



*Third lecture*

# *Optical activity Electro-optical effect*

*Msc. Eman Ahmed*

*Fourth Stage*

*Department of medical physics*

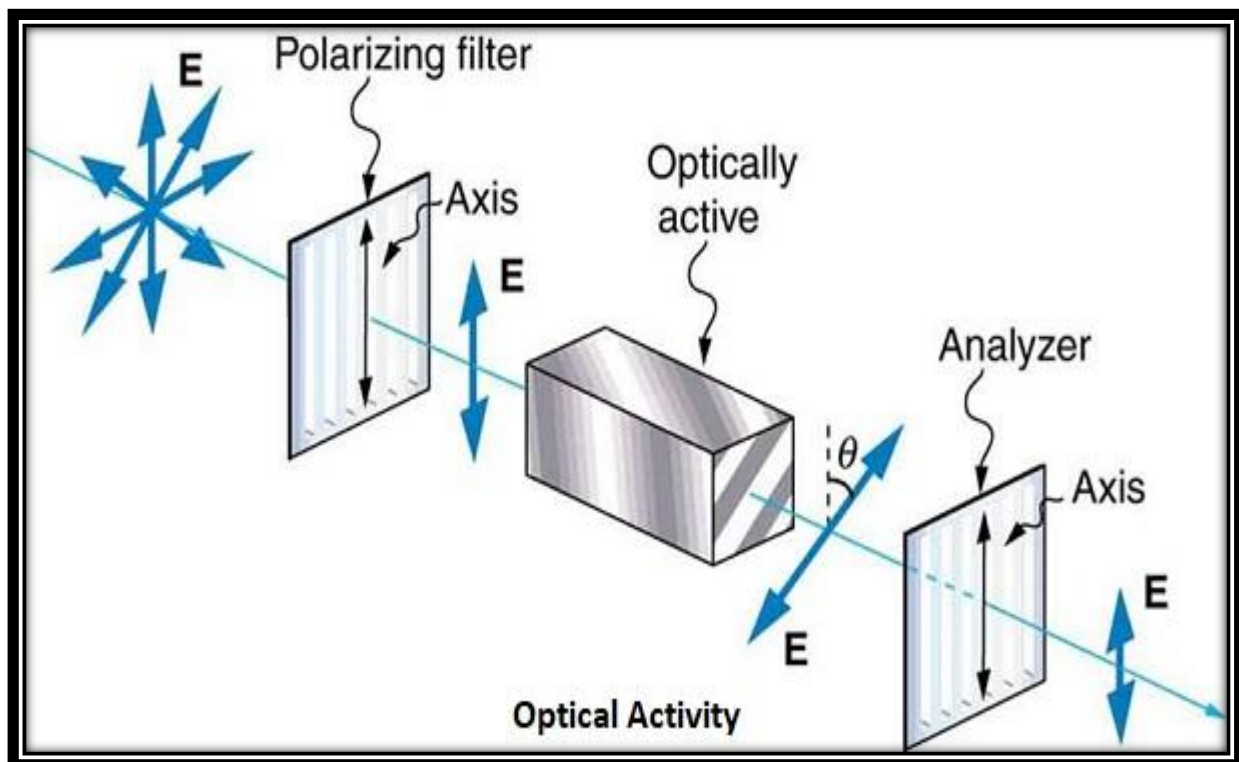
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## Optical activity Electro-optical effect

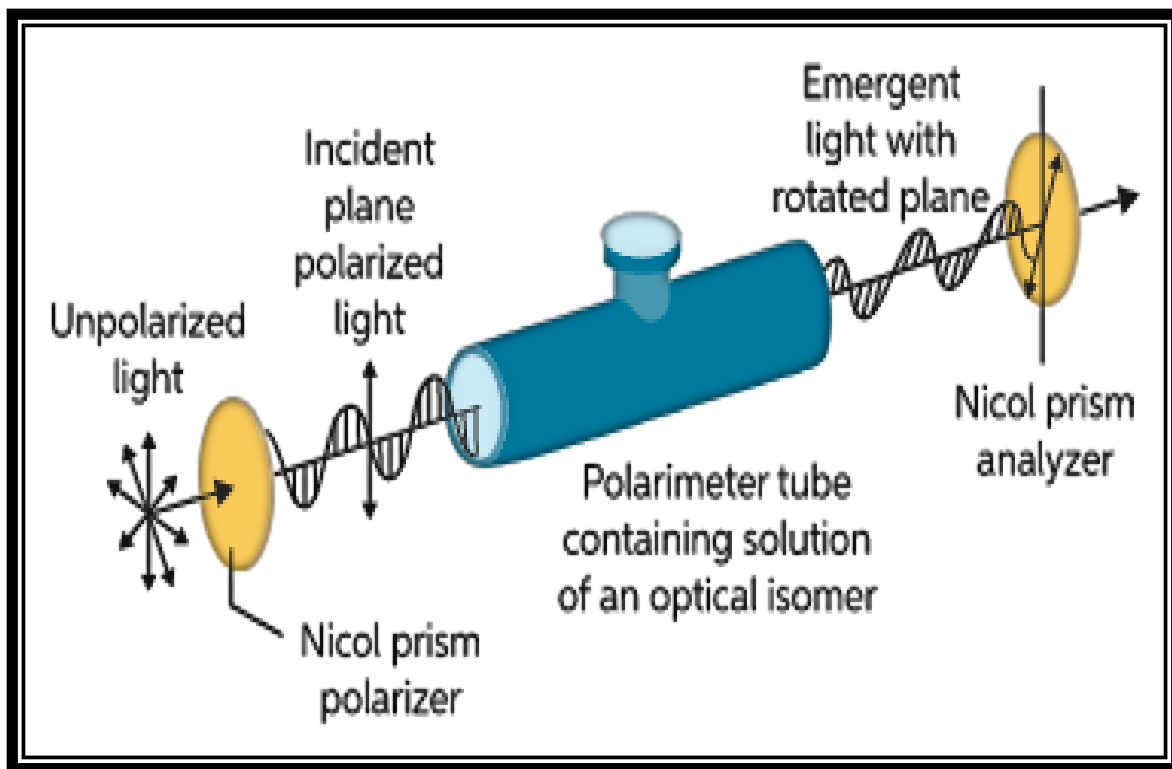
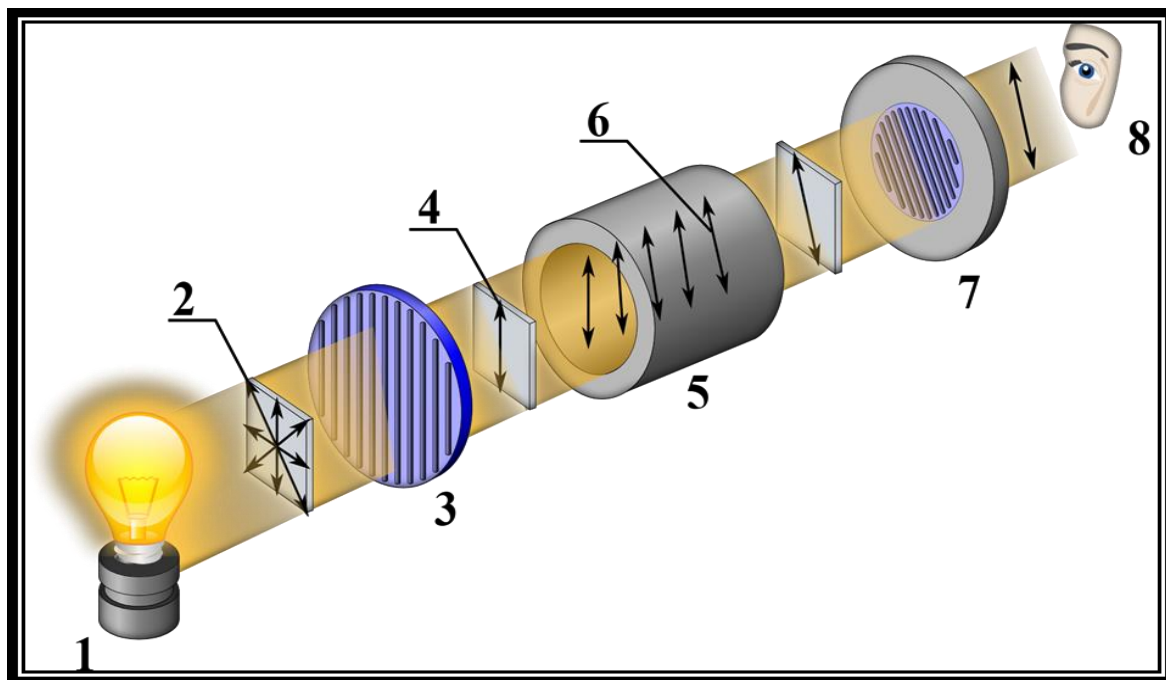
### *Introduction to Optical Activity*

Polarization plays an important role in explaining the wave nature of electromagnetic waves. While studying the polarization concept we encounter many interesting concepts regarding the wave nature of the electromagnetic waves, one among them is optical activity. Optical activity is a phenomenon that describes the ability of rotation, thus optical activity is also known as optical rotation. Optical activity is different from polarization. The optical activity corresponds to the property of some materials to rotate the plane of polarization of light waves.



## **Optical rotation**

- Let us have a look at what optical rotation is. So, optical activity or optical rotation is the ability of a compound to rotate the plane of polarized light, and the compounds having this ability to rotate the plane of polarized light are known as optically active materials.
- The optical rotation of substances is due to the interaction of the electromagnetic radiation of polarized light with the unsymmetrical electric fields generated by the electrons in a chiral molecule. Optical activity is usually found in organic substances. For example, the sugar solution is optically active, it exhibits optical rotation on observing through the polar meter. Other examples of optically active substances are turpentine, sodium chlorate, cinnabar, etc...
- Any substance or compound is said to be optically active when the linearly polarized light is being rotated when it is passing through it.
- The optical rotation or optical activity is the angle through which the plane of polarization is rotated when polarized light passes through a layer of a liquid (such as sugar solution or in other words diluted sugar solution).
- Optical rotation is the effect that is determined by the concentration of chiral molecules and their molecular structure in a substance. Every optically active substance will have its specific rotation. Depending on the concentration level the optical activity will be either increasing or decreasing.



### ***What is Optical Activity - Define Optical Activity***

In 1811, French physicist Françoise Arago observed that when a plane polarized light passed through some materials in particular through some crystals such as quartz, the plane of emerging light is not the same as the plane of the incident light. These crystals rotated the plane of polarization of incident light. This phenomenon of rotation is known as an optical activity or optical rotation.

### ***Optically Active Meaning***

The substances that exhibit such rotations are known as optically active substances. To understand what is optical activity or optical rotation we will explain a unique experiment. The optical rotation is measured through a Polarimeter.

The optical activity of optically active substances is studied by the polarimeter. Polarimetry . Gives the measurement of rotation of plane-polarized light by an optically active substance.

***Optically Active Substances are Classified in Two Types :***

***1.Dextrorotatory Substances:*** The dextrorotatory substances are also known as the right substances. Dextrorotatory Substances are those optically active substances that rotate the plane of polarization of the light towards the right and are known as right-handed or dextrorotatory. In other words, if a substance rotates the plane-polarized light to the right or clockwise direction, such substances are known as the Dextrorotatory substances.

***2.Laevorotatory Substances:*** Laevorotatory Substances are the type of substances that rotate the plane of polarization of the light toward the left and are known as left-handed or Levorotatory. The Levorotatory substances are those optically active substances that rotate the plane of polarization of the light toward the left are known as left-handed. In other words, if a substance rotates the plane-polarized light to the left or counterclockwise direction, such substances are known as the Dextrorotatory substances.

***Applications of Optical Rotation or Optical activity***

- Optical rotation is used to determine the percentage of the optically active substance in the solution.
- The sugar level in the urine of a diabetic person is determined by calculating the angle of rotation of the plane of polarization.
- Optical activity is a function of time and it is used to determine kinetic reactions.
- The optical rotation is also utilized to plot optical rotatory dispersion curves for various ranges of wavelengths; this helps in analysing molecular structure.
- The optical activity is measured on a layer of suitable thickness at the wavelength specified in the monograph.