Phonons

Explained By

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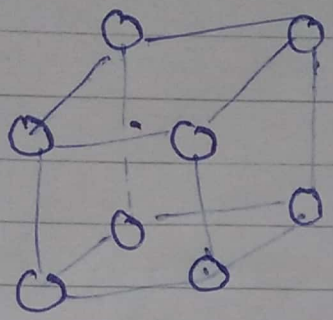
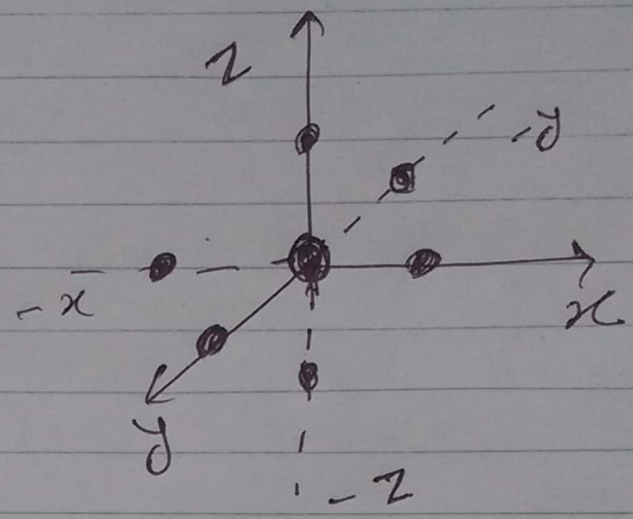
Phonons

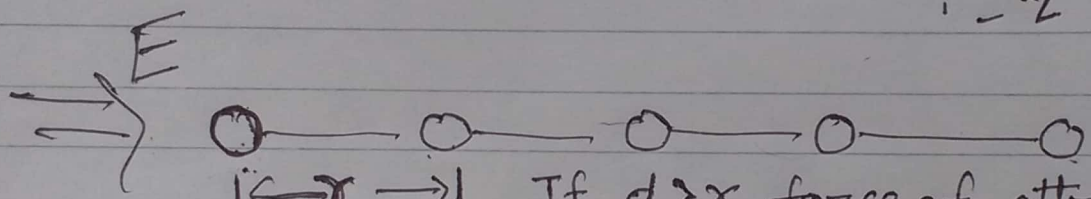
1) Solid crystal, consists of atoms bound into a specific repeating three-dimensional spatial pattern called a lattice.
2) The material shows elastic behaviors in atomic level. The bonds between atoms and intermolecular bonds are elastic.
3) The atoms act as if they are coupled by a springs. Thermal energy or outside forces causes the atoms and molecules to oscillate.
4) This generates mechanical waves that carry heat and sound through the material.
5) A packet of these waves can travel throughout the crystal with a definite energy and momentum.

6) These waves are treated as a particle called Phonons.
7) A phonon can be defined as a discrete unit of vibrational mechanical energy. Phonons exist with discrete amount of energy, given by $E = \hbar\omega = hf$.
8) A phonon quanta of lattice vibration., just as a photon is a quantum of electromagnetic or light energy.
9) Phonons play a major role in many of the physical properties of condensed matter, such as thermal conductivity and electrical conductivity.
10) The study of phonons is an important part of condensed matter physics.

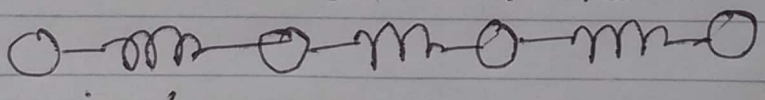
Phonons





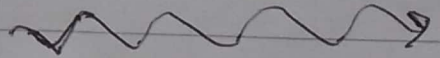


If $d > r$ force of attraction.
If $d < r$ force of repel.



Phonon $E = \hbar\omega$

Photon



$E = h\nu$