Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Characterizing Hypervelocity Impact Plasma Through Experiments and Simulations SIGRID CLOSE, NICOLAS LEE, Stanford University, ALEX FLETCHER, Massachusetts Institute of Technology, ANDREW NUTTALL, MONICA HEW, PAUL TARANTINO, Stanford University — Hypervelocity micro particles, including meteoroids and space debris with masses <1 ng, routinely impact spacecraft and create dense plasma that expands at the isothermal sound speed. This plasma, with a charge separation commensurate with different species mobilities, can produce a strong electromagnetic pulse (EMP) with a broad frequency spectrum. Subsequent plasma oscillations resulting from instabilities can also emit significant power and may be responsible for many reported satellite anomalies. We present theory and recent results from ground-based impact tests aimed at characterizing hypervelocity impact plasma. We also show results from particle-in-cell (PIC) and computational fluid dynamics (CFD) simulations that allow us to extend to regimes not currently possible with ground-based technology. We show that significant impact-produced radio frequency (RF) emissions occurred in frequencies ranging from VHF through L-band and that these emissions were highly correlated with fast (>20 km/s) impacts that produced a fully ionized plasma.

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Date submitted: 18 Jul 2017 Electronic form version 1.4