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Magnetically powered metachronal waves induce locomotion in capillary self-assemblies YLONA COLLARD, GALIEN GROSJEAN, NICOLAS VANDEWALLE, University of Liege — When tiny soft-ferromagnetic particles are placed along a liquid interface and exposed to a vertical magnetic field, the balance between capillary attraction and magnetic repulsion leads to self-organization into well-defined patterns. We demonstrate that precessing magnetic fields induce metachronal waves on the periphery of these assemblies, similar to the ones observed in ciliates and some arthropods. The outermost layer of particles behaves like an array of cilia or legs whose sequential movement causes a net and controllable locomotion. This bioinspired many-particle swimming strategy is effective even at low Reynolds number, using only spatially uniform fields to generate the waves. The motivations for studying these systems range from the fundamental understanding of biological processes to the development of medical and technological applications.

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