UCB008 - APPLIED CHEMISTRY

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

SCBC-TIET

Atomic Spectroscopy

Electromagnetic Spectrum

by

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Learning Outcomes

At the end of this session participants should be able to:

- Illustrate electromagnetic spectrum

What is Spectroscopy?

To study changes in the property of light when it interacts with the matter.

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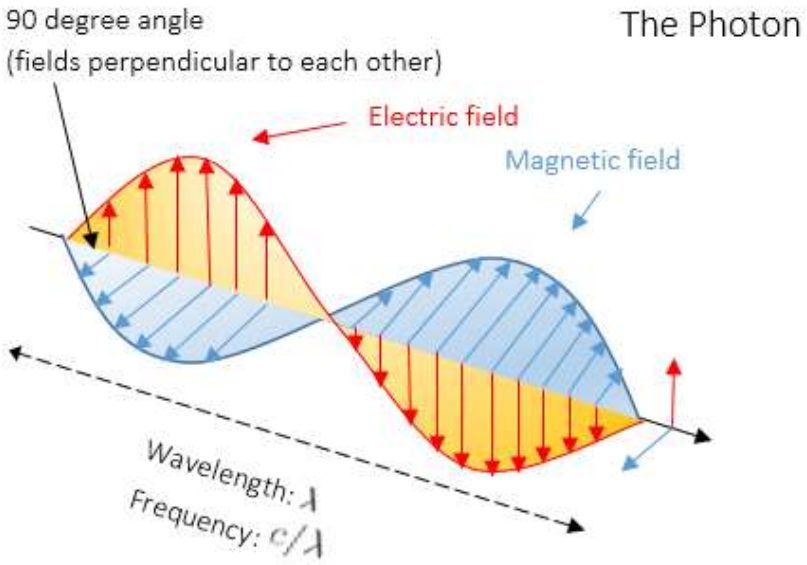
Electromagnetic Radiation

- Electromagnetic radiation: consists of distinct energy packets termed as photons.
- A photon consists two fields namely an oscillating electric field (E) & an oscillating magnetic field (M), perpendicular to each other



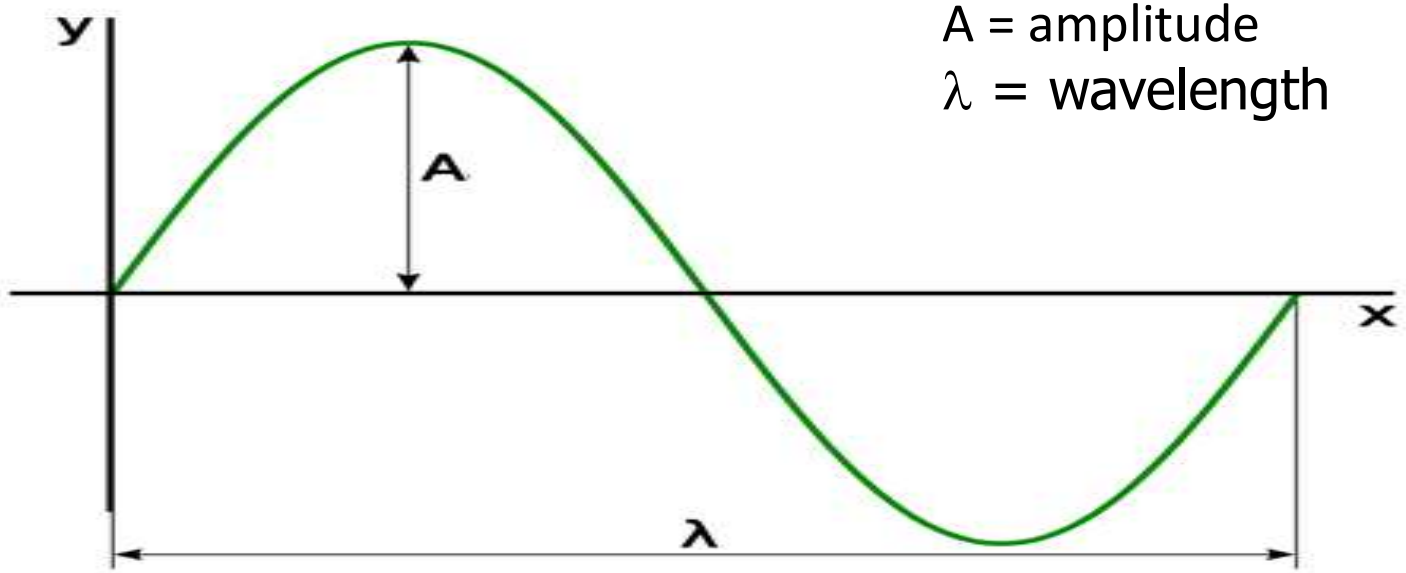
Electromagnetic Radiation

- Frequency (ν):
  - Number of waves which can pass through a point in one second.
  - Unit: Hertz (Hz).

$$1\ \text{Hz} = 1\ \text{cycle per second}$$

- Wavelength (λ):
  - Distance between two adjacent crests or troughs in a wave
  - Unit: Angstrom/nano-meter/milli-micron
- Wave number ($\bar{\nu}$):
  - Reciprocal of wavelength
  - Expressed in per centimeter

Electromagnetic Radiation



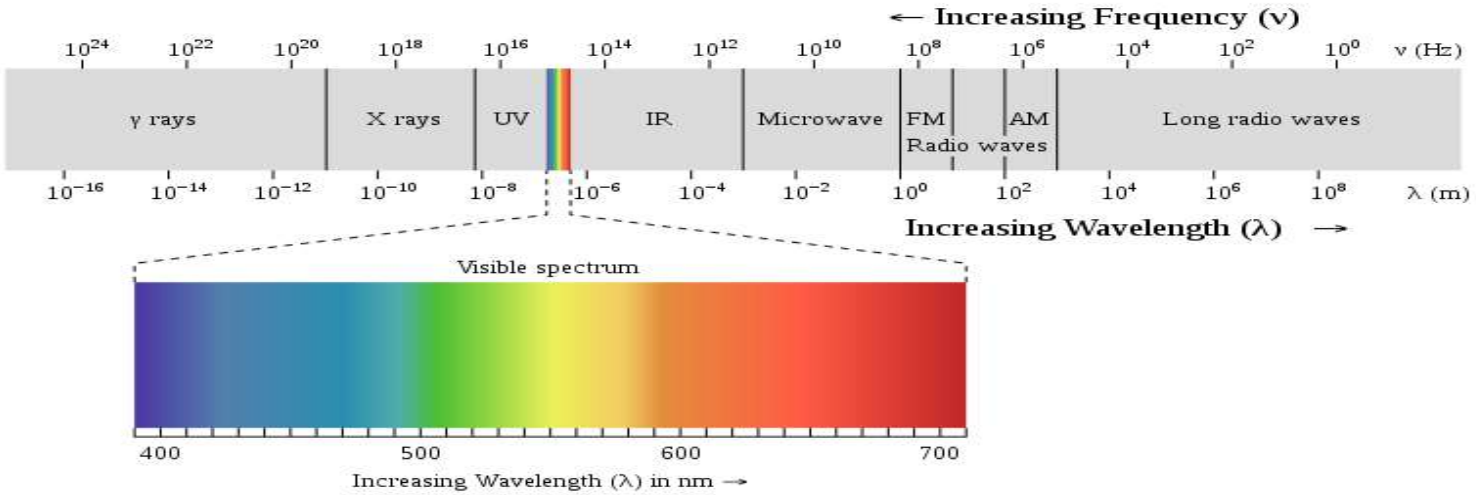
A = amplitude
λ = wavelength

- Relationship between wavelength & frequency : $c = \nu \lambda$
- Therefore, energy of photon is

$$E = h\nu = hc / \lambda$$

Electromagnetic Spectrum

- Arrangement of all types of the electromagnetic radiations in the order of their increasing wavelengths or decreasing frequencies



Cosmic rays → Gamma rays → X rays → Ultraviolet rays → Visible rays → Infrared rays → Microwaves → Radio waves

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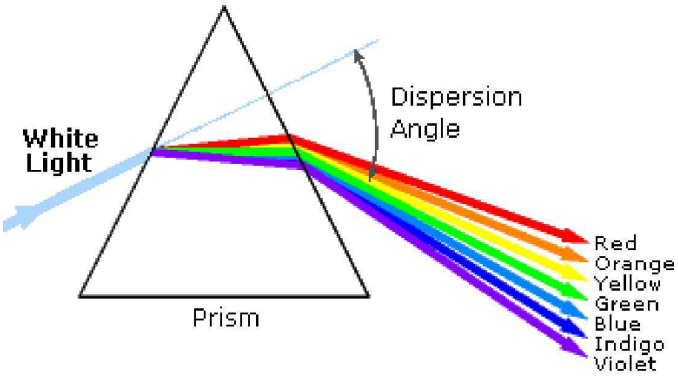
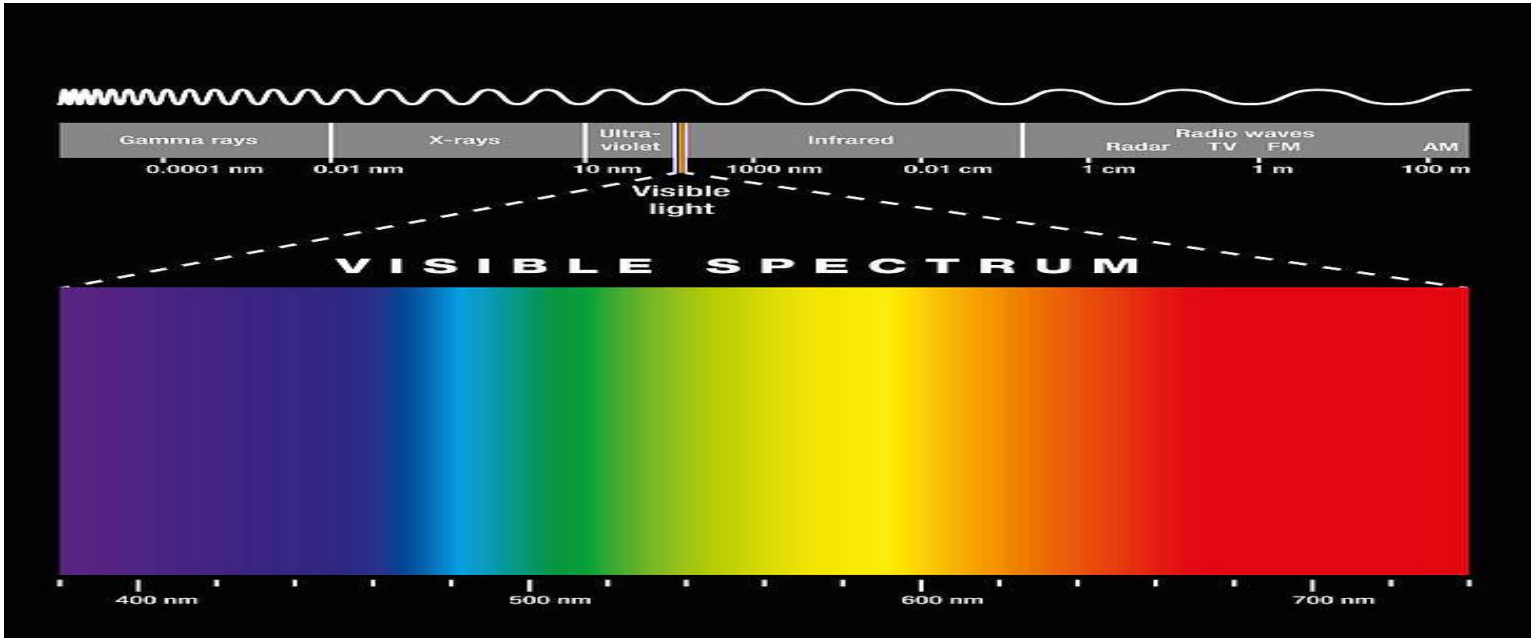
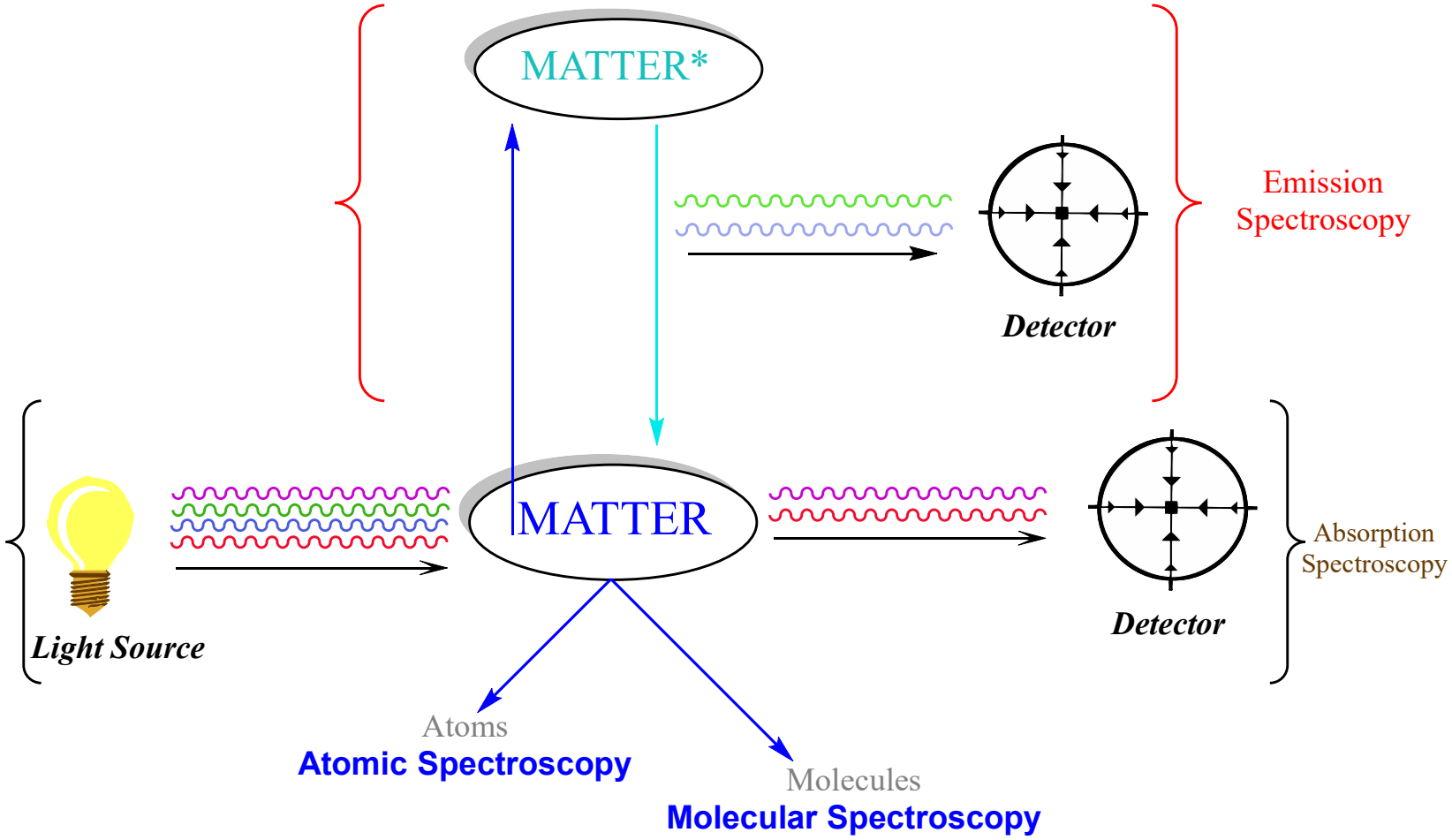
Electromagnetic Radiation





How do we study changes in the property of light when it interacts with the matter?



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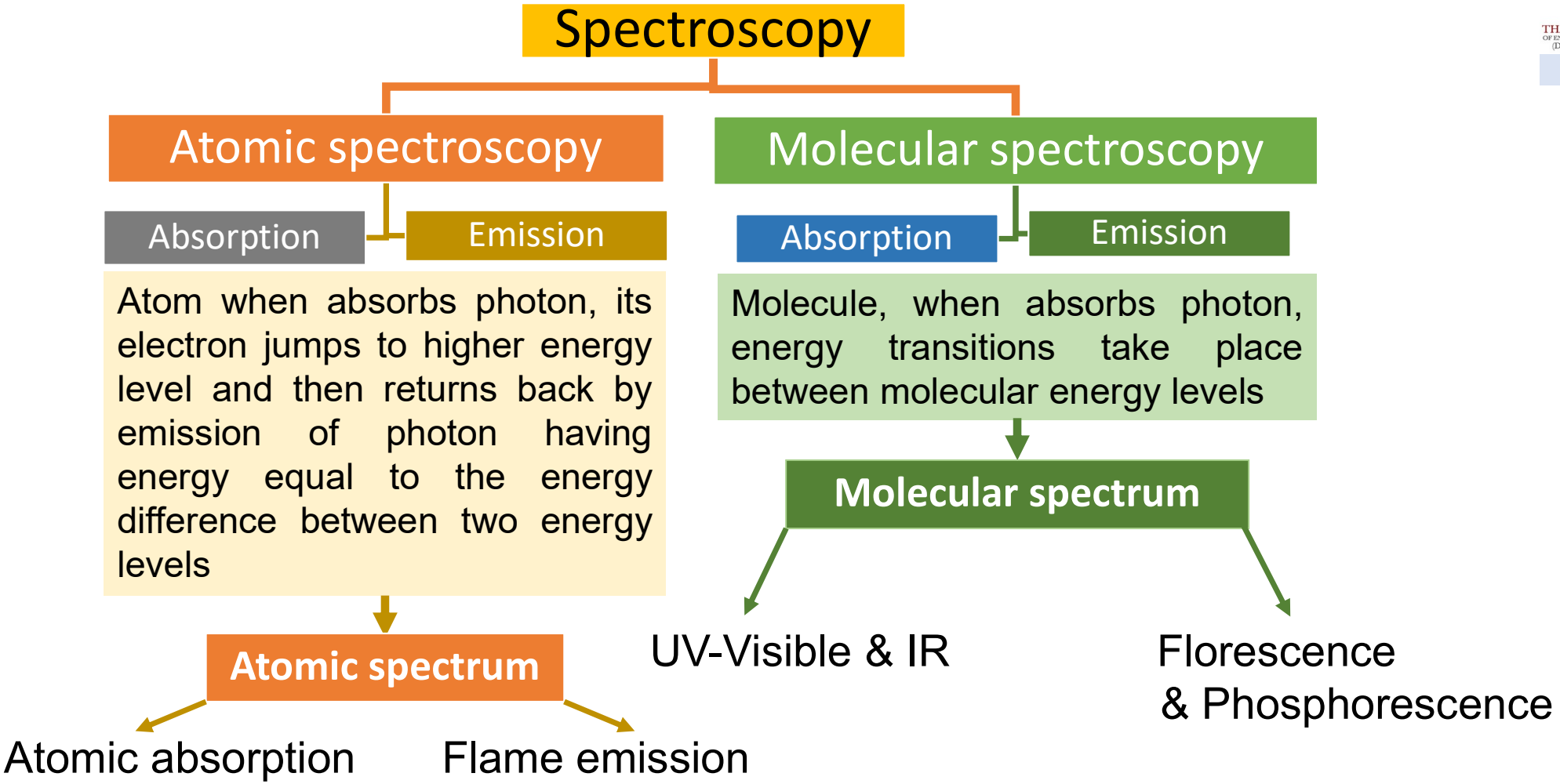
Spectroscopy
Atomic spectroscopy
Molecular spectroscopy
Absorption
Emission
Absorption
Emission
Atom when absorbs photon, its electron jumps to higher energy level and then returns back by emission of photon having energy equal to the energy difference between two energy levels
Molecule, when absorbs photon, energy transitions take place between molecular energy levels
Molecular spectrum
Atomic spectrum
UV-Visible & IR
Florescence & Phosphorescence
Atomic absorption
Flame emission

In the next session…..

- Atomic emission spectroscopy