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Non-equilibrium colloidal assembly pathways via synergistic dipolar, depletion, and hydrodynamic interactions ANNA COUGHLAN, MICHAEL BEVAN, Johns Hopkins University — The ability to assemble nano- and micro- colloidal particles into ordered materials and controllable devices provides the basis for emerging technologies. However, current capabilities for manipulating colloidal assembly are limited by the degree of order, time to generate/reconfigure structures, and scalability to large areas. These limitations are due to problems with designing, controlling, and optimizing the thermodynamics and kinetics of colloidal assembly. Our approach is to provide viable non-equilibrium pathways for rapid assembly of defect free colloidal crystals using combinations of magnetic field and depletion mediated assembly. Results include video microscopy experiments and Stokesian Dynamic computer simulations of superparamagnetic colloidal particles experiencing depletion attraction in time varying magnetic fields. Findings show multi-body hydrodynamic interactions and magnetic dipole relaxation mechanisms are essential to capture assembly and annealing of attractive colloidal crystals. With the ability to measure, model and tune colloidal interactions and dynamics, we demonstrate the use of time varying fields to manipulate non-equilibrium pathways for the assembly, disassembly, and repair of colloidal microstructures.

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