Abstract Submitted
for the OSF09 Meeting of
The American Physical Society

Plasma sheath around a large disk and associated sheath area
T.E. SHERIDAN, Ohio Northern University — The structure of the plasma sheath around a thin, circular disk biased below the plasma potential is calculated by allowing a pulsed sheath to relax to a steady-state configuration using a hybrid code with cold, kinetic ions and Boltzmann electrons. The sheath area A_s (i.e., the effective collecting area of the disk) is calculated for disk radii from 25 to 200 times the electron Debye length and biases from -5 to -50 times the electron temperature (in eV). The normalized sheath area, $A_s/A_p - 1$, where A_p is the disk's area, is found to have a power law dependence on both bias and radius over the range of values considered. An empirical analytical expression is given for the sheath area as a function of radius and bias, and the asymptotic behavior for large radius is identified. This work is directly applicable to the problem of ion collection by planar disk Langmuir probes.

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Date submitted: 16 Sep 2009 Electronic form version 1.4