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Abstract for an Invited Paper
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Pattern Transfer Nanomanufacturing[1]

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We report programmed fluidic assembly of ~12 nm diameter Fe_3O_4 nanoparticles into hierarchically-patterned architectures using the confined magnetic fields that are emitted from transitions written onto magnetic disk drive media. When combined with a controlled external field, our approach yields both laterally-programmed assemblies of nanoparticles over cm length scales and vertically-programmed periodic topography. After assembly, the 3D arrays of nanoparticles are transferred to a flexible and transparent polymer film by spin-coating and peeling. We determine the total transferred magnetic moment as a function of nanoparticle concentration and exposure time, and explain the variation in moment for low concentrations using a simple hydrodynamic model. However, this model is insufficient to explain the transferred moment at higher concentrations, likely because of the combination of dynamically-changing fields during assembly, and field-shielding near the medium surface, both of which will play an enhanced role at higher nanoparticle concentrations. We will discuss potential applications of this technology for creating optoelectronic and biomedical devices.

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