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A Theory of Shape-Shifting Droplets PIERRE HAAS, RAYMOND GOLDSTEIN, STOYAN SMOUKOV, University of Cambridge, NIKOLAI DENKOV, University of Sofia — Recent observations of cooled oil emulsion droplets uncovered a remarkable array of shape transformations[1]: the initially spherical droplets flatten into polygonal shapes, first hexagons, then triangles or quadrilaterals that ultimately grow thin protrusions from their corners. These transformations are driven by a partial phase transition of the bulk liquid phase. In this talk, we explore theoretically the simplest geometric competition between this phase transition and surface tension in planar polygons. We recover the experimental sequence of shapes and predict shape statistics in qualitative agreement with experiments. Extending the model to capture some of the three-dimensional structure of the droplets, we analyse the topological transition of droplet puncture observed in experiments.

[1]N. Denkov, S. Tcholakova, I. Lesov, D. Cholakova, and S. K. Smoukov, Self-shaping of oil droplets via the formation of intermediate rotator phases upon cooling, Nature **528**, 392 (2015)

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