Abstract Submitted
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Spontaneous curvature cancellation in forced thin sheets TAO LIANG, THOMAS WITTEN, Department of Physics, University of Chicago — We report numerically observed spontaneous vanishing of mean curvature on a developable cone made by pushing a thin elastic sheet into a circular rim [1]. The mean curvature is seen to drop by nearly two orders of magnitude in a narrow zone near this rim, independent of thickness of the sheet, the supporting radius and the amount of deflection. Several variants of developable cone are studied to examine the necessary conditions that lead to the vanishing of mean curvature. It is found that the presence of appropriate amount of radial stress is necessary. The d-cone geometry somehow produces the right amount of radial stress to induce just enough radial curvature to cancel the conical azimuthal curvature. In addition, the circular symmetry of supporting rim plays an important role. When the supporting ring is elliptical, the radial curvature overcompensates the azimuthal curvature near the minor axis and undercompensates near the major axis. Our numerical finding is verified by a crude experiment using reflective plastic sheets. We expect this finding to have broad importance in describing the general geometrical properties of forced crumpling of thin sheets. [1] Cerda et al, Nature 401, 46 (1999)

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