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Programmable Mesoscopic Architecture using Directionally-Functionalized Nanoparticles[1] JONATHAN HALVERSON, ALEXEI TKACHENKO, Brookhaven National Laboratory — Nanoparticles that have been isotropically-functionalized with complementary DNA strands have been shown to self-assemble into a variety of crystalline morphologies. To produce a nanoparticle assembly with a finite size and arbitrary shape, the NPs must be endowed with directional interactions. Directionally-functionalized nanoparticles (dfNPs) can be constructed by grafting ssDNA at specific locations on the particles, and proof-of-principle experiments have successfully demonstrated the self-assembly of such particles. Using these building blocks we have previously demonstrated with numerical simulations that a variety of target mesoscopic structures, each with a programmed local morphology and complex overall shape, can be self-assembled in near perfect yield. Here we present a model to describe the kinetics of assembly of a structure composed on dfNPs. The capability to produce these structures can be utilized in a variety of applications where bottom-up construction of 3D nano-objects with well-defined composition and architecture is required (e.g., nanoplasmonics, nanomedicine, metamaterials).

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Jonathan Halverson
Brookhaven National Laboratory

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