

Description of Additional Supplementary Files

File name: Supplementary Movie 1

Description: Orbital rotation of two hydrodynamically interacting rotors: comparison of experiments and simulations.

File name: Supplementary Movie 2

Description: Rotors and tracer trajectories in the dilute case (density 0.007) for both experiments and simulations showing Brownian motion, orbital rotation, and induced propulsion.

File name: Supplementary Movie 3

Description: Rotors and tracer trajectories in the semi-dilute case for both experiments (density 0.031) and simulations (density 0.04) showing induced propulsion and multi-vortex formation.

File name: Supplementary Movie 4

Description: Rotors and tracer trajectories in the dense collective case for both experiments (density 0.144) and simulations (density 0.14) showing fully developed active turbulence and odd viscosity.

File name: Supplementary Movie 5

Description: Multiscale vortex formation and density-correlations from simulations: simultaneous time development of rotors trajectories, vorticity, and density fields displayed for one simulation with density 0.14.