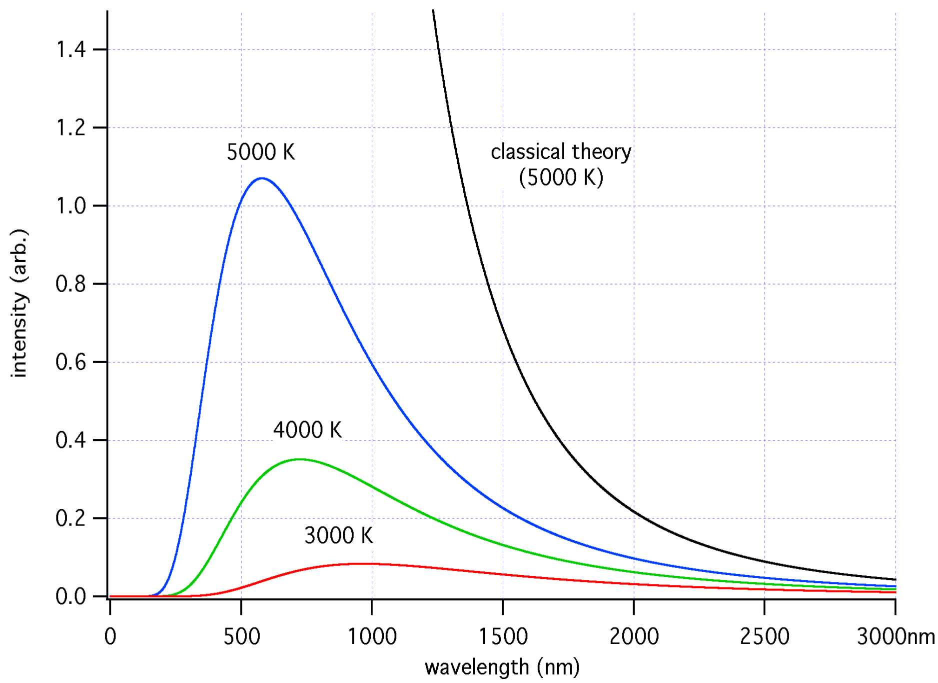
- Faraday's law

$$\oint \vec{E}\, d\vec{l} = -\frac{d}{dt}\int \vec{B}\cdot d\vec{a}$$

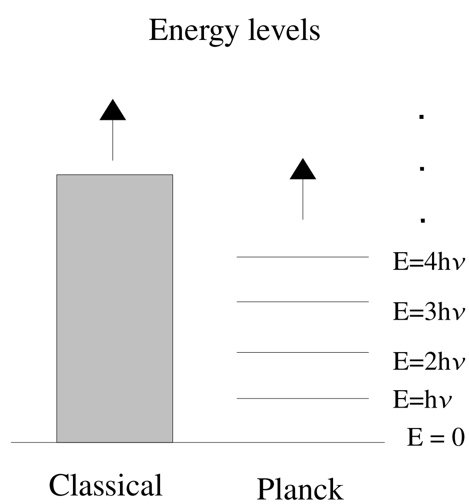
- Thermal Radiation (Blackbody Radiation)



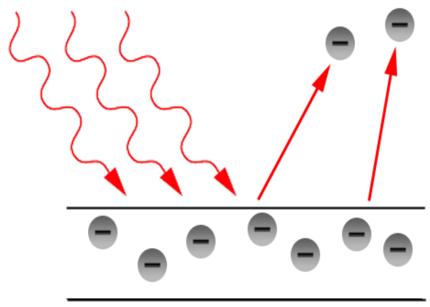
Intensity: $I(T) = \int_0^{\infty} R(\lambda, T)\, d\lambda \qquad R(\lambda, T) = \frac{dI(T)}{d\lambda}$

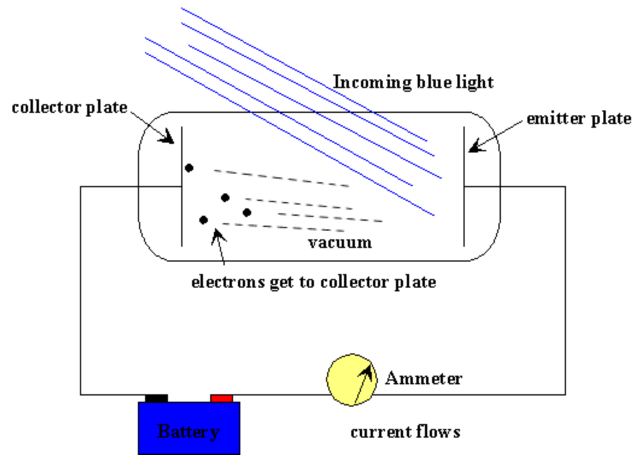
Planck's postulate : $E = h\nu$

The average energy : $\bar{E}(\nu) = \frac{\sum_{n=0}^{\infty} E\, P(E)}{\sum_{n=0}^{\infty} P(E)} = \frac{h\nu}{e^{h\nu/k_B T} - 1}$



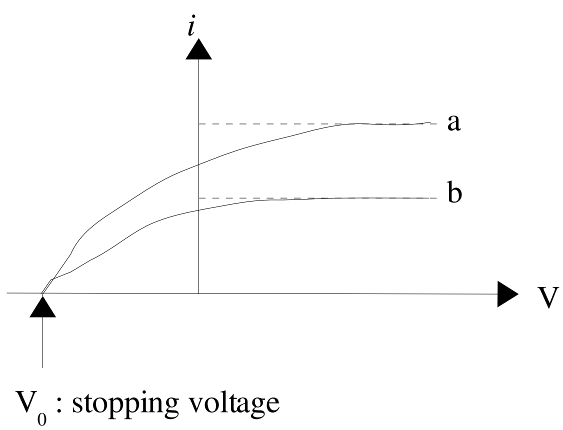
- Photoelectric Effect



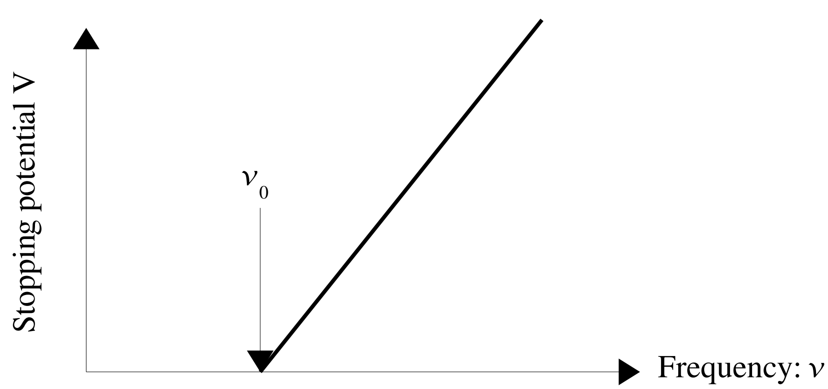


Characteristic curve:

(1) *I*-V curve



(2) V-ν curve



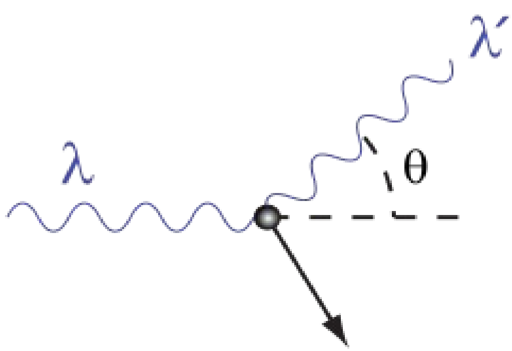
Einstein's explanation:

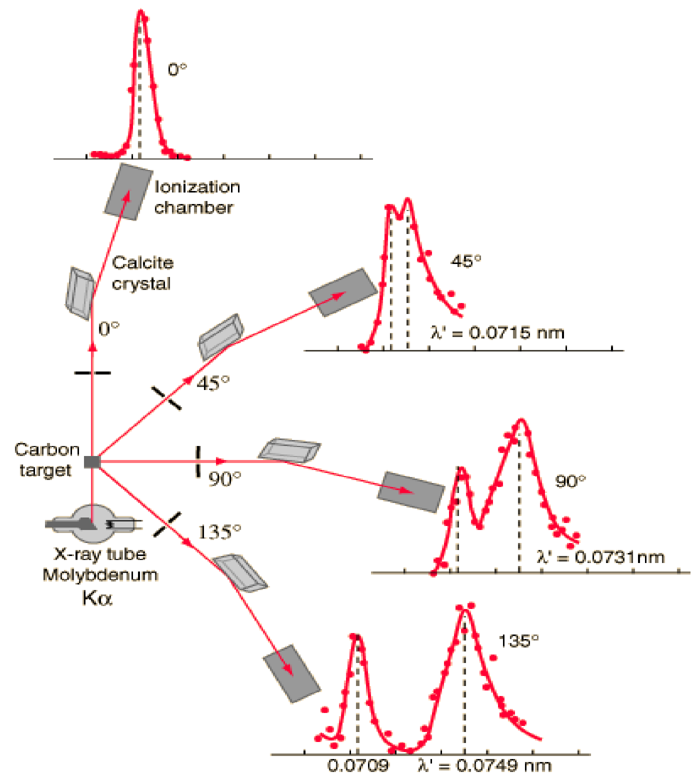
$K = eV - W$ W: work required to remove one electron from the material

$\therefore \quad K_{max} = h\nu - W_0$

W_0 is called the work function, which is the minimum energy needed by an electron to pass through the metal surface and escape the attractive Coulomb force binding the electron.

- Compton X-ray scattering:





(i) Conservation of momentum:

$$p_0 = p_1 \cos\theta + p\cos\phi$$

(ii) Conservation of (relativistic) Energy:

$$E_0 + m_0 c^2 = E_1 + K + m_0 c^2$$

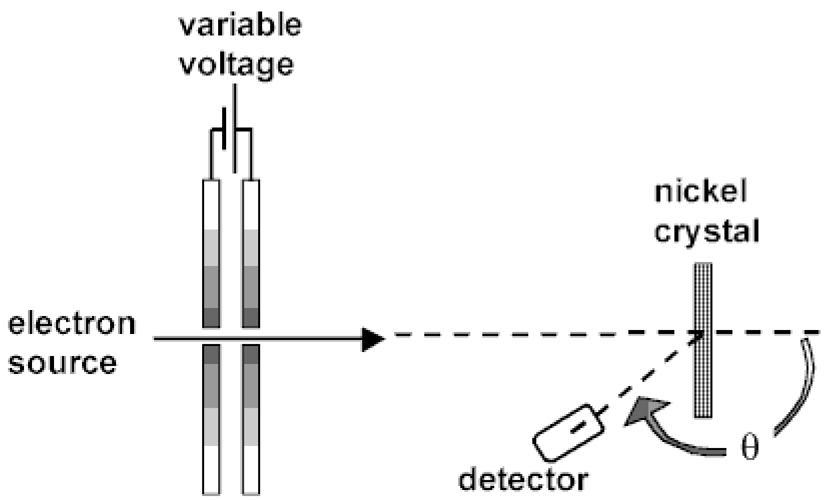
$\Rightarrow$

$$\lambda_1 - \lambda_0 = \frac{h}{m_e c}(1 - \cos\theta)$$

- de Broglie's postulate: particle-wave duality

de Broglie wavelength (mater wave) associated with a particle: $\lambda = \frac{h}{p}$

- Davisson-Germer Experiment: proof of de Broglie's postulate



Bragg relation: $n\lambda = 2d\sin\theta$