



Fourth lecture

Optical activity Electro-optical effect

Msc. Eman Ahmed

Fourth Stage

Department of medical physics

Al-Mustaqbal University-College

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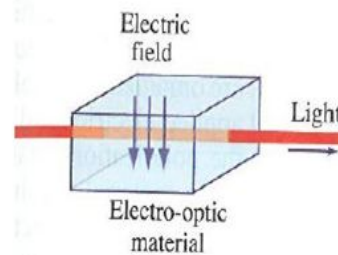
Electro-Optics: Introduction

- Reference: Saleh & Teich, *Fundamentals of Photonics*, 2nd ed., ch. 20 & ch. 21

What is electro-optic effect?

- Certain transparent materials change optical properties when subjected to an electric field.
- Distortion of position, orientations or shapes of molecules of anisotropic material.
- Change in the refractive index that results from steady or low-frequency electric field.

- The electro-optic (E-O) effect is a 2nd-order nonlinear optical effect that results in a refractive index that is a function of the applied electric field (voltage)



Saleh & Teich, p. 83⁵

Electro-optic sampling

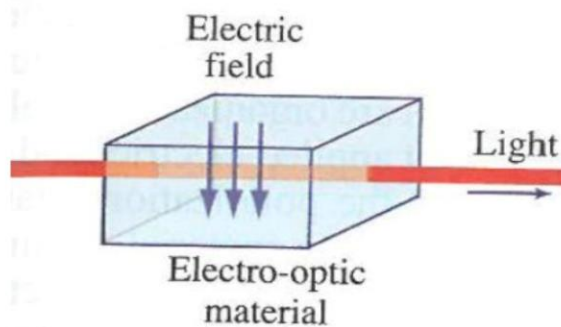
by Dr. Rüdiger Paschotta

Electro-optic sampling is an optical sampling technique based on the electro-optic effect. It can be used for investigating very fast phenomena.



Electro-Optic (EO) Effect

$$n(E) = n - \frac{1}{2}rn^3E - \frac{1}{2}sE^2 - \dots$$



Pockels effect: $n(E) = n - \frac{1}{2}rn^3E$

Kerr effect: $n(E) = n - \frac{1}{2}sE^2$

- The electro-optic (EO) effect is a nonlinear optical effect that results in a refractive index that is a function of the applied electric field (voltage)
- Examples of Pockels effect : Ammonium dihydrogen phosphate (ADP), Potassium dihydrogen phosphate (KDP), Lithium Niobate, Lithium Tantalate, etc.
- Examples of Kerr effect: Most glasses, gases, and some crystals

Electro-Optic Effect

Is a change in the optical properties of a material in response to an electric field that varies slowly compared with the frequency of light. The term encompasses a number of distinct phenomena, which can be subdivided into