Polarization in optics

Vibration in single plane perpendicular to direction of propagation

Basis of division of wave in optics

Nature of vibration of particle with direction of propagation

Nature of longitudinal wave on the basis of vibration of particle with respect to the direction of wave propagation in optics

Along the direction of wave propagation

Nature of transverse wave on the basis of vibration of particle with respect to the direction of wave propagation in optics

Perpendicular to wave propagation

Common observations of properties expressed by longitudinal and transverse wave

- Reflection
- Refraction
- Interference
- Diffraction

Specific observation only expressed by transverse wave

- Polarization

Cause of polarization of transverse wave

Vibration of particle in all possible directions in the plane perpendicular to wave propagation

Cause of unpolarization of longitudinal wave

Vibration only along the direction of wave propagation

Distinction for the observation of transverse and longitudinal wave

- Test for polarization

Types of light on the basis of polarization

- Polarized light
- Unpolarized light

Quantity of planes for the vibration of light in unpolarized light

- All the planes

Direction of a plane containing vibration of light with the direction of propagation of wave in unpolarized light

- Perpendicular to the direction of propagation

Quantity of planes for the vibration of light in polarized light

- 1

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Direction of plane containing vibration of light with the direction of propagation of wave in polarized light

- Perpendicular to the direction of propagation of light

Material needed for the verification of transverse nature of light

- Tourmaline crystals

Quantity of tourmaline crystals in verification of transverse nature of light

- 2

Expression of quantities for the verification of transverse nature of light

- C_1
- C_2

Direction of tourmaline crystal with respect to the direction of propagation of wave

- Perpendicular to the direction of propagation of wave

Relation of direction of crystallographic axes of tourmaline crystals in parallel crystallographic axes

- The direction of crystallographic axes is parallel

Physical arrangement of tourmaline crystals in verification of transverse nature of light wave

- The tourmaline crystals are placed as
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$$C_2 \text{behind} C_1$$

Relation of direction of crystallographic axes of tourmaline crystals in perpendicular crystallographic axes

- The direction of crystallographic axes is perpendicular

Working principle of experiment for the transverse nature of light

- Rotation of C2
- Tending to perpendicularity with C1
- Till intensity is minimum

Approximation of Magnitude of intensity of light at parallel crystallographic axes

- Maximum

Approximation of Magnitude of intensity of light at perpendicular crystallographic axes

- Minimum

Conclusion ins verification of transverse nature of light

- The intensity of light reduces to minimum at perpendicular axes of second tourmaline crystal.
- The light waves are transverse.

Relation for expression for intensity of light in polarization

$$I = \frac{1}{2} I_0 \cos^2 \theta$$

Plane of vibration in optics

Direction of propagation and direction of vibration

Direction of wave propagation with the vibration in plane of vibration

Parallel

Plane of polarization in optics

Direction of wave propagation and perpendicular to vibration plane

Direction of wave propagation with the vibration in plane of vibration

Perpendicular