

Problem Set # 11 (due Thursday Jan. 13, 2005)

G&R refers to Goldston and Rutherford's textbook.

1. G&R problem 23.4. Kinetic ion acoustic wave.

2. G&R problem 23.5. Another version of a two-stream instability.

3. Phase-mixing. Consider the kinetic equation for a 1-D non-interacting gas, $\partial f/\partial t + v\partial f/\partial z = 0$ (i.e., ignoring the electric field in a plasma). Solve this for the initial condition

$$f(z, v, t = 0) = F_0(v)(1 + \alpha \cos(kz)),$$

where $F_0(v) = n_0/(2v_0)$ for $|v| < v_0$, and $F_0(v) = 0$ otherwise. Calculate the density $n(z, t)$, and sketch the amplitude of the $\cos(kz)$ component of the density vs. time. Repeat this for the case of a "tent-function" form for $F_0(v) = n_0/(2v_0)(1 - |v|/(2v_0))$ for $|v| < 2v_0$, $F_0(v) = 0$ otherwise.