Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

On improving impedance probe plasma potential measurements in low density plasma[1] DAVID WALKER, Sotera, Inc, DAVID BLACKWELL, RICHARD FERNSLER, WILLIAM AMATUCCI, Plasma Physics Division, Naval Research Laboratory — We have used impedance probes of various sizes and shapes in demonstrating a method of determining plasma potential, φ_p, when the probe radius is much larger than the Debye length. The method[2,3] relies on applying a small amplitude ac signal to a probe in a plasma and measuring the complex reflection coefficient, Γ, as a function of varying probe bias, V_b. $\mathrm{Re}(Z_{ac})$ (the real part of the ac plasma impedance determined from Γ) is plotted versus V_b, and a minimum predicted by theory occurs at φ_p for a large range of electron density, n_e.[4] However, the frequency range of the applied signal is restricted and as n_e decreases it becomes even more restrictive. In addition, the minimum in $\mathrm{Re}(Z_{ac})$ ($\sim 1/n_e$) becomes more difficult to discern. Here, we suggest additional means to isolate φ_p. These measures (1) incorporate Γ to search for a minimum, (2) use not only the first derivative of $\mathrm{Re}(Z_{ac})$, but also that of $\mathrm{Im}(Z_{ac})$ with respect to V_b and, (3) use the second derivatives of both. With the additional indicators, φ_p is more easily detected in low density plasma. We present data for cylinders, spheres and a disk. *Phys. Plasmas* **17**, 113503 (2010). *NRL Memorandum Report 6750-12-9413* (2012).

[1]This work supported by the Naval Research Laboratory Base Program
[2]*Phys. Plasmas* **17**, 113503 (2010).
[3]*NRL Memorandum Report 6750-12-9413* (2012).
[4]*Phys. Plasmas* **17**

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Date submitted: 10 Jul 2013 Electronic form version 1.4