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**Degenerate Quasicrystal of Hard Triangular Bipyramids Stabilized by Entropic Forces** AMIR HAJI-AKBARI, MICHAEL ENGEL, SHARON GLOTZER, University of Michigan — The assembly of hard polyhedra into novel ordered structures has recently received much attention. Here we focus on triangular bipyramids (TBPs)- i.e. dimers of hard tetrahedra- which pack densely in a simple triclinic crystal with two particles per unit cell [1]. This packing is referred to as the TBP crystal. We show that hard TBPs do not form this densest packing in simulation. Instead, they assemble into a different, far more complicated structure, a dodecagonal quasicrystal, which, in the level of monomers, is identical to the quasicrystal recently discovered in the hard tetrahedron system [2], but the way that tetrahedra pair into TBPs in the nearest neighbor network is random, making it the first degenerate quasicrystal reported in the literature [3]. This notion of degeneracy is in the level of decorating individual tiles and is different from the degeneracy of a quasiperiodic random tiling arising from phason flips [4]. The $(3.4.3^2.4)$ approximant of the quasicrystal is shown to be more stable than the TBP crystal at densities below 79.7%.

[1] Chen ER, Engel M, Sharon SC, Disc. Comp. Geom. 44:253 (2010).
[2] Haji-Akbari A, Engel M, et al. Nature 462:773 (2009).
[3] Haji-Akbari A, Engel M, Glotzer SC, arXiv:1106.5561 [PRL, in press].
[4] Elser V, PRL 54: 1730 (1985)

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