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Templated self-assembly of colloidal microswimmers ANTOINE AUBRET, JEREMIE PALACCI, University of California San Diego — Biological living systems are prototypical examples of Active Matter. Cells, for instance, exhibit far-from-equilibrium behavior such as autonomous regulation or organization. Here, we show how we can carve non-equilibrium pathways for the controlled self-assembly of colloidal microswimmers using light as a tool. We use photocatalytic colloidal microparticles as primary building blocks for self-assembly. We specifically designed the particles to self-propel, and sense light gradients. Following sequential light-patterns, the particles autonomously assemble into robust self-spinning structures, or microgears. The gears interact with contactless 'teeth', synchronizing their motion. We characterize the interaction potential, and show that the synchronization originates from the coupling between the chemical clouds generated by the catalytic activity of the gears and hydrodynamic interactions between their constituents. Following, the gears constitute the fundamental components of synchronized micro-machineries that auto-regulate and whose dynamics is tuned by the spins of their internal components. Our study demonstrate the potential of non-equilibrium interactions to program self-assembly of dynamical colloidal architectures.

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