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Faceted structures in liquid crystalline vesicles

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The shape of liquid-crystalline vesicles, molecularly thin membrane sacs enclosing a finite volume, is determined by the competition between liquid-crystalline deformations on a surface to be determined and the bending energy of the surface in the ambient bulk. We discuss this problem in two limits: stiff (high bending rigidity compared to Frank modulus) and floppy (low bending energy compared to Frank modulus). The solution in the floppy limit is quite remarkable: it is the surface of a regular tetrahedron with topological defects at the vertices. Thus floppy liquid crystalline vesicles, which have no translational order, are sharp faceted structures more commonly found in hard crystalline materials.