

## Supplementary information to “Particle anisotropy tunes emergent behavior in active colloidal systems”

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### 1 Electronic Supplementary Information

Videos are publicly accessible at the following link:

<https://umich.box.com/s/e2z2mbyaueonzww2d1thi03lyadhwypr>.

1. **n3\_VF\_phi50.mp4**: Vertex-forward 3-gons at  $\phi=0.50$   
This video shows the same simulation system whose trajectory is shown in the  $v/P_{coll}$  space in Figure 6 in the main text. The system phase separates as the inter-particle collision pressure ( $P_{coll}$ ) increases. At approximately  $3000\tau$ , the system is destabilized as inter-particle pressure builds along slip planes and is released, leading to the break-up of the cluster. This process has been referred to as “oscillation” in other works. Onset of destabilization is seen at 0:14 in the video.
2. **n4\_VF\_phi50.mp4**: Vertex-forward 4-gons at  $\phi=0.50$   
Clear slip planes are visible in this system that allow the clusters to shear grains off large clusters.
3. **n5\_VF\_phi50.mp4**: Vertex-forward 5-gons at  $\phi=0.50$   
This system exhibits rapid cluster formation. This system notably phase-separates with a cluster that exhibits the anti-parallel densest packing form common to 5- and 7-gons. See Figure 3 in the main text for a visual of this structure.
4. **n6\_VF\_phi50.mp4**: Vertex-forward 6-gons at  $\phi=0.50$   
This system also exhibits rapid cluster formation into many stable, small clusters.

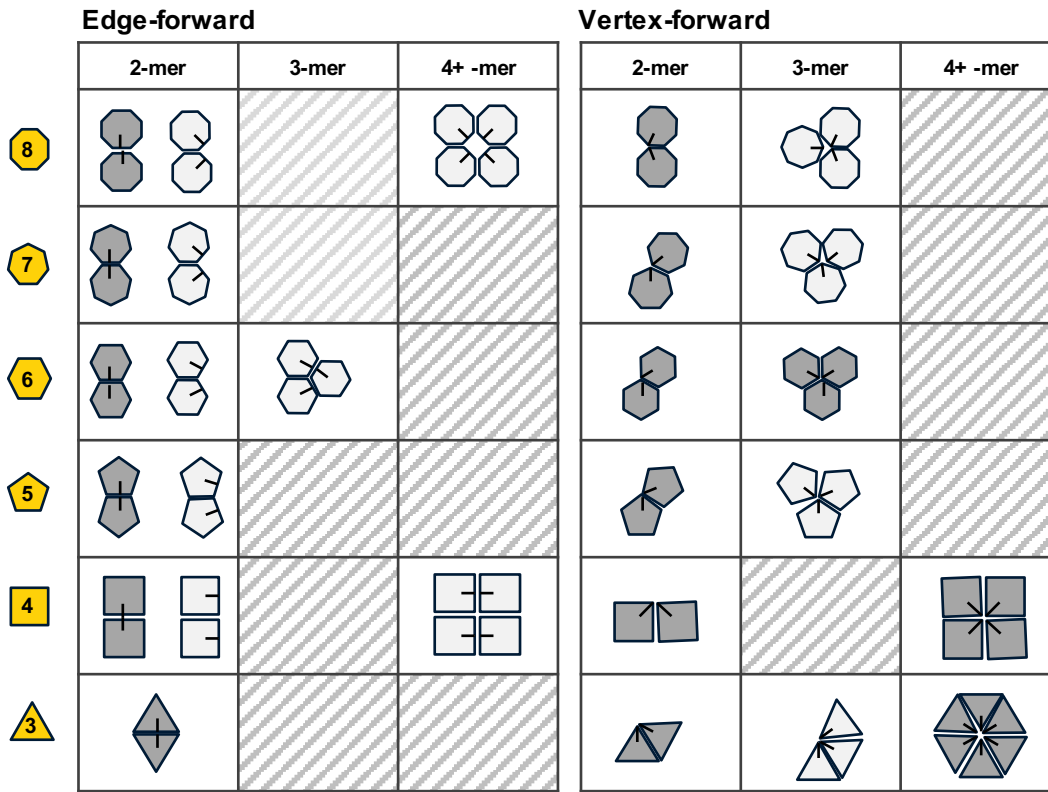


Figure 1: Representative clusters are shown for small clusters of all combinations of shape and force director studied. Clusters of shapes in dark grey are those that are commonly observed during cluster formation. Clusters of shapes in light grey are those that can be observed, but are short-lived. Shaded  $N$ -mer and shape intersections indicate combinations where there is no stable cluster observed; while it might be possible to theoretically build a cluster of size  $N$  for these shapes, we do not see such clusters in practice.