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Nonlinear Spatial Landau Damping of Plasma Waves Beating at Plasma Angular Velocity[1] A.A. KABANTSEV, C.F. DRISCOLL, UCSD — Experiments on pure electron plasmas characterize the nonlinear beat between two counter-propagating plasma waves, and the spatial Landau damping of the beat wave at the wave/rotation critical radius. The two plasma waves are $(m_\theta = 1, k_z = 1, \omega = \omega_* \pm \omega_1)$, giving the beat wave with $(m_\theta = 2, \omega = 2\omega_*)$. The beat wave is resonant with the plasma rotation $\Omega(r)$ at radius r_* where $\Omega(r_*) = \omega_*$. The net effect of this resonance is an energy exchange through wave-particle interaction between the two primary plasma waves and the background plasma rotation. Initial excitation of only one of the waves leads first to its fast sharing of energy with the other wave, and then followed by a slower combined decay of both waves. In contrast, initial excitation of both waves to (approximately) the same amplitude leads to three alternative scenarios: 1) both plasma waves may show the slow and synchronous decay evolution; 2) one of the waves may decay faster, with temporarily arrested decay of the other; 3) it may switch back and forth (seemingly randomly) between the first two types of evolution. Interestingly, wave/particle energy flow can be *reversed* when the plasma density profile is made to have a positive density gradient at r_*. In this case, spontaneous excitation (instability) of both $\omega = \omega_* \pm \omega_1$ plasma waves is observed.

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