

Supplementary Materials:

Titles and captions for the supplementary videos.

- 1) **Bees-to-serpent transition.** A magnetic fluid droplet is torn asunder by the strong uniform torque density produced by an ac/ac/dc vortex field ($f_0=150$ Hz, $200 G_{\text{rms}}$). The axis of vorticity (dc field) extends left-right in the movie. The resultant “bees” fly chaotically throughout the suspending liquid, driven on by energy injection from the field. Once the field is removed, the bees immediately become quiescent spherules. In the second part of the movie, a fully ac 1:2:3 field ($f_0=50$ Hz, $150 G_{\text{rms}}$) is applied to these spherules and reanimates the bee phase. Now the vorticity axis is the “2” component, which is up-down in the movie. But now the bees form coherent swarms which eventually nucleate a writhing serpent that moves through the suspending liquid and grows by consuming the remaining bees. Upon removal of this magnetic field the serpent immediately collapses into five spherical droplets.
- 2) **Chaotic advection.** With the aid of Al tracer particles, the flow field produced by the chaotic bee phase is seen to be quite tortuous, indicative of strong mixing. The field conditions and orientation are the same as those in the first part of Supplementary Movie 1 [*i.e.*, ac/ac/dc vortex field ($f_0=150$ Hz, $200 G_{\text{rms}}$) with the vorticity axis (dc field) left-right].
- 3) **Dancing amoeba.** Application of a phase-modulated 1:2:3 field ($f_0=50$ Hz, $150 G_{\text{rms}}$, the vorticity axis is the “2” component, which is up-down in the movie.) causes the magnetic fluid droplet to become wildly animated, undergoing many amusing contortions and gyrating throughout the suspending liquid. These amoeboid dynamics are a consequence of the periodically reversing vorticity within the magnetic fluid (caused by the phase modulation) coupled with interfacial forces between the two fluid phases, and even include the projection of fingerlike pseudopodia.
- 4) **Plasmodial slime mold.** Using isopropanol as the base liquid of the magnetic fluid instead of water lowers the interfacial tension and results in a structure and dynamics reminiscent of plasmodial slime molds such as *Leocarpus fragilis*. The back-and-forth sprawling motion is because the ac/ac/dc symmetry-breaking rational field (a 1:3 frequency ratio [$f_0=100$ Hz, $150 G_{\text{rms}}$, with the vorticity axis (dc component) oriented left-right in the movie.]) is being phase modulated by 0.1 Hz, which causes the vorticity within the magnetic fluid to reverse every five seconds.