Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Colloidal Dancers: Designing networks of DNA-functionalized colloids for non-random walks EMILY W. GEHRELS, W. BENJAMIN ROGERS, ZORANA ZERAVCIC, VINOTHAN N. MANOHARAN, Harvard Univ — We present experimental developments of a system of DNA-functionalized colloidal particles with the goal of creating directed motion ('dancing') along patterned substrates in response to temperature cycling. We take advantage of toehold exchange in the design of the DNA sequences that mediate the colloidal interactions to produce broadened, flat, or even re-entrant binding and unbinding transitions between the particles and substrate. Using this new freedom of design, we devise systems where, by thermal ratcheting, we can externally control the direction of motion and sequence of steps of the colloidal dancer. In comparison to DNA-based walkers, which move autonomously and whose motion is controlled by the substrate, our colloidal dancers respond to external driving, and their motion can be controlled in situ. Our use of DNA-functionalized colloidal particles instead of pure DNA systems also enables walking on the mesoscale in contrast to the molecular length scales previously demonstrated, allowing for the future prospect of directed transport over larger distances.

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Date submitted: 14 Nov 2013 Electronic form version 1.4