Emergent short-range repulsion for attractively coupled active particles
Electronic Supplementary Information

Supplementary movies

Movies 1(a) to 1(c) show the dynamics of the attractively coupled active particles in the stationary state in two dimensions. Motion of the active particles is shown with respect to their centre of mass coordinate. The green arrows in the movies denote the instantaneous self-propulsion directions of the particles.

1 (a) Two active Brownina particles coupled by harmonic potential $V_h(r) = (kr^2)/2$: Here the coupling strength is $k = 4$ and the self-propulsion speeds are $v_1 = 6$ and $v_2 = 2$ respectively. Rotational diffusion constant of both the particles are fixed at $D = 0.01$. Due to the emergent short range repulsion, the particles are enclosed within the annular region with inner radius $R^{\rm min}/2 = 0.25$ and outer radius $R^{\rm max}/2 = 0.5$. The values of $R^{\rm min}$ and $R^{\rm max}$ are evaluated using Eq. [3] in the main text.

1 (b) Two active Brownina particles coupled by quartic potential $V_q(r) = (\kappa r^4)/4$: We have fixed the coupling strength $\kappa = 4$. The self-propulsion speeds of the two particles are $v_1 = 1$ and $v_2 = 4$, respectively. Rotational diffusion constants of both the particles are fixed at $D = 0.02$. Similar to 1(a), both the particles are enclosed within the annular region with inner radius $R^{\rm min}/2 \simeq 0.36$ and outer radius $R^{\rm max}/2 \simeq 0.427$. $R^{\rm min}$ and $R^{\rm max}$ are evaluated using Eq. [36] in the main text.

1 (c) Three active Brownian particles coupled by pairwise quartic potential $V_q(r) = (\kappa r^4)/4$: Similar to 1 (b), the coupling strength is $\kappa = 4$ and the self-propulsion speed of the i-th particle is taken to be $v_i = 3i - 2$. Rotational diffusion constants of all the particles are fixed at $D = 0.02$.