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Influence of Film Thickness and Substrate Geometry on the Growth of Taylor Cones in Perfectly Conducting Films[1] THEODORE ALBERTSON, SANDRA TROIAN, California Institute of Technology, MC 128-95, Pasadena, CA 91125 — There are a growing number of space based applications ranging from miniature mass spectrometry devices to small focused ion beam units which rely on nanoscale fluid flow controlled by Maxwell stresses. These new technologies require ever improved understanding of the process by which a liquid stream or droplet is transformed from an initial smooth shape into a steepening cone known as the Taylor cone. While ongoing studies in the literature have elucidated how the cone-jet transition controls the delivery of mass and charge flux, less attention has been paid to the case of microscale films and how frictional effects influence the shape and timescale of evolving conical elongations. Here we describe recent efforts in our group using moving mesh and phase field methods to capture the influence of substrate geometry and film thickness on the formation of transient Taylor cones in perfectly conducting films. The computational model fully couples electrohydrodynamic fluid flow with active pressure and electrical potential fields resulting from the rapidly evolving film shape. We examine the asymptotic behavior of the film deformation process as a function of the electric field strength and substrate curvature, which in experimental systems can be easily tuned.

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Sandra Troian
California Institute of Technology, MC 128-95, Pasadena, CA 91125

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