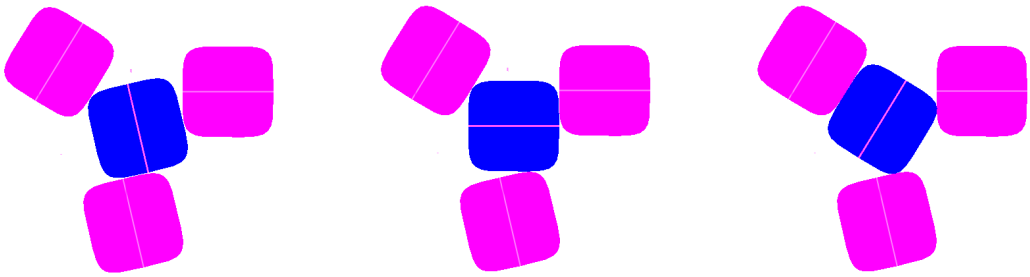

(a) (b) (c)

FIG. 8: (color online). Nongeneric locally jammed configurations associated with three fixed superdisks (pink) and the trapped one (blue). In each configuration, the central superdisk is approximately aligned with one of its fixed neighbors to form contacts associated with small curvatures to block rotation.

requires $Z = 2f = 12$ which is necessarily associated with translational crystallization [46].

We note that the aforementioned nongeneric structures (see Fig. 7(b)) are not rare. In particular, a nonspherical particle can be rotationally jammed if it has neighbors that can translationally jam the particle [32]. To illustrate this point, we will consider a small packing composed of four superdisks in two dimensions. Now we show that one can locally jam a superdisk by three contacting neighbor superdisks. Translational jamming requires that the centroids of the neighbors cannot lie in the same semi-circle around the centroid of the central superdisk. Suppose a superdisk is translationally trapped (not jammed) by its three neighbors, whose positions and orientations are fixed. This four-particle configuration has four degrees of freedom: two translational and one rotational degrees of freedom of the trapped particle as well as the expansion of the particles. To obtain a jammed configuration, the four degrees of freedom need to be completely constrained. This can be achieved by the three contact conditions for the jammed particles and its neighbors and the requirement that the three inward normal vectors at the contacting points meet at a common point, a sufficient condition for torque balance [32]. Thus, one has four independent equations for the four degrees of freedom; see the Appendix for details.

Figure 8 shows the nongeneric jammed configurations associated with three specific fixed trapping superdisks. The multiplicity of the configurations is due to the multiple solutions of the equations. The jamming configurations can be also obtained using the DTS algorithm,