Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Geometrical study of the deformations of a thin spherical shell inspired by pollen grains. ETIENNE COUTURIER, USACH, ELENI KATIFORI, MPI Göttingen, JACQUES DUMAIS, UAI Viña del Mar, ENRIQUE CERDA, USACH — Various monocotyledon pollen grains have a geometric design. They are constituted by a stiff thin shell with an n-fold rotationally symmetric softer sector. The mechanic response of these inhomogeneous shells can be approximated as an open shell. Isometric modes are known to be energetically favorable for thin shells when they are possible. Although the literature for the complete sphere, for which these modes are impossible, is extensive, analyses of the deformation of open shells whose isometric deformations are not inhibited, are much more scarce. We focus on the isometric deformation of spheres with n-fold rotationally symmetric openings. The isometric deformation means that the surface remains a constant gaussian curvature surface. Using differential geometry, we obtained an integrable family of surfaces whose gaussian curvature remains approximatively constant. We performed both simulations by tethered mesh methods and experiments with cut ping-pong balls. We observe that first the shell surface deforms without any stretching and is very well described as a part of an approximative constant gaussian curvature surface whose singularities remain outside the shell surface and get closer to the shell surface as the load increases.

Etienne Couturier
USACH

Date submitted: 08 Nov 2012 Electronic form version 1.4