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Capillary bending of a thin polymer film floating on a liquid bath[1]

TIMOTHY TWOHIG, ANDREW B. CROLL, North Dakota State Univ — Thin elastic films and shells are very important in schemes for the encapsulation and protection of fluids from their environment. Capillary origami is a particularly poignant example of how useful fluid/film structures can be formed. The interactions of fluids on thin-films which themselves lie on another surface (fluid or low friction solid) need to be studied if the differences from fluid-fluid and fluid-solid film interfaces are to be fully appreciated. In this experiment, we examine the triple line that occurs when a fluid is resting on a thin polymer film which is itself floating on a second fluid. The top fluid has a high-energy air/fluid interface which can be minimized by deforming the film in a manner that reduces the total air/fluid interface. We create a one-dimensional experiment in order to isolate the basic physics that occurs as the tension of the top fluid pulls on the thin film. Notably, the 1D geometry removes all the complexity incurred by thin films in biaxial stress states (such as wrinkling, folding and crumpling) from the problem.

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