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Parametric Decay of Nonlinear Waves Driven by Weakly-Trapped Particles[1] DANIEL DUBIN, University of California, San Diego — Parametric instabilities, in which longer-wavelength waves grow on a shorter-wavelength nonlinear wave, are endemic in plasmas. This poster discusses a new instability mechanism[2] caused by a distribution of particles that is weakly-trapped in the potential wells of the nonlinear wave, with energies just below the potential maxima (appearing as phase space rings or holes). Such distributions are common in nonlinear plasma waves. The new theory predicts detrapping and retrapping of such particles that leads to a negative adiabatic compressibility, destabilizing the wavetrain with respect to relative motion of the potential peaks. Simulations of electrostatic Trivelpiece-Gould [TG] traveling waves observe this effect with growth rates in agreement with the theory. Experiments on large amplitude TG standing waves also observe parametric decay, with temperature dependence of the decay rate pointing to the trapped particle effect. New r-z simulations in realistic geometry yield similar parametric decay rates compared to experiments. When trapped particles are removed in the simulations, the instability is suppressed.
[2]D. Dubin, Phys. Rev. Lett. **121**, 015001 (2018); M. Affolter et al., Phys. Rev. Lett. **121**, 235004 (2018).

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