



كلية المستقبل الجامعة

قسم تقنيات البصريات

الفيزياء الطبية والبصرية

المرحلة الاولى

المحاضرة الاولى

Department of Optics Techniques

Lecture 1

M.SC. Dhay ali sabur

The light

Introduction

Light is a form energy whose interaction with retina gives the sensation of sight, thus light is the visible portion of the electromagnetic radiation spectrum , from 400 nm at the violet end of the spectrum to 700 nm at the red end.

The white light consists of seven colures (violet, indigo, blue, green, yellow, orange, and red). To understand the nature of light following theories have been put forward from time to time.

Properties of light

Some of the important properties of light are summarized as follows:

- 1- Light is a form of energy which is propagated as electromagnetic waves(it does not require medium for its propagation)
- 2- Speed of light in free space(in vacuum) is 3×10^8 m/s (186,000 miles/s).
- 3- It is transverse in nature and so can be polarized.
- 4- It is not deflected by electric and magnetic fields.
- 5- When light passes from one medium to the other, velocity and wavelength change.
- 6- The speed of light in a medium is lesser than in vacuum.

7- Light of a single wavelength is called monochromatic light, white light is heterochromatic

8- Light exhibits phenomena like reflection, refraction, absorption, diffraction, interference and polarization.

Light velocity

Determination of velocity of light is of a great important.

Einstein has shown that the energy released by the nucleus of an atom is given by

$$E = m c^2$$

Where m is the decrease in mass and c is the velocity of light.

The first attempt to find the velocity of light was made by Galileo in 1600

The first successful attempt made by Romer (1676), Romer calculated the value of c as **186.000 mile/sec.**

Bradley (1729) using aberration method, Bradley calculated the value of c as 186.230 mile/sec.

Corna in 1874 determined the velocity the velocity of light as **3.013×10^8 m/sec.**

Perrotion calculated the value of c in air as **2.999×10^8 m/sec.**

Faucault (1862) found the value of c as **2.9×10^8 m/sec.**

Michelson's using rotating mirror method(1926), he found the value of c as:

$$2.99797 \times 10^8 \text{ m/sec}$$

Anderson(1941) using kerrcell method found the value of c as:

$$2.9977 \times 10^8 \text{ m/sec}$$

Houston's using piezoelectric grating method calculated the value of c as:

$$2.99782 \times 10^8 \text{ m/sec.}$$

Nature of light

Various theories have been put forward about the nature of light, while the four important theories which guided the evolution of our understanding of the nature of light, the theories are known as:

1- Corpuscular theory: by Issac Newton

A luminous body continuously emits tiny light and elastic particles called corpuscles in all directions these particles has the velocity of light, and fall on the retina of the eye, they produce the sensation of vision, Newtons law valid with the phenomenon like rectilinear propagation, reflection and refraction, while is invalid with the phenomenon of interference of light.

2- Wave theory(Huygen's principle)

1- Every point on a wave front acts as secondary source of disturbance

2- The surface which touches all the wavelengths from the secondary sources gives the new Huygens could explain reflection, refraction, however rectilinear propagation of light and polarization could not be explained.

3-Electromagnetic theory(Maxwell)

EM wave is:

- Electric field (E) perpendicular to magnetic field (M)
- Travels at velocity, c ($3 \times 10^8 \text{ ms}^{-1}$, in a vacuum)

4 -Quantum theory

Max plank had come to the conclusion that the absorption or radiation of energy is not continuous process, he postulated that thermal radiation is emitted or absorbed intermittently by indivisible amounts of energy called quantum, each quantum carries energy $h\nu$ where h is constant called planks constant.

Einstein elaborated the quantum concept in an endeavor to account for the phenomenon of photoelectric emission. He postulated that quanta travel in space as separate entities with the speed c , the quanta are named as photons.

Quantum theory explains the interaction of radiation with matter but it cannot account the phenomenon of polarization, interference and diffraction

According to quantum theory light is considered as a stream of special particles namely photons

The fundamental characteristics of a photon are its energy E and momentum P

$$E=hf$$

$$P=hf/c=hk$$

Sources of light

The sun, the stars lamps give off light, they are called Luminous Bodies like moon, mountains etc. are non luminous they are visible when they receive light from luminous sources and then send the light to our eyes.

Some bodies can emit light due to transfer of thermal energy into energy of electromagnetic waves, Emission of light due to supply of energy through processes other than heat is called luminescence, there are different kinds of luminescence, neon and other glow tubes are examples of electroluminescence in this kind of luminescence charged particles accelerated by an electric field partly transmit their kinetic energy to the atoms of the gas which then emit light.

Many living organisms such as fire filefish and bacteria emit light due to chemical reactions which called chmilumine science

The cold light emitted by tube light is are sult of photoluminescence.