Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Oscillation, Collapse and Disappearance of Debye Sheaths Due to Secondary Electron Emission[1] MICHAEL CAMPANELL, ALEXANDER KHRABROV, IGOR KAGANOVICH, Princeton Plasma Physics Laboratory — Most theories of PSI with secondary electron emission (SEE) implicitly assume a stable sheath exists. Ions are assumed to be drawn to the wall and the SEE is characterized by a fixed "coefficient" (e.g. G.D. Hobbs and J.A. Wesson, Plasma Phys. 9, 85 (1967)). We present simulations and basic theory showing a class of sheath instabilities that can arise under general conditions. Instabilities cause abrupt changes in the plasma, drive spontaneous oscillations, and dramatically increase cross-B-field transport, wall flux and energy loss. (M.D. Campanell et. al. PRL 108, 235001 (2012)). Also, if the SEE yield of hot plasma electrons impacting the walls exceeds unity, the sheath and presheath may disappear completely because there is no need for ions to be drawn to the wall in order to maintain current balance (M.D. Campanell et. al. PRL 108, 255001 (2012)). Instead, the walls acquire a positive charge. The plasma potential is negative, the ion flux is zero and plasma electrons are unconfined. These three properties all differ from the "space charge limited" sheath often assumed to form when SEE yield exceeds 1. In the new "inverse sheath" regime, zero current is maintained only by pulling the "extra" secondaries back to the wall.

[1]This work was supported by the U.S. Department of Energy, contract # DE-AC02-09CH11466.

Michael Campanell
Princeton Plasma Physics Laboratory

Date submitted: 16 Jul 2012 Electronic form version 1.4