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Template-directed growth of nanoparticle-mediated colloidal crystals on large-area patterned substrates generated by multibeam holography RYAN KERSHNER, SUMMER RHODES, FLORENCIO GARCIA-SANTAMARIA, PAUL BRAUN, JENNIFER LEWIS, PIERRE WILTZIUS, University of Illinois at Urbana-Champaign — Large-domain colloidal crystals were created by gravitational settling of microspheres onto patterned substrates. The large-area patterned substrates were produced using multibeam interference lithography, facilitating templated epitaxial growth of single domain crystals with controlled crystallographic orientation. A 2-beam UV laser setup was employed to produce 1-D features with a periodicity on the order of 500 nm ($\sim$ colloid diameter). This was extended to a square array of 2-D features through multiple exposures. Atomic force microscopy (AFM) was used to characterize the resulting surface structures. The exposure parameters were varied to control the depth and width of the features in an attempt to optimize the pattern for defect free colloidal epitaxy. Colloidal crystals were produced from a binary suspension of colloidal microspheres stabilized through the addition of highly charged nanoparticles (Tohver et al., PNAS (2001)) followed by subsequent nanoparticle gelation (Lee et al., Langmuir (2004) to yield robust structures that can withstand capillary forces during drying.

Ryan Kershner
University of Illinois at Urbana-Champaign

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