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Active colloids as assembly machines CARL GOODRICH, MICHAEL BRENNER, Harvard Univ — Controlling motion at the microscopic scale is a fundamental goal in the development of biologically-inspired systems. We show that the motion of active, self-propelled colloids can be sufficiently controlled for use as a tool to assemble complex structures such as braids and weaves out of microscopic filaments. Unlike typical self-assembly paradigms, these structures are held together by geometric constraints rather than adhesive bonds. The out-of-equilibrium assembly that we propose involves precisely controlling the two-dimensional motion of active colloids so that their path has a non-trivial topology. We demonstrate with proof-of-principle Brownian dynamics simulations that, when the colloids are attached to long semi-flexible filaments, this motion causes the filaments to braid. The ability of the active particles to provide sufficient force necessary to bend the filaments into a braid depends on a number of factors, including the self-propulsion mechanism, the properties of the filament, and the maximum curvature in the braid. Our work demonstrates that non-equilibrium assembly pathways can be designed using active particles.

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