



Fifth lecture

Quarter-Wave plates and Photoelectric Effect Optical activity Electro-optical effect

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What is the quarter wave plate?

A doubly refracting uniaxial crystal plate having refracting faces parallel to the direction of the optic axis, having a thickness such that it creates a path difference of $\lambda / 4$ or a phase difference of $\pi / 2$ between the O-ray and the E-ray is called Quarter wave plate.

For quarter wave plate :

Path difference, $\Delta = t (n_O - n_E) = \lambda / 4$ where λ is the wavelength of the incident light.

Thickness, $t = \lambda / 4(n_O - n_E)$

❖ *Uses of quarter wave plate*

If linearly polarized light is incident on a quarter-wave plate at 45° to the optic axis, then the light is divided into two equal electric field components. One of these is retarded by a quarter wavelength. This produces circularly polarized light.

If circularly polarized light is incident on quarter wave plate at 45° to the optic axis then it produces linearly polarized light. If linearly polarized light is incident on quarter wave plate other than 45° to the optic axis then it produces elliptical polarized light.

Optical Isolation

A quarter-wave plate can be used in an optical isolator, that is, a device that eliminates undesired reflections. Such a device uses a quarter-wave plate and a linear polarizer or polarizing beam splitter cube.

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.