

# Optics

## Article to be checked

Check of this article is requested.

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## Introduction

Optics is one of the scientific fields that are dealing with light and its transmission through various environments. This field is concerned with the origins and mechanisms of light phenomena, physical interactions of light and matter, and light detection.

Light is a type of electromagnetic radiation that is visible to the human eye. Its wavelength is 390 – 790 nm. It consists of multiple light patterns of different colours with the colour depending on the wavelength of the light pattern. When put together, these light patterns create what we call white (visible) light. Purple light has the shortest wavelength, red light has the longest wavelength.

Apart from the visible light, optics is also concerned with two spectra that are the closest to the visible light: Infrared radiation (IR) and Ultraviolet radiation (UV).

Infrared radiation's wavelengths lie between 0,3 mm and 780 nm, spanning the field between the shortest radio waves and visible light. Its sources are objects heated to high temperatures. Absorption of this radiation results in heat transfer, heating the irradiated object. IR can be viewed using optical systems constructed from special materials, as the same laws apply to it as to visible light. This principle is applied in construction of infrared binoculars, for example, which can be used to observe objects in the dark, as infrared radiation is emitted by nearly all objects. Compared to visible light, IR passes through turbid environments more easily.

Wavelengths of ultraviolet radiation are shorter than those of visible light, between 390 nm and 10 nm. Its shortest wavelengths overlap with those of X-rays. It can be emitted by objects heated to extreme temperatures, such as stars or electric arcs, and mercury-vapor lamps. UV radiation is mostly absorbed in high levels of the atmosphere, leading to ionization of oxygen molecules and creation of ozone. It can also be absorbed by ordinary (potassium) glass, meaning that tubes for UV lamps need to be made from quartz glass.

## Branches of optics

- Geometrical optics (Ray optics) describes light propagation in terms of rays.

Phenomena: Reflection (Total reflection), Refraction (Refraction index, Optical media)

- Physical optics (Wave optics) studies light as electromagnetic waves.

Phenomena: Interference, Diffraction, Polarization

- Quantum optics studies quantum properties of light (Photons)

Phenomena: Photoelectric effect, Compton's effect

- Photometry studies light in terms of its perceived brightness to the human eye

## Sub-topics

- Main bands of the electromagnetic spectrum – approximate definition by wavelength
- Light dispersion
- Light absorption
- Optical systems
  - Diffraction grating
  - Magnifying glass
  - Optical microscopy
- Eye from the biophysical point of view
  - Development of the eye
  - Resolution of human eye
  - LIGHT, EYE AND VISION
- Laws
  - Snell's law
  - Huygens-Fresnel principle

- Optical aberrations
- Wave nature of light: Diffraction
- Refraction index:
  - types of optical media
  - total reflection conditions
- Optical activity and its medical use