In this talk, I will outline our recent efforts in producing nanomagnet arrays using self-assembly. We apply different particle surface coatings or thermal annealing to control interparticle spacing and interface diffusion, and use particle shapes to control crystal orientation of each particle in a self-assembled superlattice. The Co or Fe_3O_4 nanoparticle arrays show Coulomb blockade and MR effects, while ferromagnetic FePt nanoparticle and FePt- Fe_3Pt nanocomposite assemblies are of interest for ultra-high density information storage and high performance permanent magnetic applications.