

Abstract Submitted
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Shrinking Instabilities of Toroidal Liquid Droplets in The Stokes Flow Regime ZHENWEI YAO, MARK BOWICK, Syracuse University — We analyze the stability and dynamics of toroidal liquid droplets. In addition to the Rayleigh instabilities akin to those of a cylindrical droplet there is a shrinking instability that is unique to the topology of the torus and dominates in the limit that the aspect ratio is near one (fat tori). We first find an analytic expression for the pressure distribution inside the droplet. We then determine the velocity field in the bulk fluid, in the Stokes flow regime, by solving the biharmonic equation for the stream function. The flow pattern in the external fluid is analyzed qualitatively by exploiting symmetries. This elucidates the detailed nature of the shrinking mode and the swelling of the cross-section following from incompressibility. Finally the shrinking rate of fat toroidal droplets is derived by energy conservation.

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