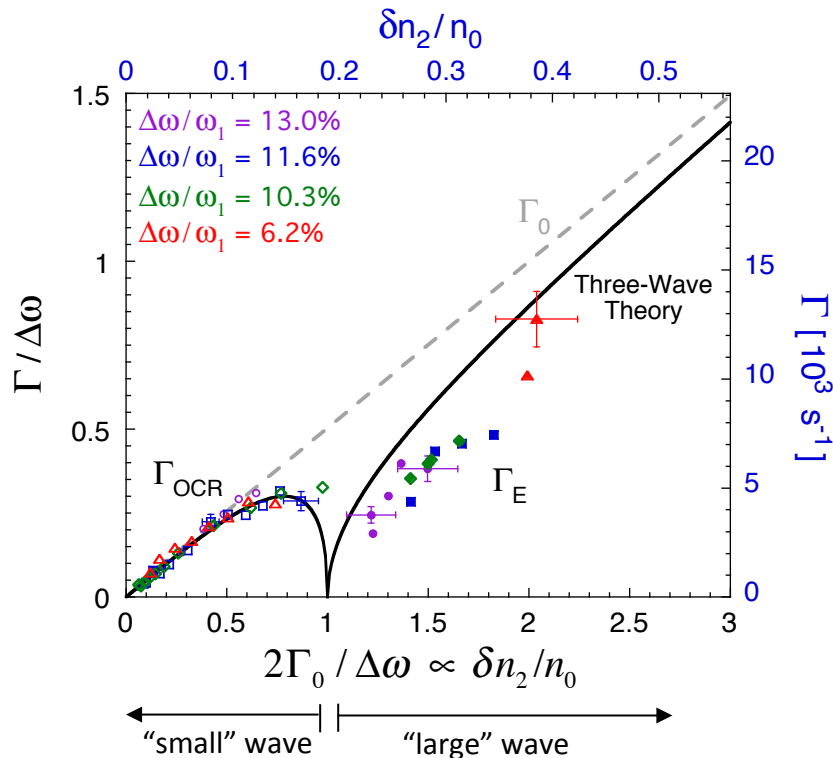
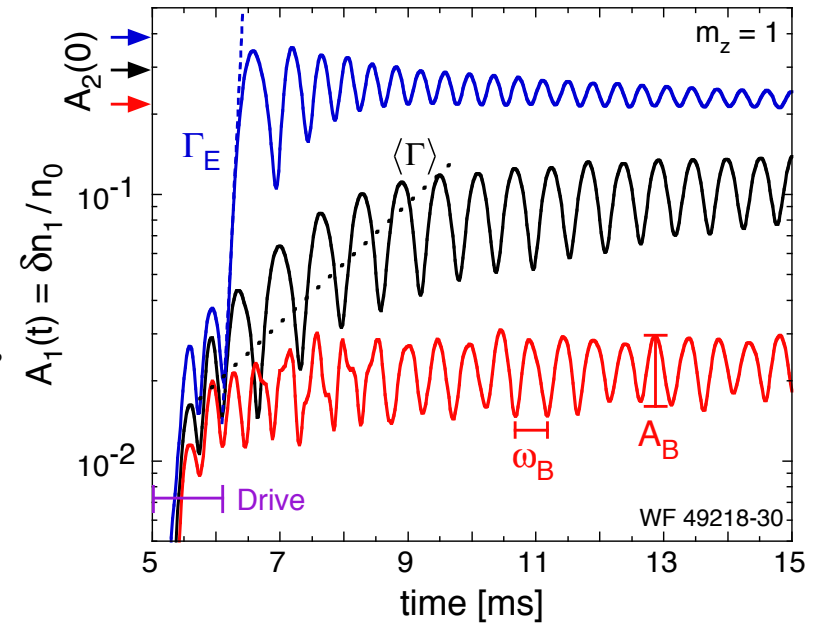


Decay Instability of Near-Acoustic Plasma Waves

Experiments investigating large amplitude, near-acoustic Langmuir waves have provided the first quantitative measurements of wave-wave coupling rates and the decay instability. The $m_z = 2$ pump wave and $m_z = 1$ daughter wave with $\cos(m_z \pi z / L_p)$ axial dependence have a slight frequency detuning $\Delta\omega = 2\omega_1 - \omega_2$, which is fundamental to the wave-wave interaction. For small pump wave amplitudes (red curve), this detuning causes the daughter wave amplitude to “bounce” at a frequency near $\omega_B \approx \Delta\omega$ as energy is exchanged between the pump and daughter wave at a rate Γ_{OCR} .



In contrast, for large pump wave amplitudes (blue curve), phase-locked exponential growth of the daughter wave at a rate Γ_E is observed. This oscillatory coupling (open symbols) and exponential growth (closed symbols) rates are in quantitative agreement with cold fluid, three-wave theory. However, significant variations are observed near the decay threshold, including slow oscillatory growth of the daughter wave (black curve). These experimental results have motivated wide-ranging theory and simulations, which provide both insights and puzzles.