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And yet it moves - propulsion of colloidal clusters under reciprocal actuation[1] GABI STEINBACH, Technische Universität Chemnitz, SIBYLLE GEMMING, ARTUR ERBE, Helmholtz-Zentrum Dresden-Rossendorf — In the regime of low Reynolds numbers, the challenge of torque-based magnetic actuation lies in the conversion of torque into an effective force via symmetry breaking without inertial effects. Most reported systems rely on the hydrodynamic coupling between rotation and translation by an asymmetry in the environment (surfaces/interfaces) or the object shape. There, net translation can be realized only under non-reciprocal actuation given by precessing and rotating fields. In contrast, under oscillating fields, which are easier to realize, hydrodynamic coupling intrinsically leads to cyclic, reciprocal translation (Scallop theorem) unless the object has a certain flexible shape such as a flagellum. We present an alternative approach where symmetry breaking can be realized by magnetically interacting colloids which have been effectively modeled by spheres with shifted dipoles. If such colloids self-assemble, they form rigid clusters. We show how the collective, non-equilibrium dynamics of the colloids under oscillating fields propel the cluster. Depending on the configuration of the cluster it can rotate, translate and perform screw-like motion.

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