

DEPARTMENT OF PHYSICS AND NANOTECHNOLOGY SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

18PYB101J -Electromagnetic Theory, Quantum Mechanics, Waves and Optics

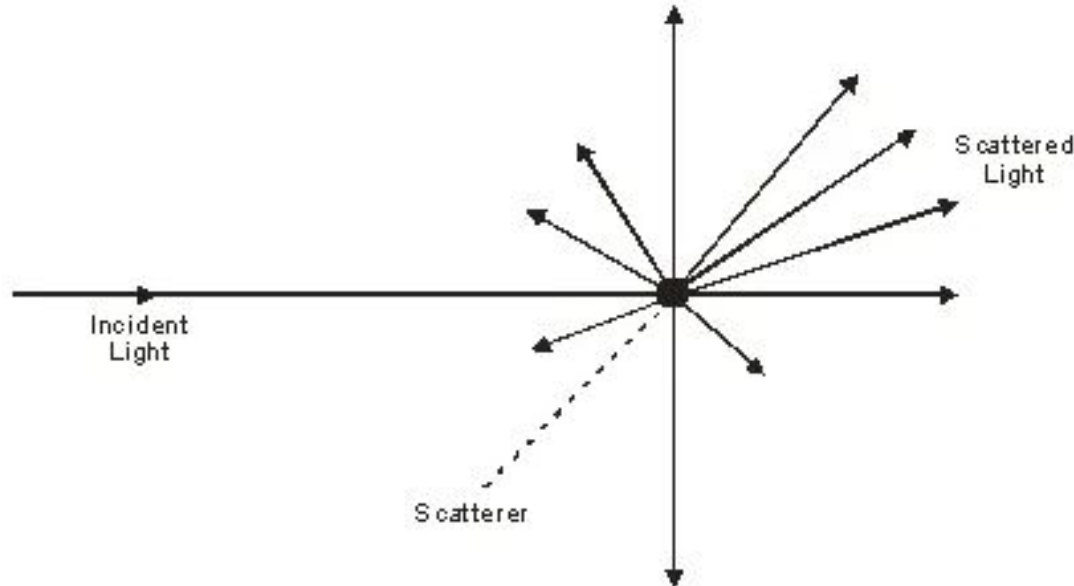
Module-IV (Waves and Optics) Lecture-13

**Scattering of light and Circular polarization –
Production and detection**

Scattering of light



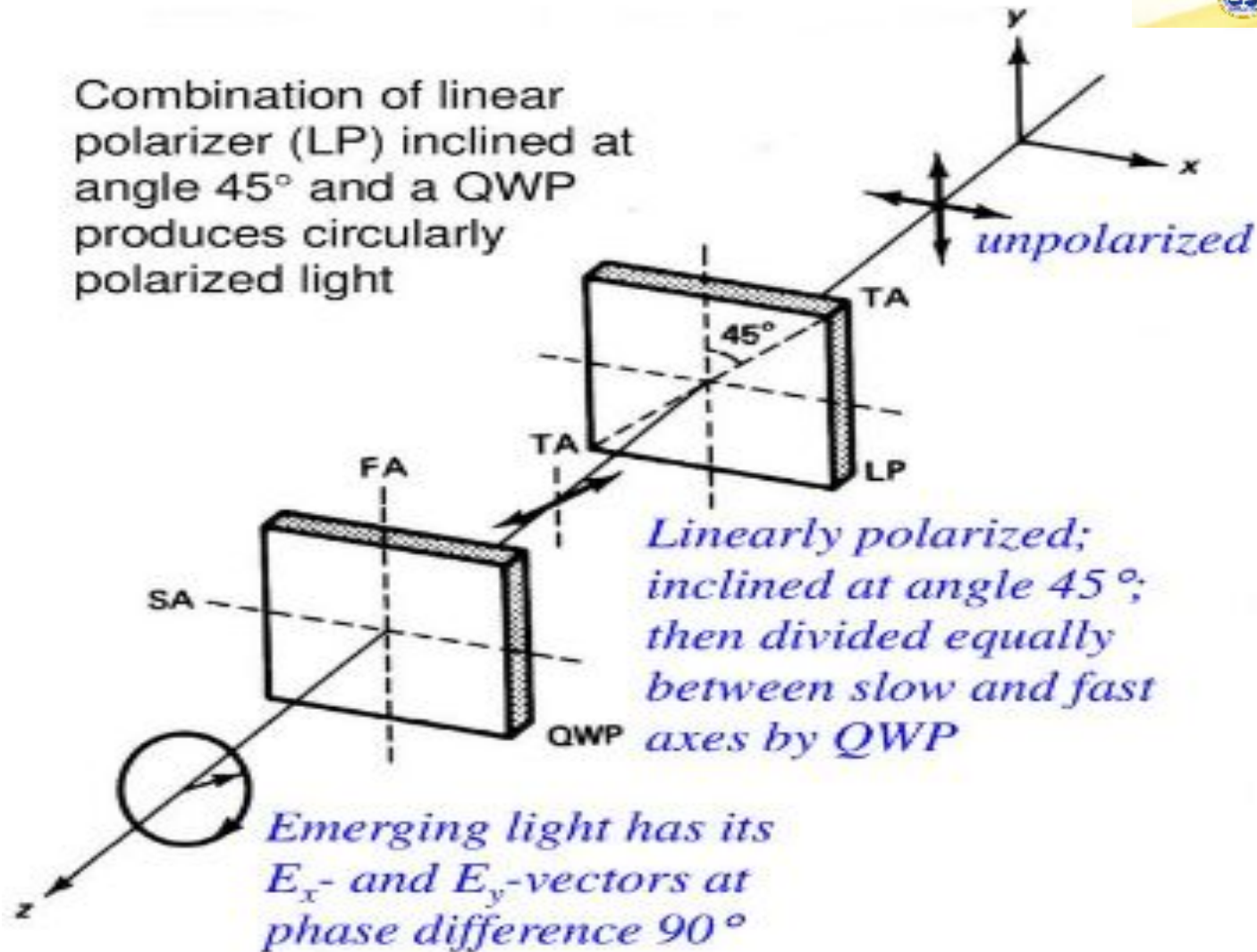
Scattering of light results from the electric polarizability of the particles. The oscillating electric field of a light wave acts on the charges within a particle, causing them to move at the same frequency. The particle, therefore, becomes a small radiating dipole whose radiation we see as scattered light.



Production of Circularly polarized light



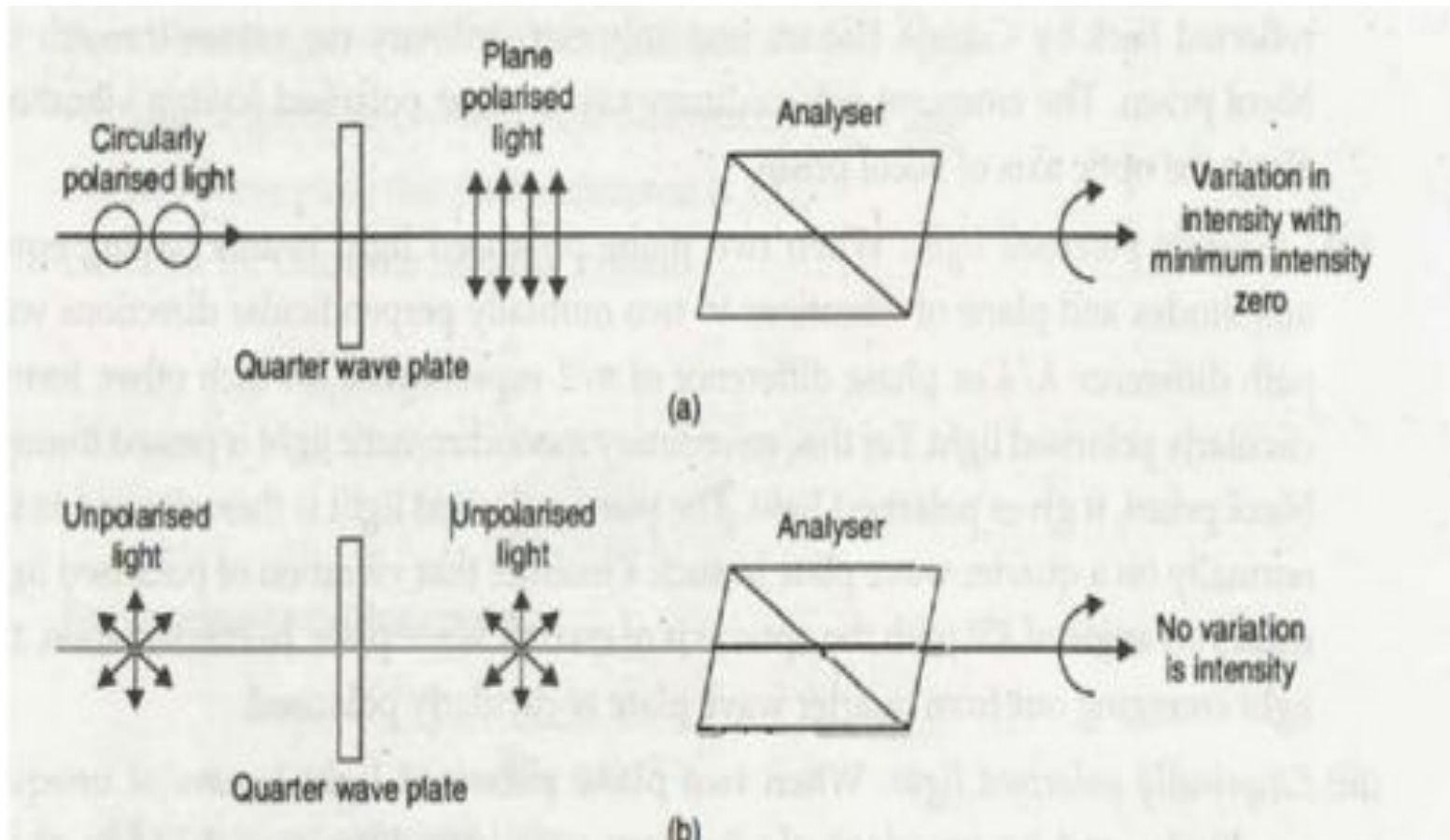
Combination of linear polarizer (LP) inclined at angle 45° and a QWP produces circularly polarized light



- Unpolarized light is first converted to plane polarized light by allowing it to pass through a polarizer.
- The polarizer and QWP are rotated such that the electric vector E of the plane polarized wave makes an angle of 45° with the optic axis of QWP, the plane polarized wave splits into two rays O-ray and E-ray of equal amplitude.

- The two rays are in phase at the front face of the crystal but progressively get out of phase as they travel through the crystal. As they emerge from the rear face of the crystal, they will have a path difference of $\lambda/4$ or phase difference of 90° .
- The two rays are linearly polarized in mutually perpendicular directions. When they combine, they produce circularly polarized light.

Detection of Circularly polarized light



□ The circularly polarized light beam is allowed to pass through the rotating analyzer, the intensity of the emerging beam remains uniform, then the incident is circularly polarized light. Similar result would be obtained if the incident light is unpolarized light.

□ To distinguish between these two cases, by introducing the QWP in the path of light before it falls on the analyzer.

□ If the light passes through the QWP, an additional path difference of 90° is introduced between O-ray and E-ray. Therefore the total phase difference of 180° between O-ray and E-ray. On emerging from the QWP, the O-ray and E-ray combine to produce plane polarized light.

□ Therefore if light coming out of QWP is examined with an analyzer, light will be extinguished twice in one full rotation of the polarizer.