Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

The Buckliball: Pressure Induced Pattern Transformation of a Structured Elastic Shell JONGMIN SHIM, Harvard University, CLAUDE PERDIGOU, Massachusetts Institute of Technology, ELIZABETH R. CHEN, University of Michigan, KATIA BERTOLDI, Harvard University, PEDRO REIS, Massachusetts Institute of Technology — We report an experimental and computational study of a patterned elastic shell which, under pressure loading, undergoes a transformation in its structural configuration. The geometry of the ball comprises of an elastomeric spherical shell patterned with a regular array of circular holes. These voids are covered with a thin membrane, thereby making the ball air tight. Upon reduction of the internal pressure, the thin membranes first invert their curvatures inward. Consequently, beyond the critical pressure, the thin ligaments between the holes buckle leading to a cooperative buckling cascade of the skeleton of the ball. During this process, the initially circular holes evolve into an elliptical shape, and eventually become fully closed. This pattern transformation is induced by mechanical instability that opens the possibility for reversible encapsulation, over a wide range of length scales.

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Date submitted: 25 Jul 2011 Electronic form version 1.4