230(1): Influence of Phonon Assumption on LENR.

Ref. R. Eisberg and R. Resnick, "Quantum Physics", (Wiley, 1985, 2nd. ed., p. 399).

Phonons are quanta of acoustic radiation and are emitted and absorbed by vibrating atoms in a solid lattice. They are conventionally massless and:

$$E = \hbar \omega \quad -(1)$$

where ω is the angular frequency of the acoustic vibration. The phonon propagates through the crystal lattice, which contains a gas of phonons. The dispersion relation is:

$$\omega = v\kappa \quad -(2)$$

where v is the speed of sound.

Now consider eq. (24) of UFT 229 in the presence of a phonon:

$$T = \frac{4}{\left(2\theta + \frac{1}{2\theta}\right)^2} \quad -(3)$$

$$\theta = \exp\left(\left(\frac{2\mu}{\hbar}\right)^{1/2}\int_a^b \left(V(r) - E\right)^{1/2} dr\right) \quad -(4)$$

with the potential function $V(r)$ defined as in

2) eq. (27) of 4FT229.

The absorption of a phonon means that:

$$E \rightarrow E + \hbar\omega \quad - (5)$$

i.e

$$E_1 = E_0 + \hbar\omega \quad - (6)$$

Resonant phonon absorption occurs at:

$$\omega = (E_1 - E_0)/\hbar \quad - (7)$$

At the frequency ω the transmission coefficient changes to:

$$T_1 = \frac{4}{\left(2\theta_1 + \frac{1}{2\theta_1}\right)^2} \quad - (8)$$

where:

$$\theta_1 = \exp\left(\left(\frac{2\mu}{\hbar}\right)^{1/2} \int_a^b \left(V(r) - E - \hbar\omega\right)^{1/2} dr\right) \quad - (9)$$

The wavelength of a phonon is about 10^{-10} m, and they are quantized normal modes of lattice vibration.

In n phonon absorption:

3)

$$E \rightarrow E + n\hbar\omega \quad (10)$$

where:

$$n = 1, 2, 3, \ldots \quad (11)$$

so:

$$T_n = \frac{4}{\left(2\theta_n + \frac{1}{2\theta_n}\right)^2} \quad (12)$$

where:

$$\theta_n = \exp\left(\left(\frac{2\mu}{\hbar}\right)^{1/2} \int_a^b \left(V(r) - (E + n\hbar\omega)\right)^{1/2} dr\right) \quad (13)$$

At the point:

$$E + n\hbar\omega = V(r) \quad (14)$$

then

$$T_n = \frac{4}{2.5^2} = 0.64. \quad (15)$$

This occurs at the point:

$$\boxed{\omega = \frac{V - E}{n\hbar}} \quad (16)$$

If:

$$E \ll V \quad (17)$$

then:

$$\omega \sim \frac{V}{n\hbar} \quad (18)$$