Quantum Mechanics

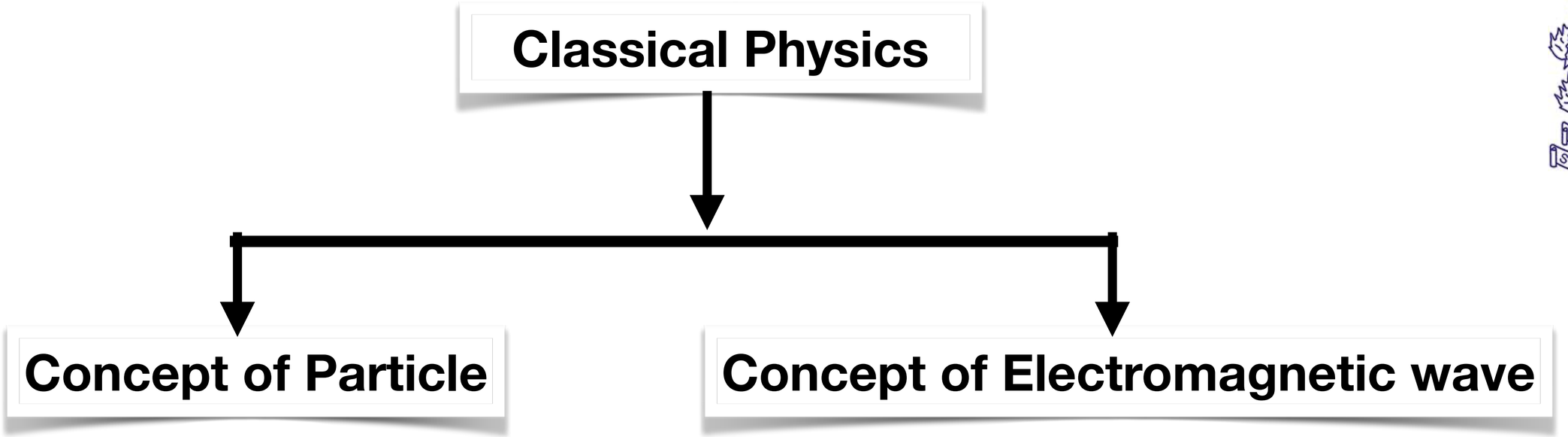
Lecture Series by Dr Prince A Ganai

Btech- Course

Department of Physics NIT Srinagar

Lecture 01

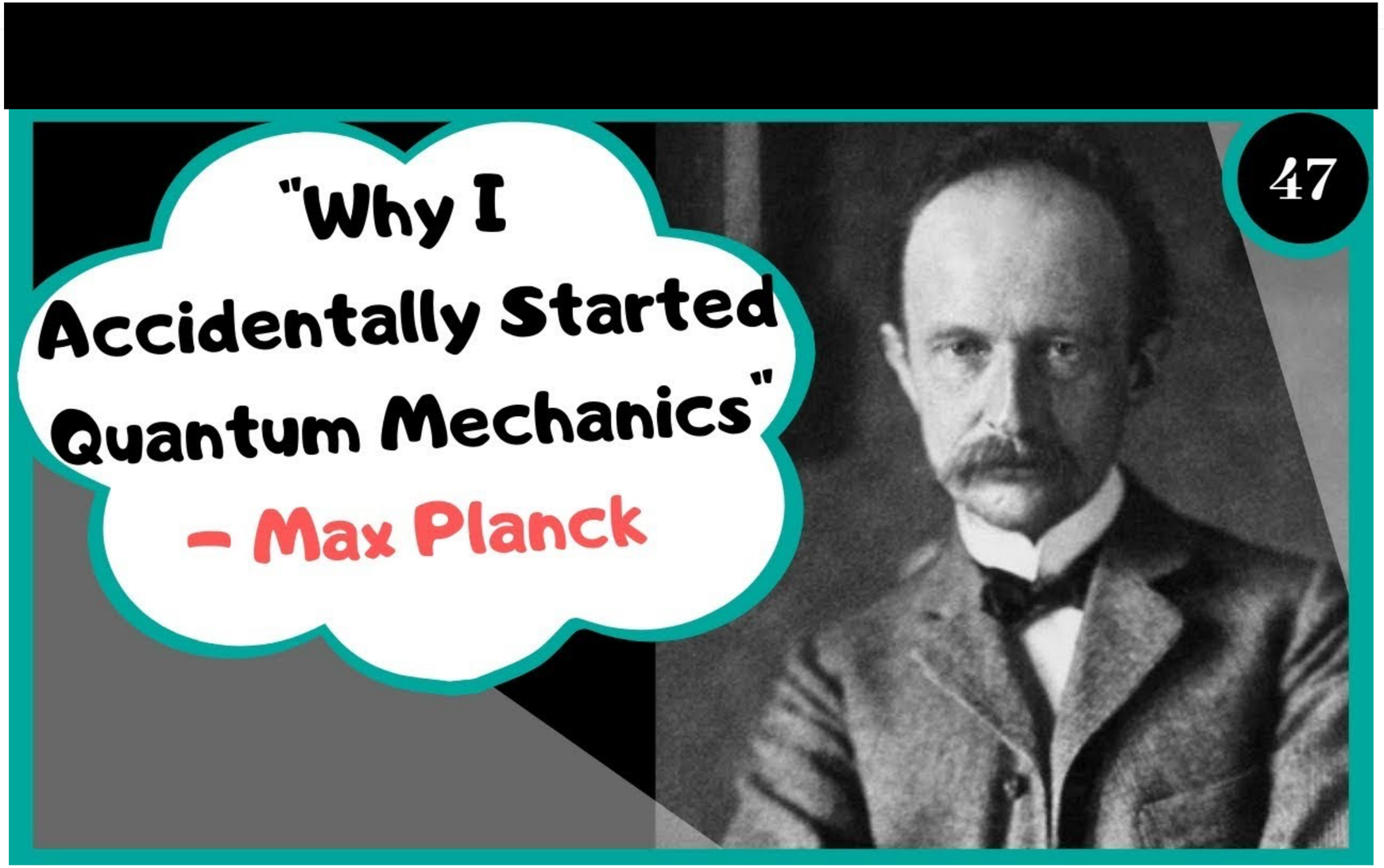
Introduction to Quantum Mechanics



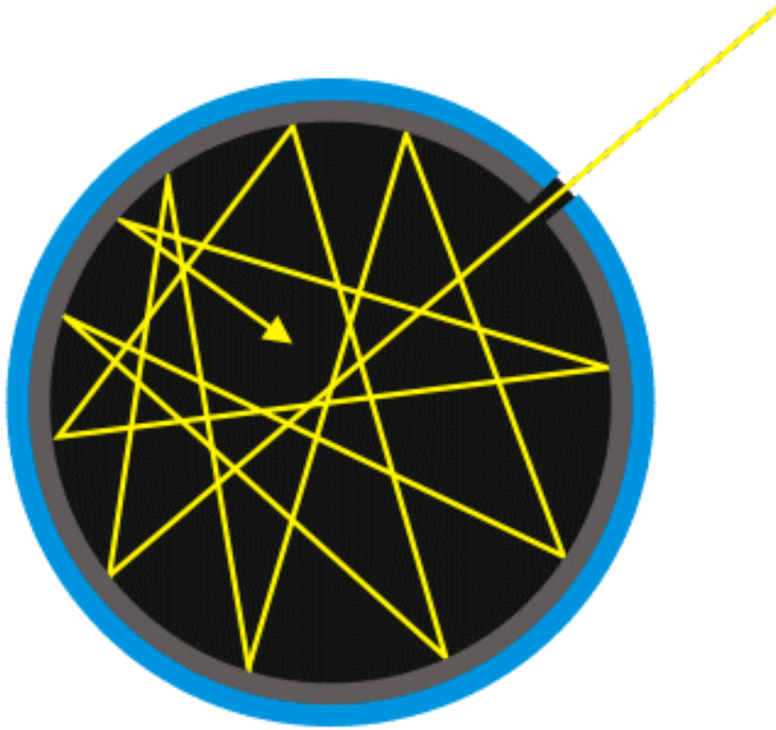
Laws of Motion and Theory of Electromagnetism

Most Important Idea : Deterministic world

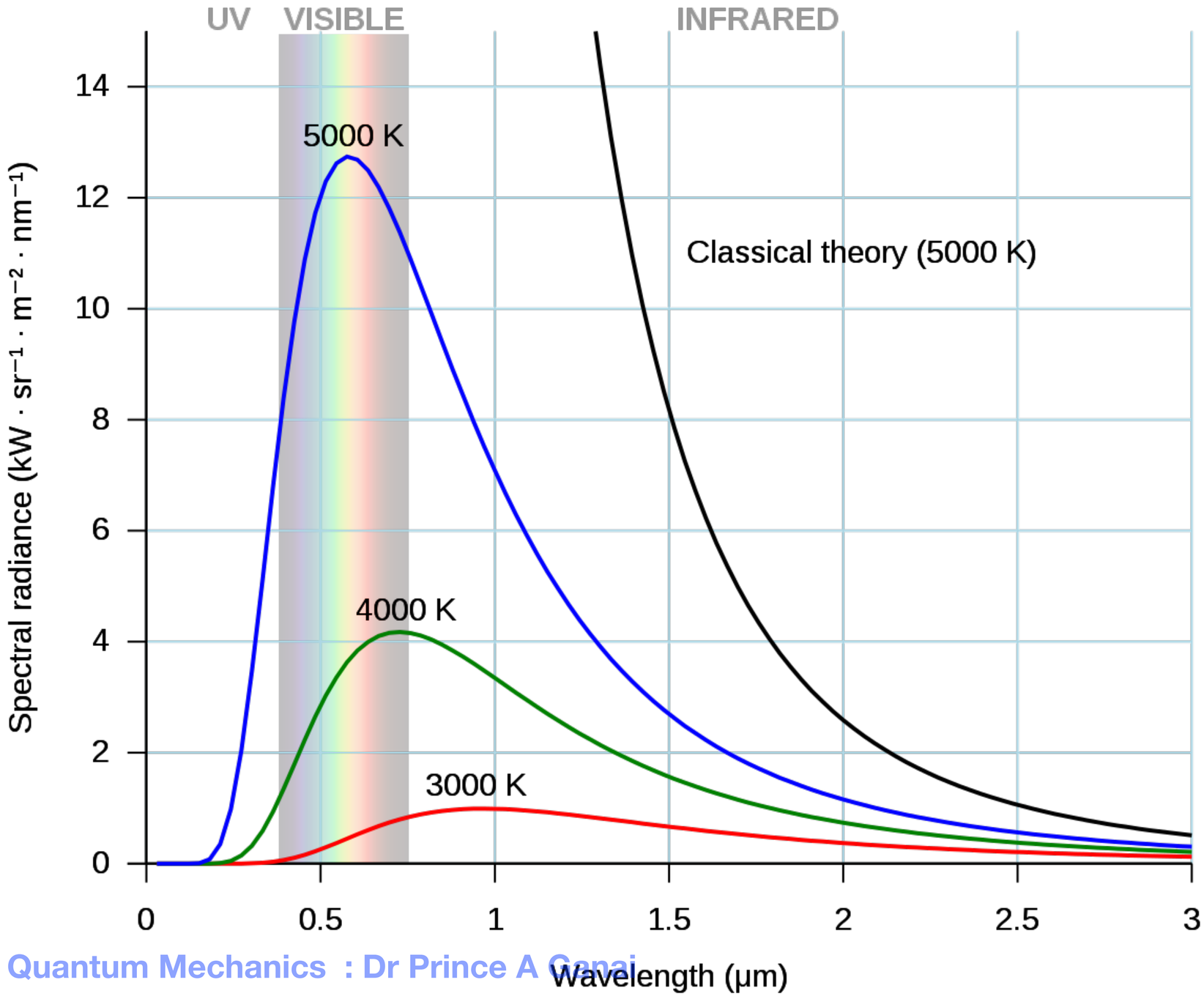
Particle Properties of Waves



This classical picture began to crumble in 1900 when Max Planck published a theory of black-body radiation



Conceptual Black Body


UV
VISIBLE
INFRARED
5000 K
Classical theory (5000 K)
4000 K
3000 K
Spectral radiance (kW · sr⁻¹ · m⁻² · nm⁻¹)
Wavelength (μm)
0
2
4
6
8
10
12
14
0
0.5
1
1.5
2
2.5
3

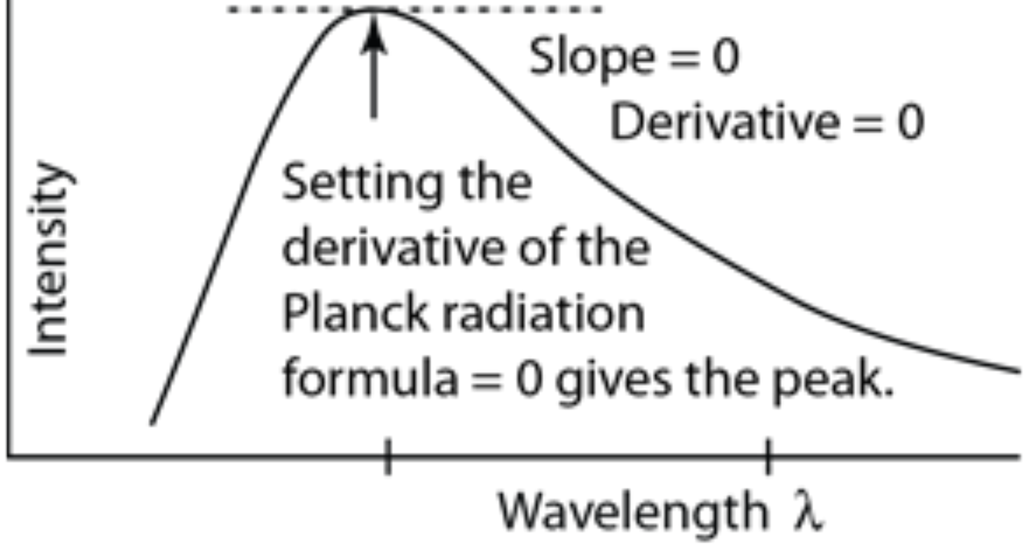
Planck relation:

$$E = h\nu = \frac{hc}{\lambda}$$

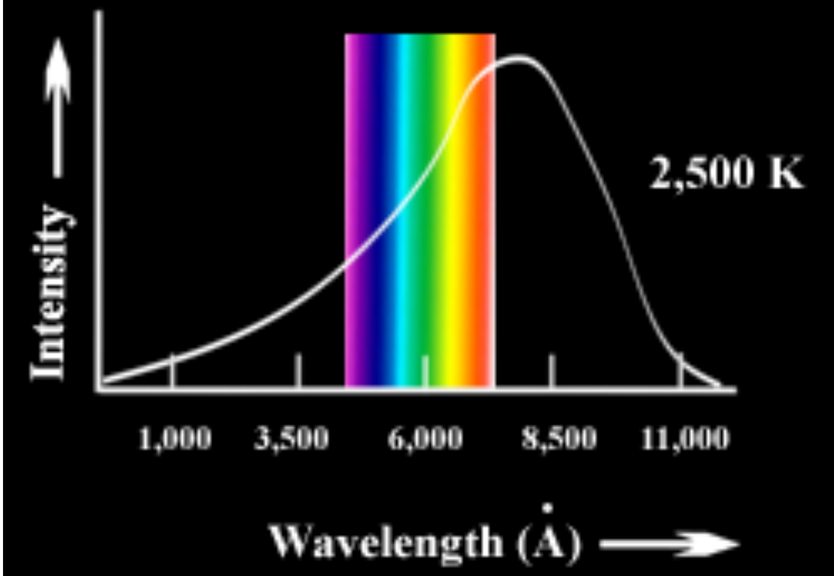
where:

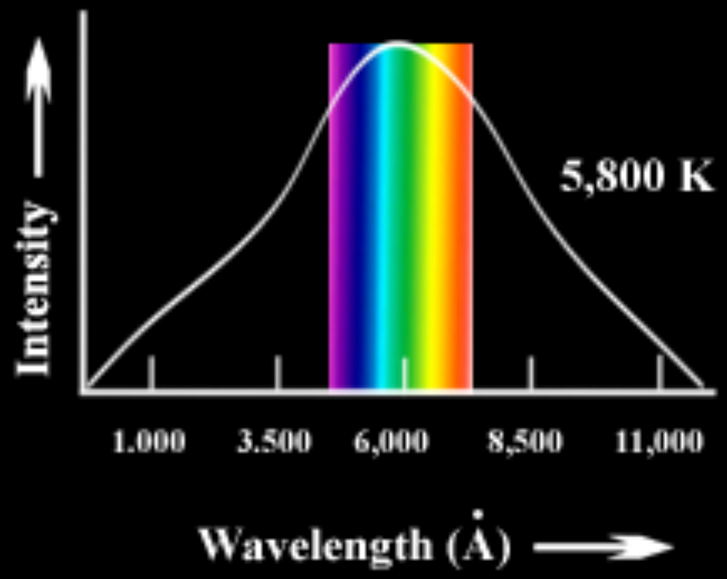
E = energy
h = Plank constant
v = frequency
c = speed of light
λ = wavelength

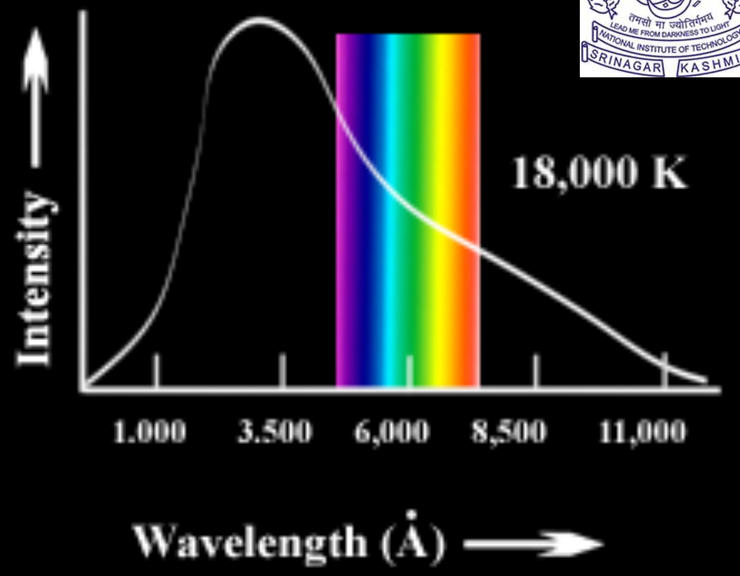
$$S_\lambda = \frac{8\pi ch}{\lambda^5}\frac{1}{e^{hc/\lambda kT} - 1}$$

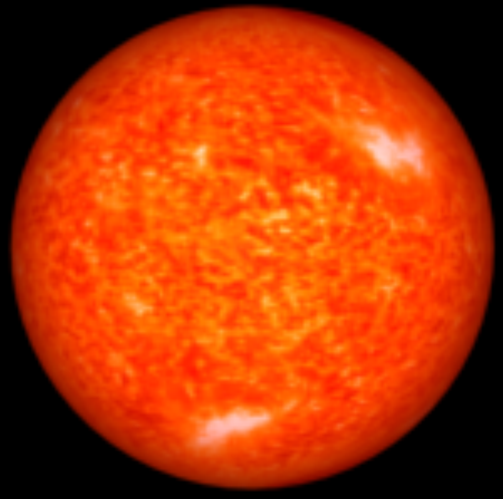


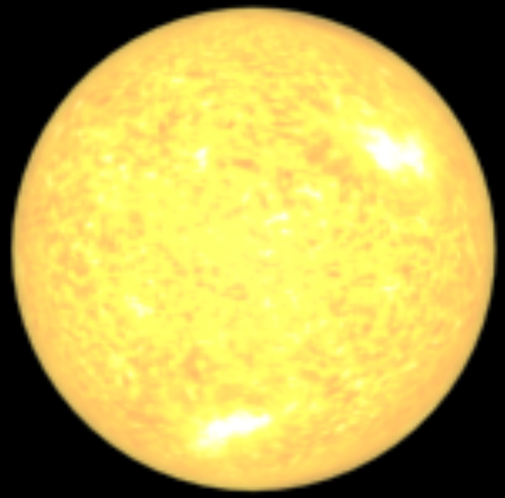
Let $a = \frac{hc}{k}$ and note that the constant term does not affect the peak.

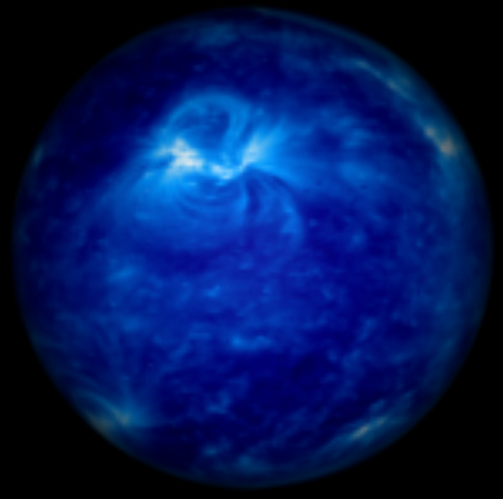








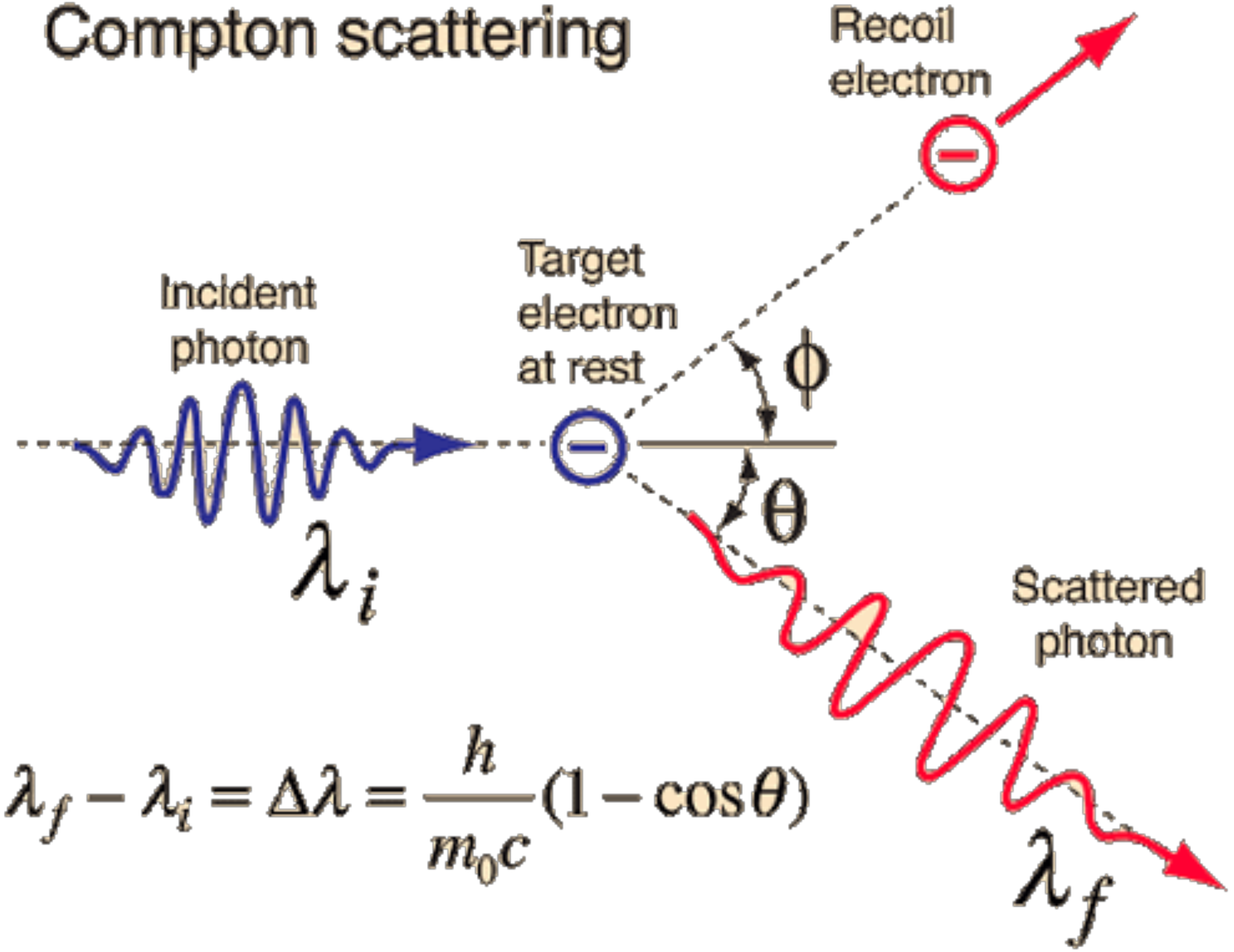




Colors are exagerrated

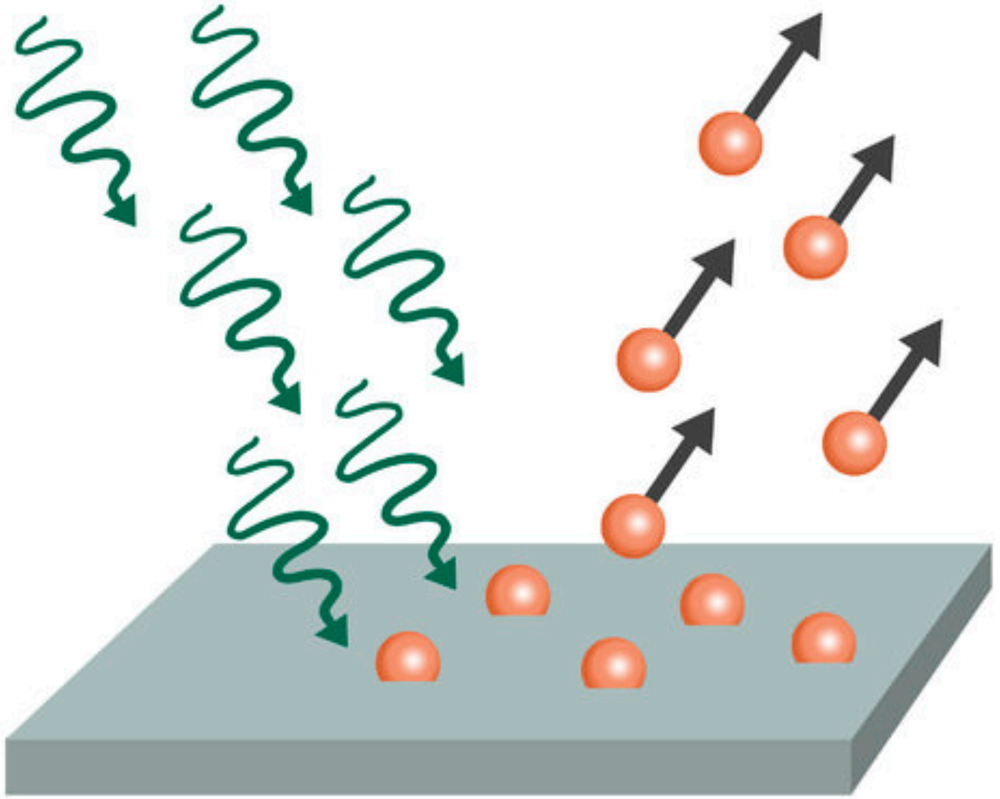
Photons

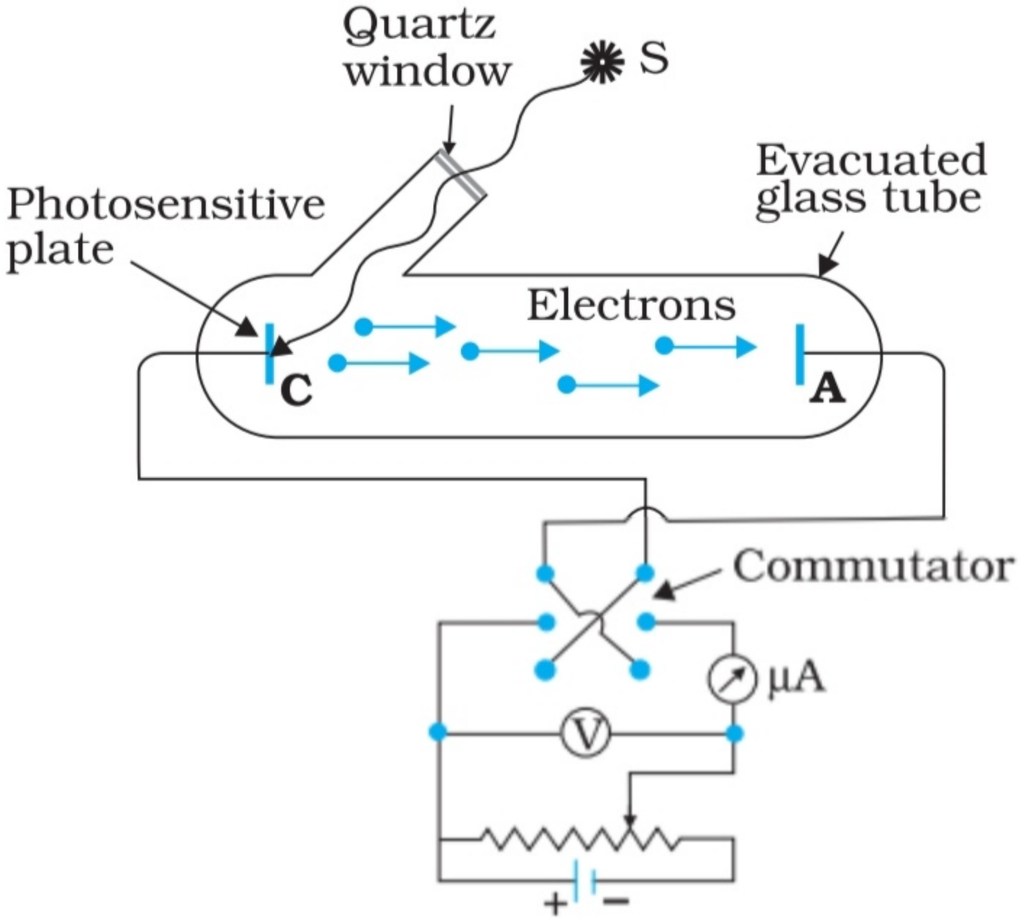
Compton scattering



$$\lambda_f - \lambda_i = \Delta\lambda = \frac{h}{m_0 c}(1 - \cos\theta)$$

Photo electric effect

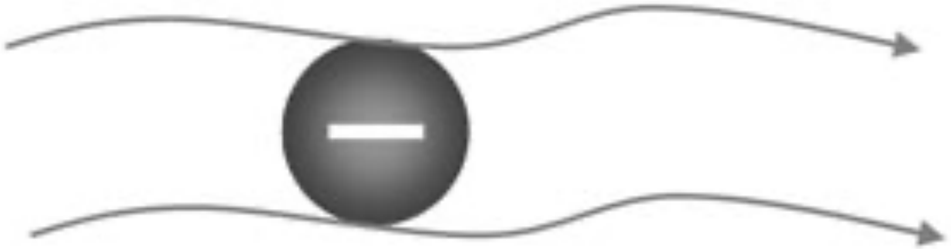




Wave Properties of Particles

Matter as Waves

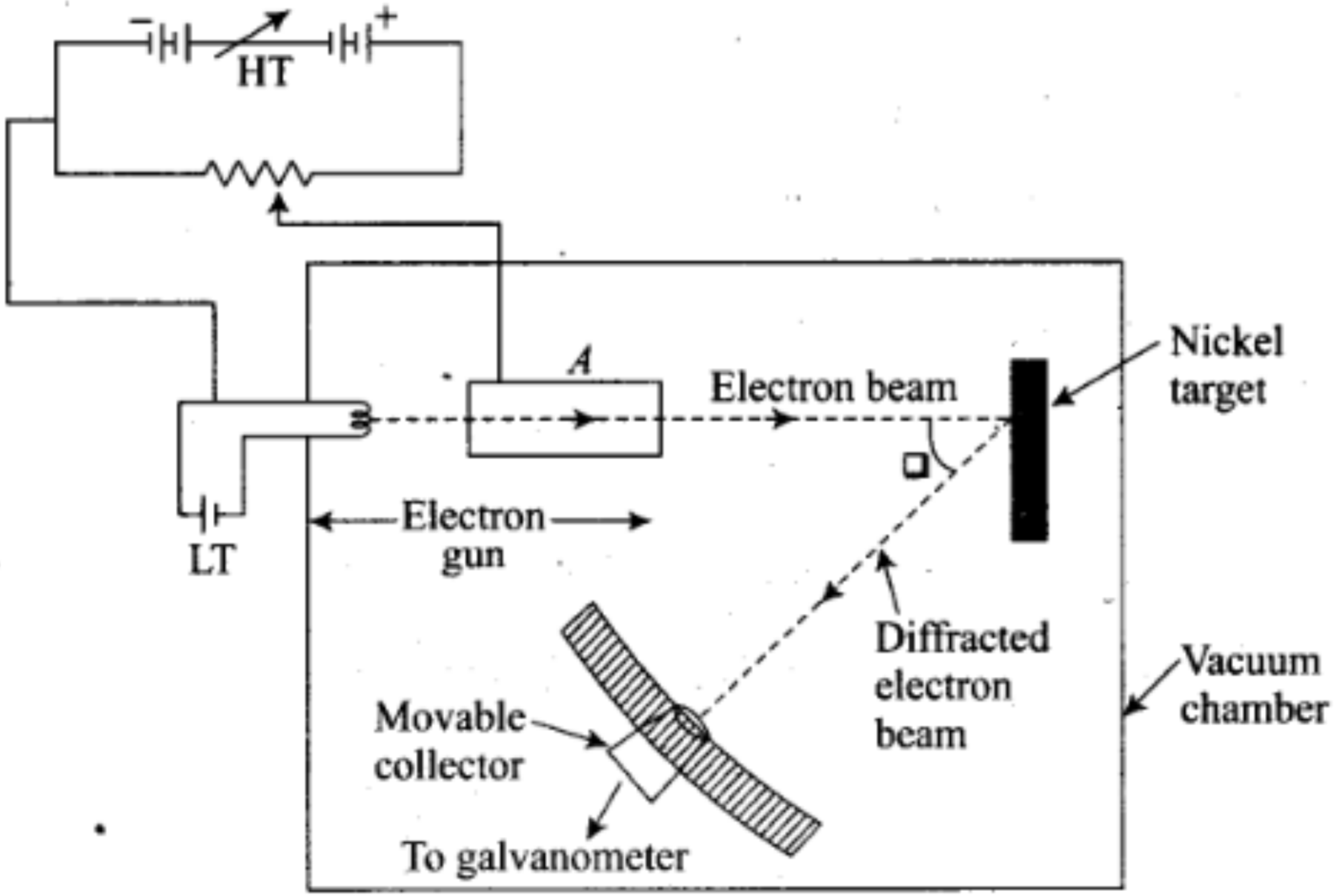
$$\lambda = \frac{h}{mv}$$



Note: v is for velocity and not for frequency as shown before.

Louis de Broglie

Electron Diffraction



Lecture 01 Concluded