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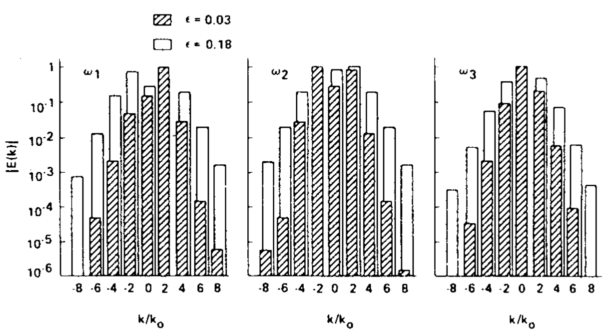
Chen

LASER DRIVEN MODE COUPLING OF ION AND ELECTRON WAVES

Francis F. Chen
University of California, Los Angeles, CA 90024, U.S.A.

When stimulated Raman scattering (SRS) and stimulated Brillouin scattering (SBS) occur simultaneously in a plasma, the plasma waves excited by SRS must exist in a medium whose density has been modulated by the ion wave. In that case, the plasma wave develops other values of wavenumber $\mathbf{k}$ via mode coupling to the ion wave. Barr and Chen[1] have previously computed the k-spectrum of the lowest three resulting frequencies, ω_1, ω_2, and ω_3, where ω_1 is the normal SRS-generated plasma wave, and ω_2 and ω_3 are new waves produced by mode coupling. The spectra are shown belowfor ripple amplitudes of 3 and 18%. Note that the normal (uncoupled) value of k/k_o is 2, and that the mode ω_2 has a dominant k value of -2; that is, it propagates back toward the pump laser. The strange fact that the coupled mode at k = -2 is larger than the driving mode at k = 2 has been explained by Chen[1].

The backward wave has now been detected by Umstadter *et al.*[2] in an SRS experiment using a 10-J, 2-nsec CO_2 laser. It shows up as a blue-shifted satellite on the backscattered CO_2 signal and also as a blue satellite on the scattered light from an independent ruby laser Thomson scattering system. The measured amplitude of 4% of the fundamental k = 2 mode is consistent with the results of Barr and Chen for an ion ripple of 3-10%. Since ω_1, ω_2, and ω_3 could not be resolved, the comparison is made with the sum of the graphs below. Thus, the unexpected prediction that mode coupling can create a relatively large wave propagating counter to the driven wave has apparently been verified.



1. H.C.Barr and F.F.Chen, Phys. Fluids 30, 1180 (1987).
2. D.Umstadter, W.Mori, and C.Joshi, Phys. Fluids, 1988, *to be published*.

Nonlinear Phenomena in Vlasov Plasmas
F. Doveil Ed., Editions de Physique, Orsay, 1989