

Due April 4

1. In Brillouin scattering light amplifies sound waves rather than plasma waves. Thus, the ion response to the low frequency wave must be included. The high frequency waves are unchanged.
 - (a) Derive the dispersion relation for the back-scattering of light waves off of sound waves (Brillouin scattering). You may continue to use the ponderomotive force as in the Raman problem (you don't have to re-derive this). Take the ions to be cold and the electrons to be isothermal.
Hint: The electromagnetic waves still only respond to the electron density perturbation as calculated in class so the key is to compute the electron density perturbation associated with the sound wave while including the ponderomotive force of the high frequency waves.
 - (b) Calculate the growth rate under the assumption that the growth rate is smaller than the frequency of the sound wave. Then consider the case in which the growth rate exceeds the ion sound frequency. Contrast the scaling of the growth rate with the amplitude of the pump in the two cases.
Hint: For both assume that $k \ll k_{De}$. For the former assume that $\gamma \ll kc_s$. For the latter assume that $kc_s \ll \gamma \ll \omega_{pi}$.