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The Influence of Trapped Particles on the Parametric Decay Instability of Near-Acoustic Waves[1] M. AFFOLTER, F. ANDEREGG, D.H.E DUBIN, C.F. DRISCOLL, University of California, San Diego — We present quantitative measurements of a decay instability to lower frequencies of near-acoustic waves. These experiments are conducted on pure ion plasmas confined in a cylindrical Penning-Malmberg trap. The axisymmetric, standing plasma waves have near-acoustic dispersion, discretized by the axial wave number $k_z = m_z(\pi/L_p)$. The nonlinear coupling rates are measured between large amplitude $m_z = 2$ (pump) waves and small amplitude $m_z = 1$ (daughter) waves, which have a small frequency detuning $\Delta\omega = 2\omega_1 - \omega_2$. Classical 3-wave parametric coupling rates are proportional to pump wave amplitude as $\Gamma \propto (\delta n_2/n_0)$, with oscillatory energy exchange for $\Gamma < \Delta\omega/2$ and decay instability for $\Gamma > \Delta\omega/2$. Experiments on cold plasmas agree quantitatively for oscillatory energy exchange, and agree within a factor-of-two for decay instability rates. However, nascent theory suggest that this latter agreement is merely fortuitous, and that the instability mechanism is trapped particles. Experiments at higher temperatures show that trapped particles reduce the instability threshold below classical 3-wave theory predictions.

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