the curvatures at the contacting points are sufficiently small [32]. In addition, due to the relatively small asphericity γ of superdisks and superballs, there is little reason to expect the rotational motions of these particles (especially those with p close to unity) would be frozen even when they are translational trapped and may only rattle inside small "cages" formed by their neighbors. Near the jamming point, it is expected that the particles can rotate significantly [45] until the actual jamming point is reached, at which rotational jamming will also come into play, and rotational degrees of freedom are frozen with the number of additional contacts much less than $2f_R$. This is in contrast to hypostatic MRJ packings of ellipsoids with large aspect ratios, for which the translational and rotational degrees of freedom are on the same footing and, thus, the average contact number per particle is only slightly below twice the number of total degrees of freedom.

Furthermore, the local geometry of the MRJ packings is necessarily nontrivially correlated (nongeneric), i.e., all the normal vectors at the points of contact for a particle should intersect at a common point to achieve torque balance and block rotations. In light of the isostatic conjecture, the local packing structures are less nongeneric when they possess larger contact numbers so that the constraining neighbors are less correlated. The truly generic local packing structures should have $Z = 2f$ per particle, for which the constraining neighbors could be completely uncorrelated. To characterize the "nongenericity" of the packings, we compute G_{ng}, the fraction of local structures composed of particles with less contacts Z_{local} than average $Z_{average}$, i.e.,

$$G_{ng} = \frac{N(Z_{local} \leq Z_{average})}{N_{total}}. \tag{2}$$

A larger G_{ng} indicates a larger degree of nongenericity. We find G_{ng} is approximately 0.65 in two dimensions and 0.78 in three dimensions when p is close to unity, which quickly decreases and plateaus at 0.6 and 0.68, respectively as p increases. Figure 7 shows the distribution of contact numbers for different p values and the topology of the local structures contributing to G_{ng}. It can be seen that as p moves away from unity, the distributions become more skewed as the means shift to larger Z. Moreover, the subset of particles associated with the nongeneric structures do not percolate. We do not observe any tendency of increasing Z even for the largest p values that are computationally feasible and we expect that MRJ packings in the cubic limit are also hypostatic. It is noteworthy that isostatic random packings of superdisks and superballs are difficult to construct, since achieving isostaticity