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Influence of Inertial, Visous and Capillary Effects on the Apical Behavior of Taylor Cone Formation in Liquid Metals[1] THEODORE ALBERTSON, SANDRA TROIAN, California Institute of Technology — Above a critical applied field strength, the surface of a liquid metal can deform into a conical shape whose apex can emit ions. The precursor shape and dynamics to that event have been debated for decades. In a landmark paper, Zubarev (2001) invoked potential flow theory to predict the existence of self-similar apical sharpening for the case of an ideal perfectly conducting liquid. He found that the Maxwell and capillary pressures at the cone tip scale in time as -2/3 upon approach to the singularity. In this talk, we examine the behavior of thin electrified microscale films placed in close proximity to a grounded planar counter electrode to probe how inertial and viscous forces, diminished or neglected in the original analysis, modify the power law exponents governing the apical self-similar regime. We employ finite element, moving mesh simulations to investigate these effects for low, intermediate and high electric Reynolds and capillary numbers. We confirm the robustness of the self-similar regime characterized by power law exponents despite the lack of potential flow - however, the power law exponents, no longer -2/3, assume values which depend on the choice of dimensionless numbers.

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