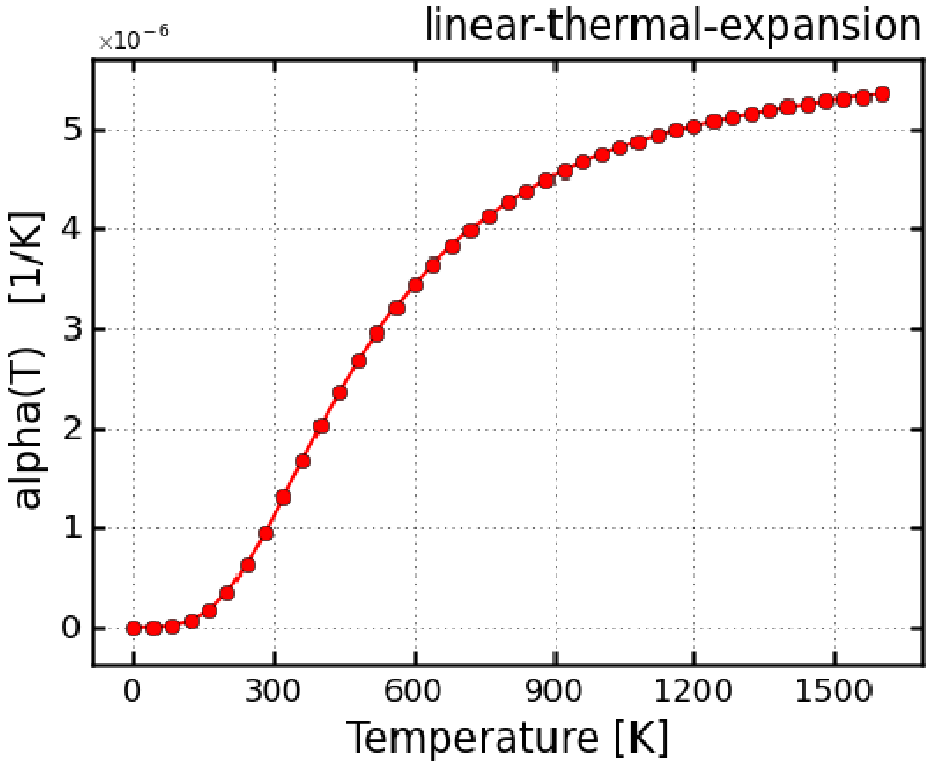
Homework # 5; due Thursday, April 4

21. In the in-class presentation of Kevin Babb and Petar Petrov (posted on the class web page) on the third viewgraph, the authors state the density of states (DOS) for a three-, two-, and one-dimensional metal. Please verify (derive) these expressions. Hint: we have essentially done one of these cases in lectures.

22. What is the physical reason for the phenomenon of thermal expansion of solids? The figure below (from http://exciting-code.org/) shows the coefficient of thermal expansion (CTE) of diamond as a function of temperature. Explain why this quantity vanishes at low temperatures.



23. Derive the expression for the *Hall coefficient,* $R_{H,}$ in terms of the density of charge carriers in a solid and the charge of a single carrier. Assuming a single-valence metal with the density of silver,
    a. calculate the value of $R_{H,}$ in SI units.
    b. Compare this value with experiment.
    c. What is the Hall voltage across a 1 cm slab of the material if the current density is j = 1 A/mm^2 and the magnetic field applied transversely to the current is 1 T?

24. Show that the number of modes in each Brillouin zone in a metal is equal to the number of unit cells in the crystal lattice.