Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Wrapping a liquid drop with a thin elastic sheet JOSEPH PAULSEN, VINCENT DÉMERY, BENNY DAVIDOVITCH, CHRIS SANTANGELO, THOMAS RUSSELL, NARAYANAN MENON, University of Massachusetts Amherst — We study the wrapping of a liquid drop by an initially-planar ultrathin ($\sim$ 100 nm) circular sheet. These elastic sheets can completely relax compressive stresses by forming wrinkles [1]. In the experiment, we find that when a small fraction of the drop is covered, the overall shape of the sheet (i.e. averaging over the wrinkles) is axisymmetric. As we shrink the drop further, the sheet develops radial folds that break the axisymmetry of the sheet and the drop. Our data are consistent with a model where the sheet selects the shape that minimizes the exposed liquid surface area. We thus identify a "geometric wrapping" regime, where the partially-wrapped shape depends only on the relative radii of the sheet and the drop; the global breaking of axisymmetry is independent of the elastic energy of the deformed sheet. This regime requires that bending energy is negligible compared to surface energy, in contrast to the "capillary origami" regime [2] where the static shape of the drop comes from a balance of bending and capillary forces.

[1] King et al., PNAS 109, 2012.
[2] Py et al., PRL 98, 2007.

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Date submitted: 01 Aug 2014 Electronic form version 1.4