Abstract Submitted
for the GEC17 Meeting of
The American Physical Society

Electrostatic Debye layer formed at a plasma-liquid interface DAVID GO, PAUL RUMBACH, JEAN PIERRE CLARKE, University of Notre Dame — Many of the new applications of low-temperature plasma in medicine and material synthesis rely on the direct interaction of plasma with an aqueous media. In this work, we derive and experimentally test an analytic model for the electrostatic Debye layer formed at a plasma-liquid interface [1]. Our theoretical model combines the Gouy-Chapman theory of aqueous electrolytes with a simple parabolic band model for the plasma sheath, and it gives closed form expressions for the electric field and charge distribution at the interface. It also predicts the plasma current density as a function of the solution ionic strength, which we experimentally confirmed using a liquid anode plasma. Fitting the model to the experimental data yields a plasma electron density on the order of 10^{19} m^{-3} and an electric field on the order of 10^4 V/m on the liquid side of the interface. Importantly, this work clearly shows that the plasma behavior and the electrostatics of the plasma-liquid interface are highly dependent on the ionic strength of the aqueous solution. [1] P. Rumbach, J. P. Clarke, D. B. Go, *Phys. Rev. E*, 95, 053203 (2017).

Paul Rumbach
University of Notre Dame

Date submitted: 31 May 2017 Electronic form version 1.4