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Experimental Investigation of Electron Acoustic Waves in Electron Plasmas.[1] A.A. KABANTSEV, C.F. DRISCOLL, UCSD — Electron-acoustic wave (EAW) solutions of the linearized electrostatic Vlasov equations are usually ignored because their small phase velocity implies a huge linear damping. However, recent nonlinear theory and simulations[2,3] found that electrons trapped in wave potentials result in long-lived BGK states at the EAW mode frequency. Experimentally, the predicted modes are readily observed on pure electron plasmas, when they are excited by weak wall voltages which are resonant over ∼100 cycles. The modes have phase velocity $v_\phi \approx 1.3 v_{th}$, in close agreement with theory; and the long-wavelength BGK states exhibit only weak damping ($-\gamma/\omega \leq 0.01$) due to electron-electron collisions. The mode frequencies are unambiguously calibrated by comparison to electron plasma wave frequencies. Discrete standing modes are observed, but modes with $m_z = 2, 3...$ show a strong decay instability into $m_z = 1$. This instability corresponds to a merger of vortices in (z, v_z) phase space, which can be suppressed (or enhanced) by application of potential barriers (or wells) between the high m_z wavelengths.

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[2]J.P. Holloway and J.J. Dorning, Phys. Rev. A. **44** 3856 (1991).
[3]F. Valentini, T.M. O'Neil, D.H.E. Dubin, Phy Plas **13**, 052303 (2006).

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