Abstract Submitted
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Electron Acoustic Waves in Pure Ion Plasmas[1] F. ANDEREGG, C.F. DRISCOLL, D.H.E. DUBIN, T.M. O'NEIL, UCSD — Electron Acoustic Waves (EAW) are the low frequency branch of electrostatic plasma waves. These waves exist in neutralized plasmas, pure electron plasmas and in pure ion plasmas[2] (where the name is deceptive). Here, we observe standing $m_\theta = 0$ $m_z = 1$ EAWs in a pure ion plasma column. At small amplitude, the EAWs have a phase velocity $v_{ph} \simeq 1.4\overline{v}$, and the frequencies are in close agreement with theory. At moderate amplitudes, waves can be excited over a broad range of frequencies, with observed phase velocities in the range of $1.4\overline{v} \leq v_{ph} \leq 2.1\overline{v}$. This frequency variability comes from the plasma adjusting its velocity distribution so as to make the EAW resonant with the drive frequency. Our wave-coherent laser-induced fluorescence diagnostic shows that particles slower than v_{ph} oscillate in phase with the wave, while particles moving faster than v_{ph} oscillate 180° out of phase with the wave. From a fluid perspective, this gives an unusual negative dynamical compressibility. That is, the wave pressure oscillations are 180° out of phase from the density oscillations, almost fully canceling the electrostatic restoring force, giving the low and malleable frequency.

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[2]F. Anderegg *et al.*, PRL **102**, 095001 (2009) and PoP **16**, 055705 (2009).

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