Answer on Question #64028-Physics-Atomic and Nuclear Physics

The surface of Lithium of work function ϕ is illuminated by electromagnetic radiation whose electric field component varies with time as a=(1+Cos(omega)t)Cos(omega0)t . The maximum kinetic energy of photo electron liberated from surface is?

Solution

$$a = (1 + cos(\omega)t)cos(\omega_0)t = cos(\omega_0)t + cos(\omega)t\ cos(\omega_0)t$$

Using trigonometric identity:

$cos(\omega)t\ cos(\omega_0) = \frac{1}{2}(cos(\omega + \omega_0)t + cos(\omega - \omega_0)t).$

Thus,

$$a = cos(\omega_0)t + \frac{1}{2}cos(\omega + \omega_0)t + \frac{1}{2}cos(\omega - \omega_0)t)$$

The maximum angular frequency is $(\omega + \omega_0)$.

The maximum frequency of electromagnetic radiation is

$$f = \frac{(\omega + \omega_0)}{2\pi}.$$

The maximum kinetic energy of photo electron liberated from surface is

$$K = h\frac{(\omega + \omega_0)}{2\pi} - \phi = \hbar(\omega + \omega_0) - \phi.$$