

### Supplemental Movie 1 Description:

Experimental recordings that display the motion of the self-propelled bbots and the driven tracer particle within the gravitational harmonic arena. For sufficiently large number of bbots  $N_b$ , the active medium behaves like an active gas-like state, frequently and randomly colliding with the passive tracer, thereby driving a Brownian-like motion in the potential well. The video shows the tracer motion under different  $N_b$  configurations.

### Supplemental Movie 2 Description:

The video was recorded using an ultra-high-speed camera operating at 6400fps, capturing a typical experimental time interval of  $\Delta t \approx 0.03_s$  used to track tracer trajectories. The footage compares the motion of a light versus a heavy tracer within an active system of  $N_b = 6$  self-propelled bbots.

The heavy tracer can undergo a sequence of persistent, directed collisions with the bbots, which are coarse-grained at the experimental resolution of  $\Delta t$ . During strong impacts, particularly at higher relative velocities, the heavy tracer is capable of altering the bbots' dynamics, noticeably affecting their post-collision velocities. Over longer timescales, the video shows that the bbots can transiently “cage” the heavy tracer, causing it to remain confined within a cluster in the trap.

In contrast, the light tracer exhibits ballistic motion between discrete collision events, each acting as a distinct “kick”. Unlike the heavy tracer, the light tracer does not typically become caged and remains free from clustering effects throughout its motion in the system.