

Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

**Influence of Neutral Pressure on Instability Enhanced Friction
and Ion Velocities at the Sheath Edge of Two-Ion-Species Plasmas¹**

PATRICK ADRIAN, Massachusetts Institute of Technology , SCOTT BAALRUD, University of Iowa, TREVOR LAFLUER, Laboratoire de Physique des Plasmas, CNRS, Sorbonne Universites, UPMC Univ Paris 06, Univ Paris-Sud, Ecole Polytechnique — The speed at which ions enter the sheath is a critical parameter to model in low temperature plasmas. For two ion species plasmas, the Instability-Enhanced Friction (IEF) theory [1] predicts the ions' sheath-edge flow speeds based upon the presence of ion-ion two stream instabilities in the presheath which cause an enhanced friction between the ions merging their velocities up-until the sheath-edge. Here we will report two contributions advancing the IEF theory. First, we have directly calculated the ion-ion friction force in the presheath due to the two stream instability from new Particle-in-Cell Monte-Carlo Collision (PIC-MCC) simulations. This result directly links the merging of the ion velocities with the enhanced wave-particle scattering due to the ion-ion two stream instability. Our second result was that the two stream instability persisted up to 10's of mTorr as we varied the neutral pressure in the simulations. Adding an ion-neutral collision operator into the IEF theory resulted in accurate predictions for the ion sheath-edge speeds over a range of neutral pressures. This result could impact plasma based manufacturing designs which can operate in the 10's of mTorr.

[1] S. D. Baalrud, C. C. Hegna, and J. D. Callen, PRL 103, 205002 (2009)

¹DOE Grant Award No. DE-SC0016473

Patrick Adrian
Massachusetts Institute of Technology

Date submitted: 11 Jul 2017

Electronic form version 1.4