Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Breakdown of the Orbital-Motion-Limited charging theory in the positively charged regime GIAN LUCA DELZANNO, XIAN-ZHU TANG, LANL — The Orbital-Motion-Limited theory (OML) is the most widely used theory for charging of a spherical dust grain in a plasma. It is normally applicable to grains whose radius is much smaller than the plasma Debye length, although Particle-In-Cell simulations have shown that, when the grain is negatively charged, OML is still accurate even for moderately large grains. In this work, we show that OML can become inapplicable in the positively charged regime when the grain is an electron emitter [1]. It can completely miss the transition between negatively and positively charged dust (thus predicting a positive dust potential when simulations show a negative dust potential) and overestimates the power collected by the grain. This is due to the development of a non-monotonic potential (a potential well) near the grain, which affects the electron emission current. A parametric study of the critical parameters controlling the breakdown is presented, together with a revised OML theory that remains accurate when potential well effects are important.

[1] G.L. Delzanno, X.Z. Tang, "Charging and heat collection by a positively charged dust grain in a plasma," to appear in Physical Review Letters (2014).

Gian Luca Delzanno
LANL

Date submitted: 11 Jul 2014 Electronic form version 1.4