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Phase-Coherent Measurement of Particle Distributions in Electron Acoustic Waves.[1] C.F. DRISCOLL, F. ANDEREGG, R.B. LYNCH, UCSD — Phase-coherent velocity distribution functions $f(\mathrm{v}_z)$ are measured by Laser Induced Fluorescence, for standing "electron acoustic" waves in pure ion plasmas. These (mis-named) waves are the lower-frequency branch of standard electrostatic plasma waves, with phase velocity $\mathrm{v}_\phi \approx 1.3\bar{\mathrm{v}}$. The waves are necessarily nonlinear so as to flatten the distribution at v_ϕ, thereby voiding the otherwise strong Landau damping. Our measurements are performed on $m_\theta = 0$, $m_z = 1$ waves driven to moderately large amplitude, i.e. $e\delta\phi \geq 0.1T$. Received LIF photons are accumulated in 8 phase bins, according to the instantaneous received phase of the wall electric field. The phase-coherent $f(\mathrm{v}_z)$ shows 1) particle sloshing, $\delta\langle\mathrm{v}\rangle$, as expected; 2) phase reversal of δf at $\mathrm{v} = 0$ and $\mathrm{v} = \mathrm{v}_\phi$, in general correspondence with the linear perspective of $\delta f = (\delta f_0/\partial\mathrm{v})/(\mathrm{v} - \mathrm{v}_\phi)$; and 3) plateaux around v_ϕ with velocity widths as expected from wave-trapping theory. Measurements will be compared to traveling wave trapping theory and to standing wave particle simulations.

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