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Probing active turbulence by self-assembled spinners[1] GASPER KOKOT, IGOR ARONSON, ALEX SNEZHKO, Materials Science Division, Argonne National Laboratory — Active magnetic colloidal systems are driven locally by a global energizing field. They exhibit not only a wealth of directed collective behavior, but also regimes where the collective motion is on average non-directional, which gives rise to an active (self-driven) diffusion. We exploit a system of Ni microparticles suspended at the water-air interface and subject to a uniaxial oscillating magnetic field applied along the interface. The self-assembled spinners, emerging as a result of spontaneous symmetry breaking of self-assembled chains rotations, generate a local flow vorticity leading to strong quasi-two dimensional flows in the container. Experiments reveal the dependence of the diffusion constant on the frequency of the driving magnetic field, active particle density and tracer size, the last being, intriguingly, non-monotonic. Erratic motion of spinners in the container results in highly disordered and non-periodic flow velocity field which we show to be of a turbulent-like nature despite the low Reynolds number ($Re \sim 30$) associated with the spinners.

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