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ENGINEERING PHYSICS

Radhakrishnan S, Ph.D.

Department of Science and Humanities

- Atomic Spectra
- Photo Electric effect

➤ *Suggested Reading*

1. *Concepts of Modern Physics, Arthur Beiser, Chapter 2*
2. *Learning Material prepared by the Department of Physics*

➤ *Reference Videos*

1. *drPhysicsA youtube channel*

- **Atomic absorption lines are observed in the solar spectrum and referred to as Fraunhofer lines**
- **Robert Bunsen and Gustav Kirchhoff discovered new elements by observing their emission spectra.**
- **The existence of discrete line emission spectra or the absence of discrete lines in an absorption spectra**

Atomic spectra

- *Continuous spectra from a source of white light*
- *Discrete emission lines*
- *Absence of lines from a continuous spectrum*



<- Continuous spectrum



<- discrete emission
line spectrum



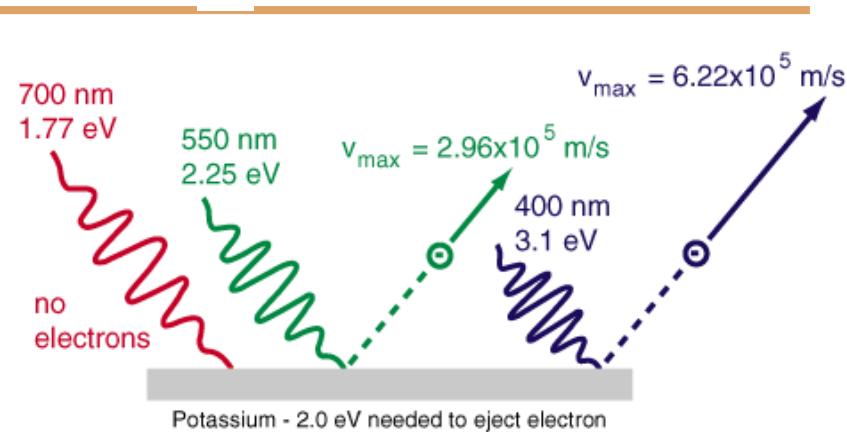
<- absorption line
spectrum

- The classical ideas of harmonic oscillators existing on the surface of the emitter result in a continuous spectrum
- Classical Physics could not explain
 - the presence of strong discrete line of a particular wavelength or
 - the absence of specific wavelengths in the case of an absorption spectra

This was one of the instances of failure of classical physics.

Photo electric effect

- *Electron emission from metals under irradiation - Photo electric effect*
- *Instantaneous emission of electrons with kinetic energy dependent on wavelength of radiation*
- *Energy of photo electrons independent of intensity of radiation*
- *Failure of EM wave theory to explain observed results*



Photoelectric effect

Photo electric effect

- *Failure of EM wave theory to explain the electron emission from surfaces*
- *The classical idea that energy of the EM wave is dependent on the amplitude of the EM was erroneous*
- *The ideas of oscillating electric fields increasing the energy of the electrons failed to explain the instantaneous electron emission*

- *Einstein brought in the idea of an the packet of energy as a particle – the photon*
- *The interaction of radiation with matter is then a case of a particle - particle interaction*
- *The energy of the photon $h\nu = W + KE$ of photo electron*
- *The dual nature of radiation confirmed from these ideas!*

The concepts which are incorrect

- 1. EM waves can explain discrete spectral lines**
- 2. The spectra from the sun has the absence of certain wavelengths**
- 3. Photo electric effect is the first proof for wave particle duality**
- 4. Photo electric effect is observed when photons of any frequency is incident on the metal**
- 5. The energy of the photo electron is equal to the energy of the incident photon**



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THANK YOU

Radhakrishnan S, Ph.D.

Professor, Department of Science and Humanities

sradhakrishnan@pes.edu

+91 80 21722683 Extn 759