Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Localization in thin shells under indentation ALICE NASTO, Massachusetts Institute of Technology, AMIN ADJARI, Northeastern University, ARNAUD LAZARUS, Massachusetts Institute of Technology, ASHKAN VAZIRI, Northeastern University, PEDRO REIS, Massachsuetts Institute of Technology —
We perform a hybrid experimental and numerical investigation of deformation in thin spherical elastic shells under indentation. Past the initial linear response, an inverted cap develops as a Pegorelov circular ridge. For further indentation, this ridge loses axis-symmetry and sharp points of localized curvature form, which we refer to as 's-cones' (for shell-cones), in contrast with their developable cousins in plates, 'd-cones'. We quantify how the formation and evolution of s-cones is affected by systematically varying the indenter's curvature. In our precision model experiments, rapid prototyping is used to fabricate elastomeric shells and rigid indenters of various shapes. The mechanical response is quantified through load-displacement comparison tests and the deformation process is further characterized through digital imaging. In parallel, the experimental results are contrasted against nonlinear Finite Element simulations, which enable us to explore the role of friction at the shell-indenter contacts and characterize the relative strain energy focusing properties at different loci of localization. Our combined experimental and computational approach allows us to gain invaluable physical insight towards rationalizing this geometrically nonlinear process.

Alice Nasto
Massachsuetts Institute of Technology

Date submitted: 07 Nov 2012 Electronic form version 1.4