

0. Spin half paramagnet entropy
1. Simple harmonic oscillator
2. Combining two independent aspects of a system
3. 3D SHM
4. application to crystal vibrations
5. Rotator
6. Equipartition theorem

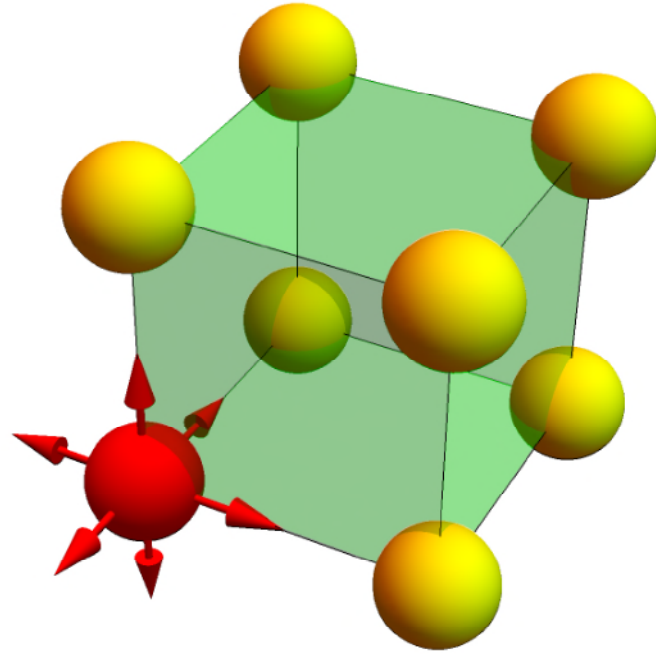
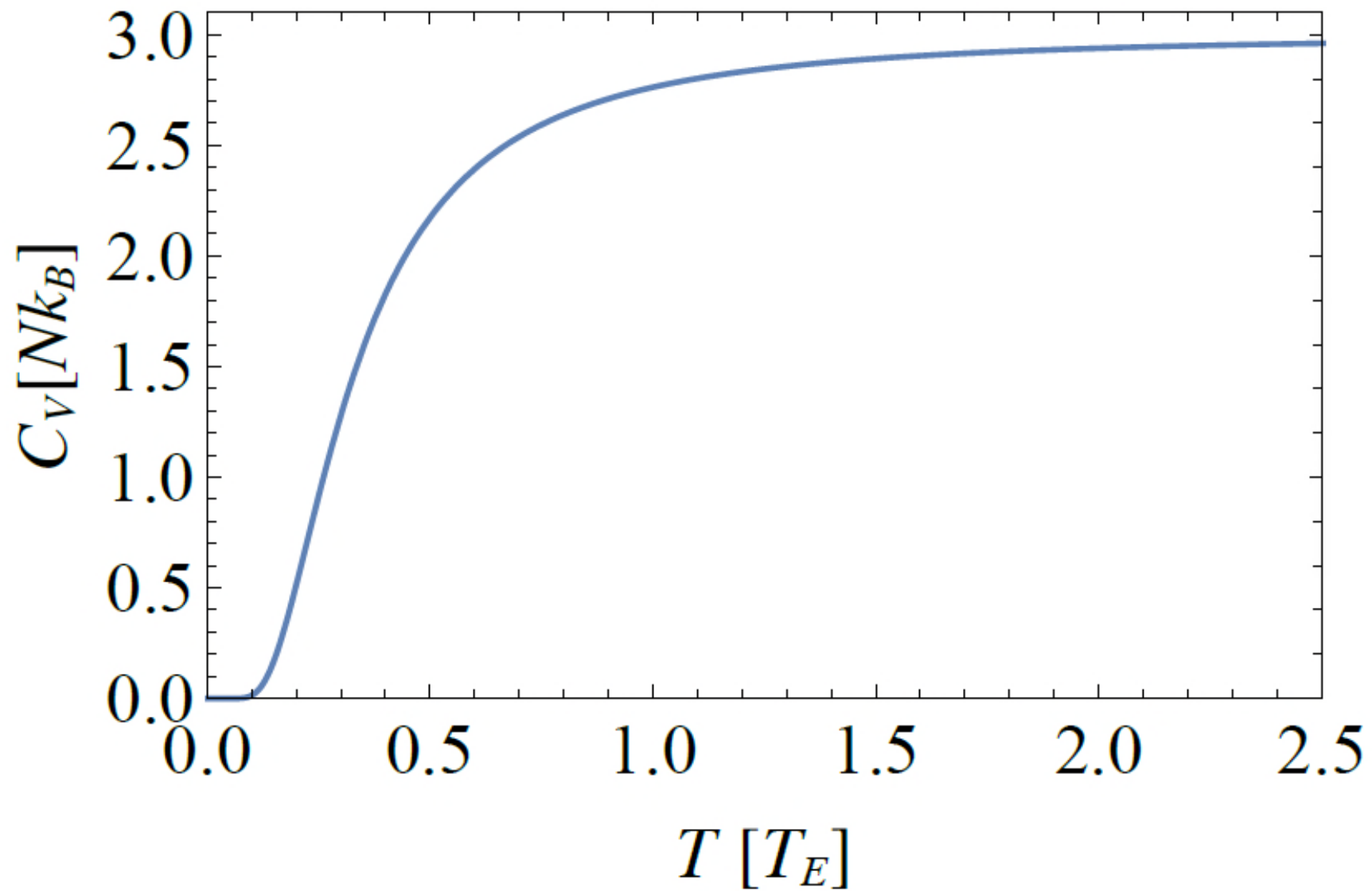


Diagram to illustrate the idea of an atom in a crystal vibrating around its equilibrium position. (Of course, all the atoms vibrate in practice, not just one!)



Heat capacity of a 3-dimensional crystal owing to vibrations, according to a simple model (the Einstein model) which only allows for one vibrational frequency.

Theorem 8.1 Equipartition theorem. *Each independent quadratic term in the Hamiltonian makes a contribution $\frac{1}{2}k_{\text{B}}T$ to the mean internal energy in thermal equilibrium when the associated motion is highly excited.*