Abstract Submitted
for the GEC18 Meeting of
The American Physical Society

The Inverse Mode of Thermionic Current Flow from a Hot Cathode Through a Plasma[1] MICHAEL CAMPANELL, Lawrence Livermore Natl Lab — Understanding the plasma and sheaths under intense thermionic current is important for modeling many hot cathode devices. The conventional view [1,2] is that when the current is space-charge limited (SCL) the cathode sheath consumes the electrode bias and an electric field proportional to the resistivity drives the current through the plasma. In our last GEC talk, we showed that SCL modes cannot exist [3]. Instead, the current-limited equilibrium of a plasma diode should have an inverse cathode sheath. Recently, the unique properties of the inverse current mode were modeled analytically and verified in simulations [4]. Unlike classical or SCL cathode sheath modes, in the inverse mode (a) plasma ions are trapped, (b) the electric field in the plasma is zero, i.e. no field from resistivity or presheath, (c) the anode sheath consumes the electrode bias. Also, the power loss and cathode sputtering can be minimized in the inverse mode, so it may be benificial to design future devices to operate in this mode. [1] S. Takamura et al., Contrib. Plasma Phys. 44, 126 (2004). [2] L. Pekker and N. Hussary, PoP 22, 083510 (2015). [3] M.D. Campanell and M.V. Umansky, PSST 26, 124002 (2017) (presented at GEC 2017 invited). [4] M.D. Campanell, Phys. Rev. E 97, 043207 (2018).

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract No. DE-AC52-07NA27344, and supported by US DOE, Office of Science, Fusion Energy Sciences.

Michael Campanell
Lawrence Livermore Natl Lab

Date submitted: 01 Jun 2018 Electronic form version 1.4