Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

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 — Liquid metal ion and droplet sources are finding application in many different fields ranging from high resolution focused ion beam imaging and lithography to space micropropulsion to nanofabrication and nanomanufacturing. These applications require ever improved understanding of the process by which Maxwell forces deform a smooth molten metal film into a liquid cusp known as a Taylor cone. While recent computational studies have elucidated how the cone-jet transition controls the mass and charge flux, less attention has been paid to the regime involving very thin coating films and how frictional effects influence the shape and timescale of the evolving conical elongations. We describe recent efforts in our group using moving mesh techniques to quanify the influence of substrate geometry and film thickness on the shape and formation of transient Taylor cones in perfectly conducting films. Our results appear to confirm self-similar exponents predicted theoretically upon onset of cone formation. Under certain conditions, we find not only Taylor cone formation at the tip of a sharp axisymmetric emitter but also Taylor coronal rings away the sharpest point. Such secondary formations can ultimately enhance mass and charge flux.

[1]TGA acknowledges support from a NASA Space Technology Research Fellowship.

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Date submitted: 17 Nov 2014 Electronic form version 1.4