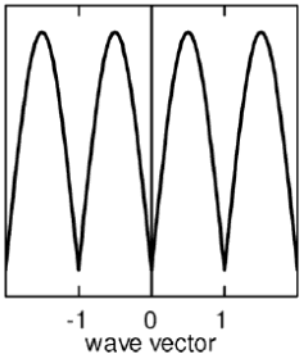
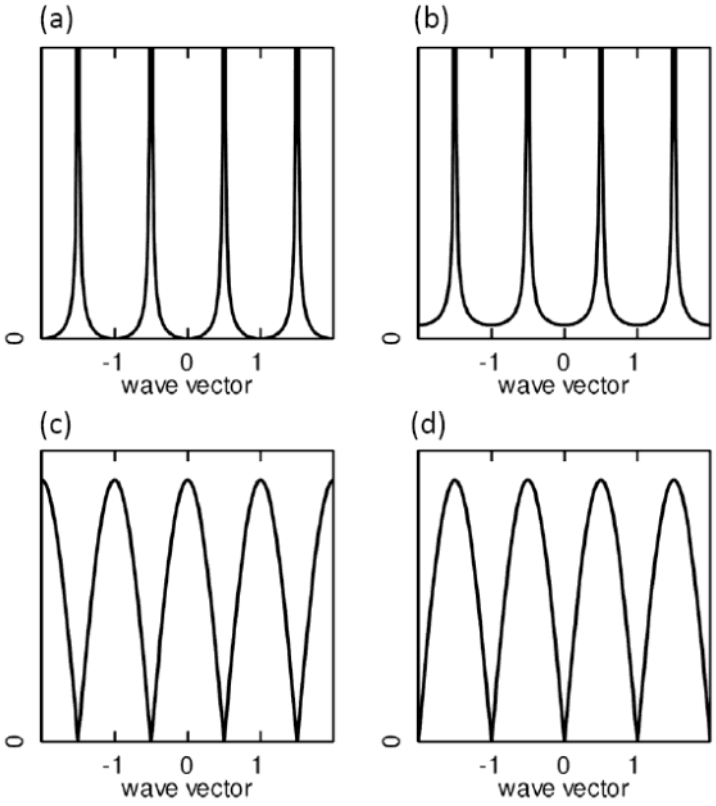
Quiz 5

Thursday, February 17, 2011

Your name:

1. [10 points] The following figure shows a dispersion relation in a one dimensional crystal. Which one is the correct density of states for the dispersion relation? Briefly explain why.





[flip over for the 2nd problem, please]

2. [10 points] Some "manganites" $La_{1-x}Ca_xMnO_3$ become ferro-magnetic metals at low temperatures ($< 10\ K$), and show a specific heat component $\propto T^{3/2}$. Explain why this behavior is likely due to bosons (collective modes such as spin waves or phonons) rather than fermions (electrons). What is the exponent α, if we assume that the boson dispersion relation $\omega_k \propto |k|^{\alpha}$? What would you conclude as to the nature of the boson, phonon or spin wave?