Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Unifying Paschen Curve Conditions across Pressure and Gap Distance AMANDA LOVELESS, ALLEN GARNER, Purdue University, AGUST VALFELLS, Reykjavik University — The Paschen curve (PC) predicts the breakdown voltage of a gas by relating it to the product of pressure and gap distance (pd). Recent experiments deviate from the PC for microscale gaps at low pd. A scaling law incorporating field emission-driven breakdown and field enhancement to the macroscale Paschen law yields more accurate predictions for microscale gaps (A. Venkattraman and A. A. Alexeenko, Phys. Plasmas **19**, 123515 (2012).). While many studies consider low pd, deviations from the PC also arise at high pd, as demonstrated for gap distances between 0.0508 and 0.254 cm and pressures between 96.5 and 6900 kPa (W. J. Carey, A. J. Wiebe, R. D. Nord, and L. L. Altgilbers, in Proc. IEEE Pulsed Power Conf., 2011, pp. 741-744). High pd values are relevant for ongoing high voltage plasma experiments for food treatment and combustion. We attempt to elucidate the impact of large gap distances ($\sim$ 5 cm) and higher pressures ($\sim$ 200-300 kPa) on these deviations by connecting recent work at low pd to high pd by assessing scaling laws, analyzing field emission models, and using particle-in-cell codes. Implications on experimental design will be discussed, and the development of a universal Paschen curve will be explored.

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Date submitted: 22 Jul 2015 Electronic form version 1.4