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Nonlinear frequency shift on an electron plasma wave : hysteresis, nonlocality and multidimensional effects in an inhomogeneous plasma DIDIER BENISTI, CEA — We provide a general derivation of the nonlinear frequency shift, $\delta\omega$, for a sinusoidal electron plasma wave (EPW) that varies slowly enough for neo-adiabatic theory to apply. We first consider the situation when the EPW monotonously grows and then monotonously decays in a homogeneous plasma. In this situation, we show a hysteresis in the wave frequency, which does not converge back to its linear value as the wave decays to small amplitudes. We then address the derivation of $\delta\omega$ for an EPW that keeps growing in a one-dimensional (1-D) inhomogeneous plasma. We show that, usually, the frequency shift does not only depend on the local EPW amplitude and wavenumber. It also depends on the whole history of the density variations, as experienced by the wave. In a multidimensional inhomogeneous plasma, the values assumed by $\delta\omega$ are usually different from those derived in 1-D because, due to the transverse electron motion, one must account for the hysteresis in $\delta\omega$ in addition to plasma inhomogeneity. Hence, unless the EPW keeps growing in a homogeneous 1-D plasma, one cannot derive $\delta\omega$ a priori as a function of the local wave amplitude and wavenumber. Due to the nonlocality in the action distribution function, $\delta\omega$ depends on the whole history of the variations of the EPW amplitude and plasma density.

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