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**Beyond Wrinkles: Stress and Fold Localization in Thin Elastic Membranes<sup>1</sup>**

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Thin elastic membranes supported on fluid or elastic foundations deviate from their flat geometries upon compression. We demonstrate that the periodic and much studied wrinkled state is but one possible solution for such strained membranes. Folds, sharply localized solutions, appear whenever the membrane is compressed beyond a third of its initial wrinkle wavelength. Eventually the surface transforms into a symmetry broken state with flat regions of membrane coexisting with locally folded points, reminiscent of a crumpled unsupported membrane. We study this transition in many systems including lipid monolayers on liquid subphases of differing viscosity and use neutron and x-ray reflectivity to elucidate the role of the subphase in setting the wrinkle and fold size.

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