

Supplementary Material for “Clustering of microswimmers: Interplay of shape and hydrodynamics”

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PHASE DIAGRAM

Figure 1 displays the phase diagrams of spheroidal squirmers for $\beta = 0, \pm 1$ as well as spheroidal active Brownian particles. The classification as gas phase (open symbols) or giant cluster (filled symbols) is based on the probability distribution for the local packing fraction determined via Voronoi tessellation (cf. Sec. V of the main text). A system is in the gas/fluid phase, when the distribution function has a major peak preferentially at the average density (cf. Fig. 12(a)), and in two-phase coexistence regime, when a major peak appears at high packing fractions (cf. Fig. 12(b)). In case of two well pronounced peaks (cf. Fig. 12(a)), the system is near the phase-transition point, which we indicate by triangles. The phase borders, which are added to separate the two regions, should be viewed as approximations to the infinite-systems-size phase diagram. An accurate calculation of the phase boundaries requires a substantial simulation effort due to finite-size effects. The considered system sizes are certainly too small to ensure absence of finite-size effects.

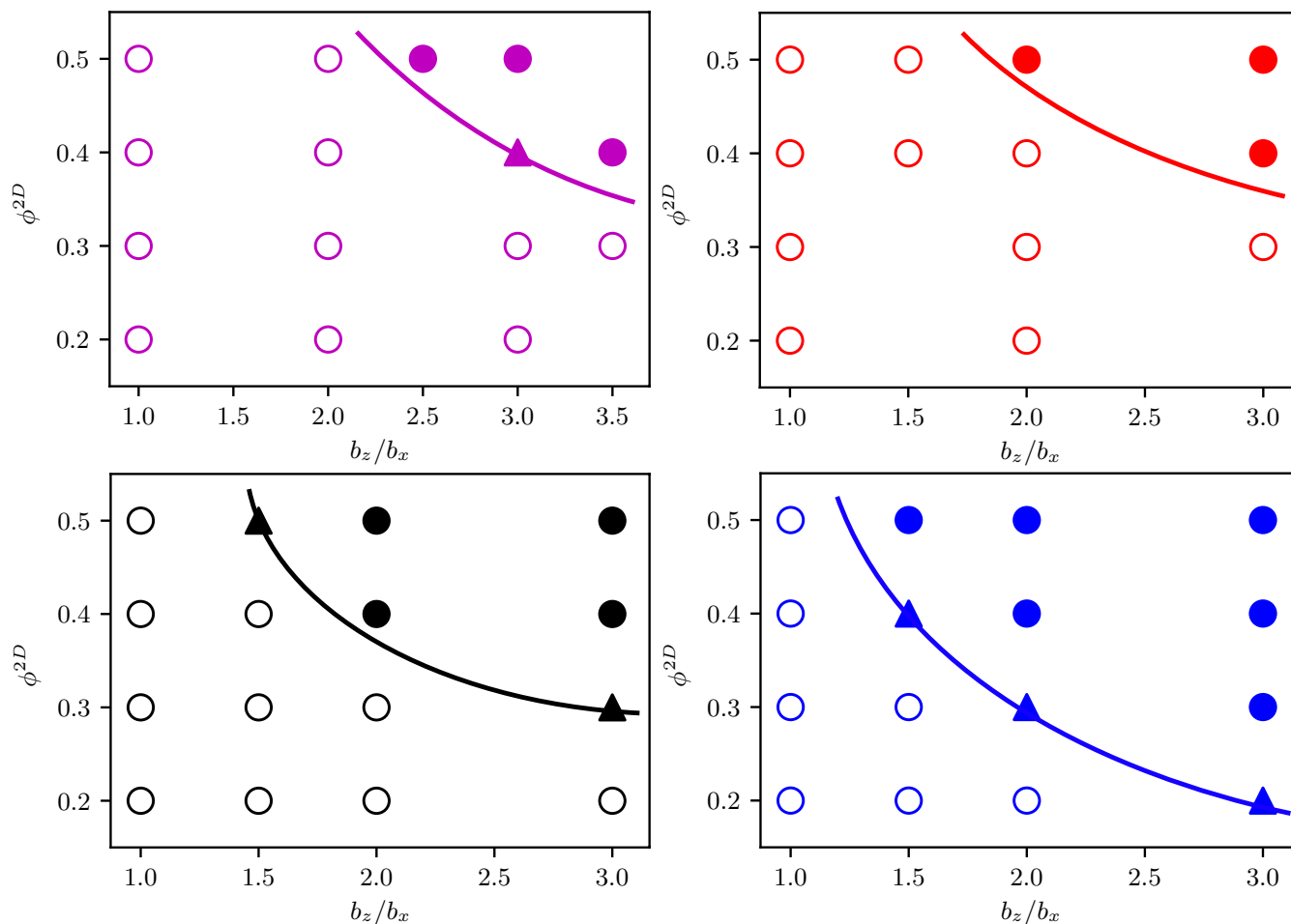


Fig. S1. Phase diagrams for ABPs (purple) and squirmers with $\beta = -1$ (red), $\beta = 0$ (black), and $\beta = 1$ (blue). Open symbols indicate the gas/fluid phase, and filled symbols the two-phase coexistence regime.

Movies

- **Movie M1** – MIPS for ABPs at $Pe = 115$ and $\phi^{2D} = 0.6$ (cf. Fig. 3(a)). Emerging defects partially destabilize the dense phase, an effect which reduces with increasing system size.
- **Movie M2** – Cluster formation for neutral squirmers at $Pe = 115$ and $\phi^{2D} = 0.6$ (cf. Fig. 3(b)). Clusters are continuously created and dissolve again.
- **Movie M3** – ABP fluid at $Pe = 12$ and $\phi^{2D} = 0.5$ (cf. Fig. 11(a)). No MIPS appears for this low Péclet number.
- **Movie M4** – Cluster formation of spheroidal neutral squirmers with the aspect ratio two at $Pe = 12$ and $\phi^{2D} = 0.5$ (cf. Fig. 11(b)). A dynamical dense aggregate is formed, which shows swarming behavior due to its finite size.
- **Movie M5** – Cluster formation of spheroidal neutral squirmers with the aspect ratio three at $Pe = 12$ and $\phi^{2D} = 0.5$ (cf. Fig. 11(b)).
- **Movie M6** – Cluster formation of spheroidal neutral squirmers with the aspect ratio four at $Pe = 12$ and $\phi^{2D} = 0.5$ (cf. Fig. 11(b)).