Abstract Submitted
for the GEC05 Meeting of
The American Physical Society

Asymmetry reversal of ion collection by Mach probe in flowing unmagnetized plasma[1] EUNSUK KO, XU WANG, NOAH HERSHKOWITZ, Dept. of Engineering Physics, University of Wisconsin - Madison, GREGORY SEVERN, Dept. of Physics, University of San Diego — Mach probes derive ion drift velocity in flowing plasma from the asymmetry of ion current collection by measuring upstream and downstream flux. Intuitively it is expected that the ion flux density on the upstream side of the Mach probe is higher compared to the downstream side. Hutchinson's numerical calculation[2] of a sphere in unmagnetized plasma found unexpected result that the downstream flux was higher than the upstream flux for relatively low drift velocity v_d, comparable Debye length λ_D to the probe size r_p, high probe bias V_p. We found experimental evidence for such a reversal when $\lambda_D/r_p \sim 0.18$, $v_d < 2.7c_s$, where c_s is the ion sound velocity, and $V_p > 20T_e$. The experiments were performed in a double plasma system with $v_d \leq 4.5c_s$ and Ar pressure range of $0.3 \sim 0.6$mTorr and a plasma density range of $10^8 \sim 10^{10}\text{cm}^{-3}$. The supersonic ion drift was determined from ion beam detection[3] using the upstream planar Mach probe, and the ion beam energy was found to agree with Ion energy analyzer measurements.

[1]Work Supported by US DOE grant no. DE-FG02-97ER 54437.
[2]I. H. Hutchinson, Plasma Phys. Control. Fusion **45**, 1477 (2003)
[3]Wim. J. Weber, Richard J. Armstrong, and Jan Trulsen, J. Appl. Phys. **50** (7), 4545 (1979)

Eunsuk Ko
Dept. of Engineering Physics, University of Wisconsin-Madison

Date submitted: 16 Jun 2005 Electronic form version 1.4