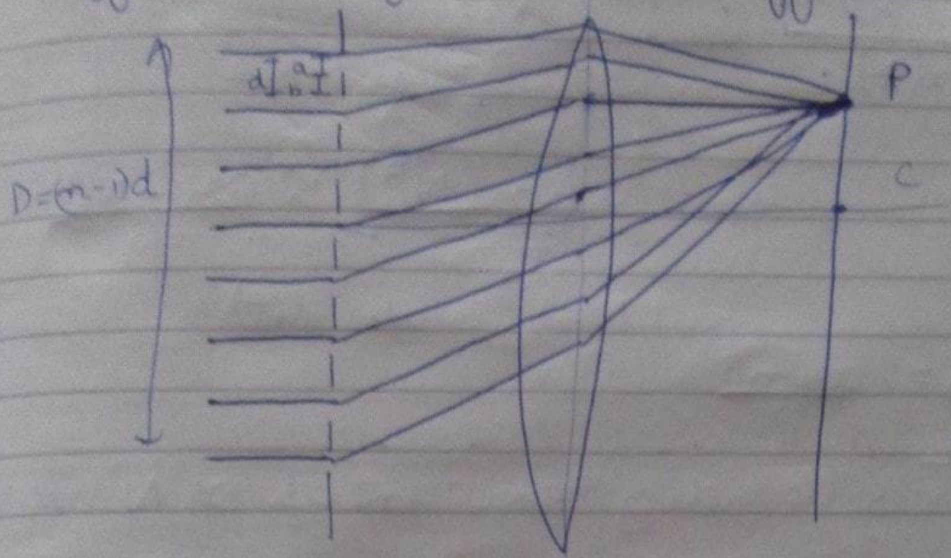
→ Diffraction for N-slits (Diffract^n Grating)



a = illuminated part
b = ~~opaq~~ opaque part

N-waves of same amplitude & d

$$y_1 = a\sin\omega t$$

$$y_2 = a\sin(\omega t+\phi)$$

$$y_3 = a\sin(\omega t+2\phi)$$

$$(\alpha = \phi_2-\phi_1)$$

$$y_n = a\sin(\omega t+(n-1)\phi)$$

$$y_R = y_1+y_2+y_3+\dots+y_n$$

$$y_R = a e^{-i\omega t}\left[e^{i\phi_1}+e^{i\phi_2}+\dots+e^{i\phi_N}\right]$$

$$= a e^{-i\omega t} e^{i\phi_1}\left[1+e^{i(\phi_2-\phi_1)}+\dots+e^{i(\phi_N-\phi_1)}\right]$$

$$= a e^{-i\omega t} e^{i\phi_1}\left[1+e^{i\alpha}+e^{i2\alpha}+e^{i3\alpha}+\dots+e^{i(N-1)\alpha}\right]$$

$$= a e^{-i\omega t} e^{i\phi_1}\left[\frac{e^{iN\alpha}-1}{e^{i\alpha}-1}\right] \rightarrow \left[\frac{e^{iN\alpha/2}-e^{-iN\alpha/2}}{e^{i\alpha/2}-e^{-i\alpha/2}}\right]\times\left[\frac{e^{iN\alpha/2}}{e^{i\alpha/2}}\right]$$

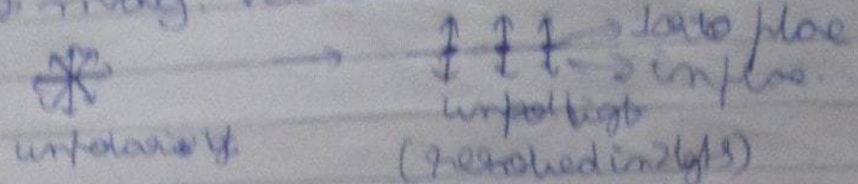
$$\left(\frac{\sin\frac{N\alpha}{2}}{\sin\alpha/2}\right) e^{\frac{i(N-1)\alpha}{2}}$$

$$y_R = a e^{-i\omega t} e^{i\phi_{avg}} \times \frac{\sin N\alpha/2}{\sin\alpha/2}$$

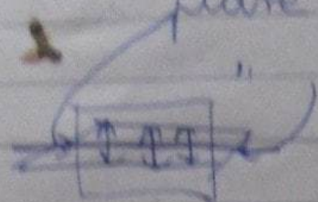
Take real part.

Polarization

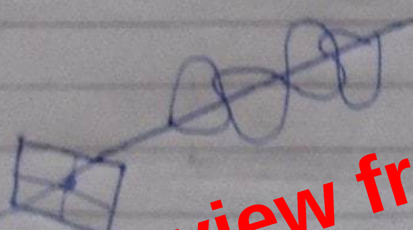
→ It establish transverse nature of light
→ Elec. & mag. vectors mutually ⊥ar.



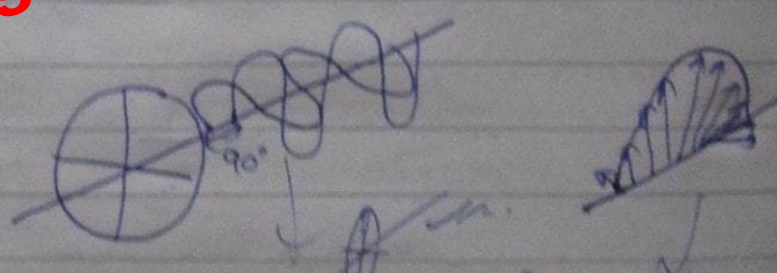
plane of polarisatⁿ → where's vibratⁿ get cancelled
" " vibratⁿ → vibratⁿ are there.



→ Types of Polarization-
① Plane polarized - elec. vtor. vib. in straight line ⊥ar to directⁿ of propⁿ & mag.



② Circularly Polarized - 2 PP light superimposed, elec. vector rotates as a circle. $\frac{\pi}{2}$ → phase diff.

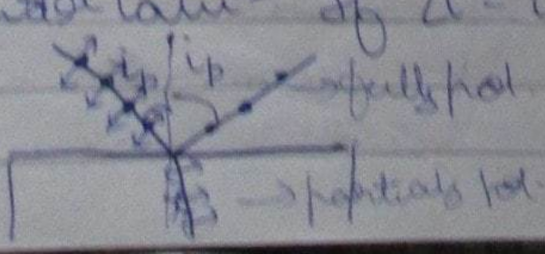


③ Elliptically Polarized - diff. mag, $\Delta\phi = 90°$, ellipse to

→ Methods to produce polarized light-
① By reflectⁿ ② By refract ③ By double refraⁿ ④ By selective absor/

→ By Reflectⁿ-
• Brewster law - If $\angle i = i_p$, unpol → pol

$\mu = \tan i_p$



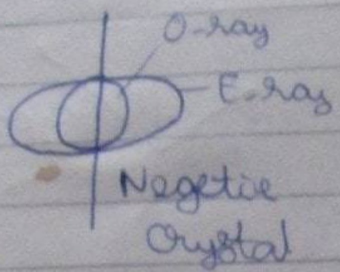
① $\frac{\sin i_p}{\sin r} = \mu = \frac{\sin i_p}{\cos r}$

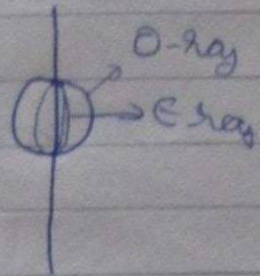
② $i_p + r + \theta = 180°$
$\theta = 90°$

- Postulates-

• for O-ray - crystal is isotropic - spherical (same v in all direct)

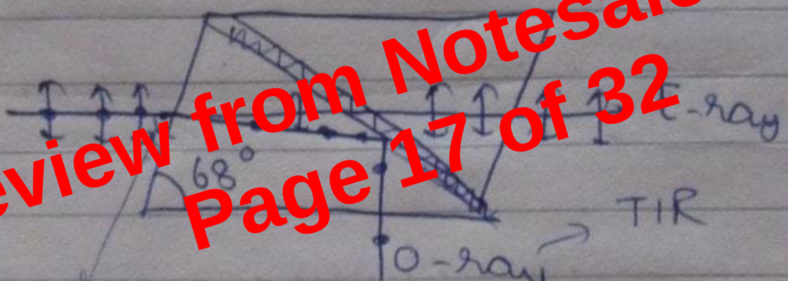
• for E-ray - " " anisotropic - spheroid & ellipsoid





→ Nicol prism - 2 calcite crystal, cut to 68° and joined by Canada Balsam

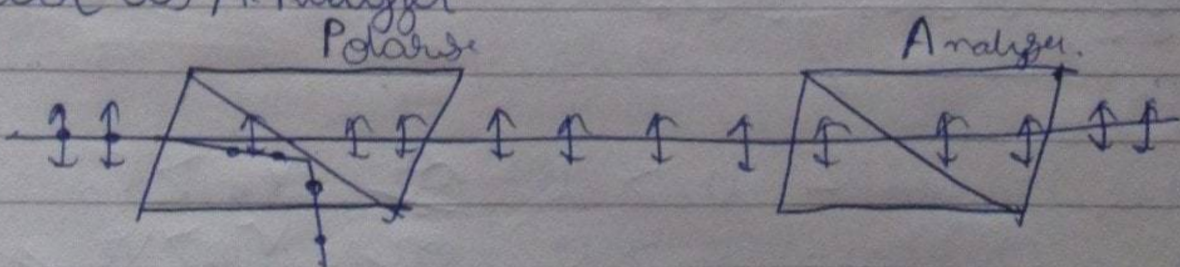
$v_e < v_{cb} < v_o$



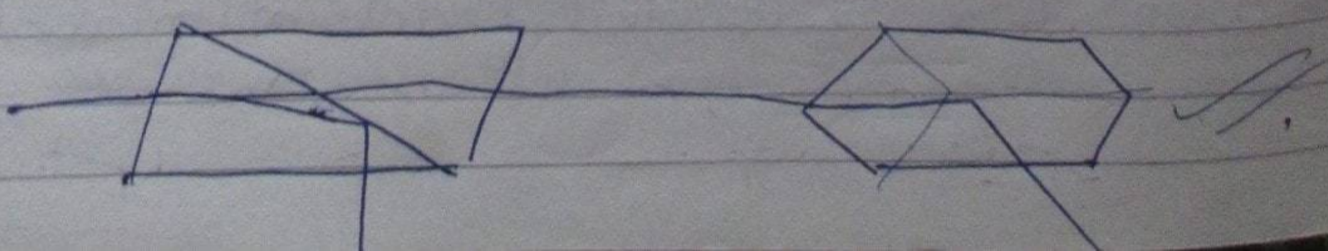
If ∠x is small, no TIR for O-ray
∠x is large, TIR for E-ray also.

→ Nicol as Analyzer-

I.



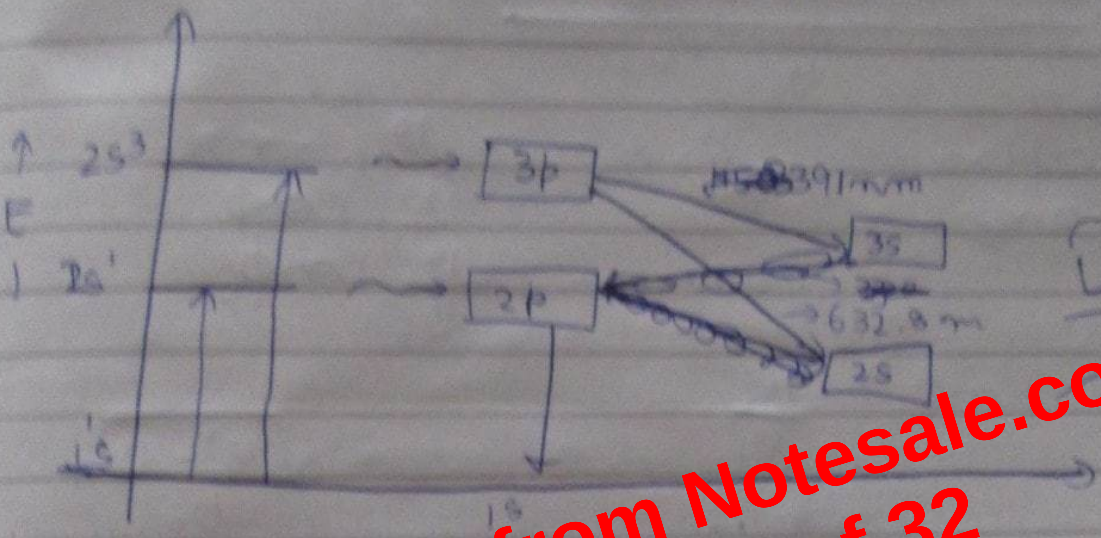
II. If rotated 90°, for A, E ray = O ray.



→ He-Ne Laser

I. He → He^* II. $He^* + Ne \rightarrow He + Ne^*$

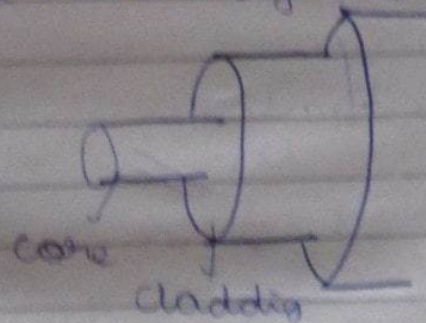
III. Pop^n inversion IV. 632.8 Å nm, 1150 Å, 3390 Å



HeNe laser

Ray Optics

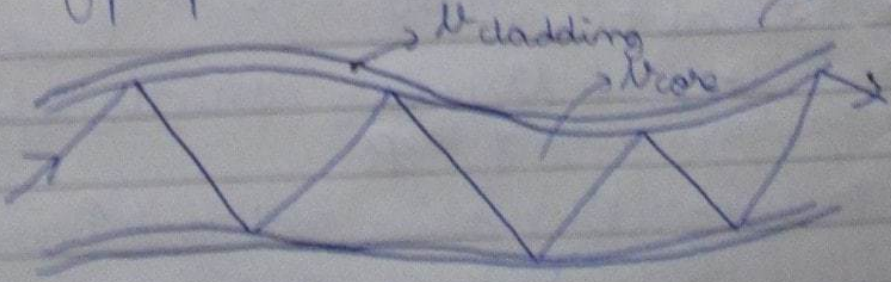
→ Optical Fibre - light as waveguide - long dis (visible & infrared)



$n_{clad} > n_{core}$ → based on TIR

$n = \sin(i_c)$

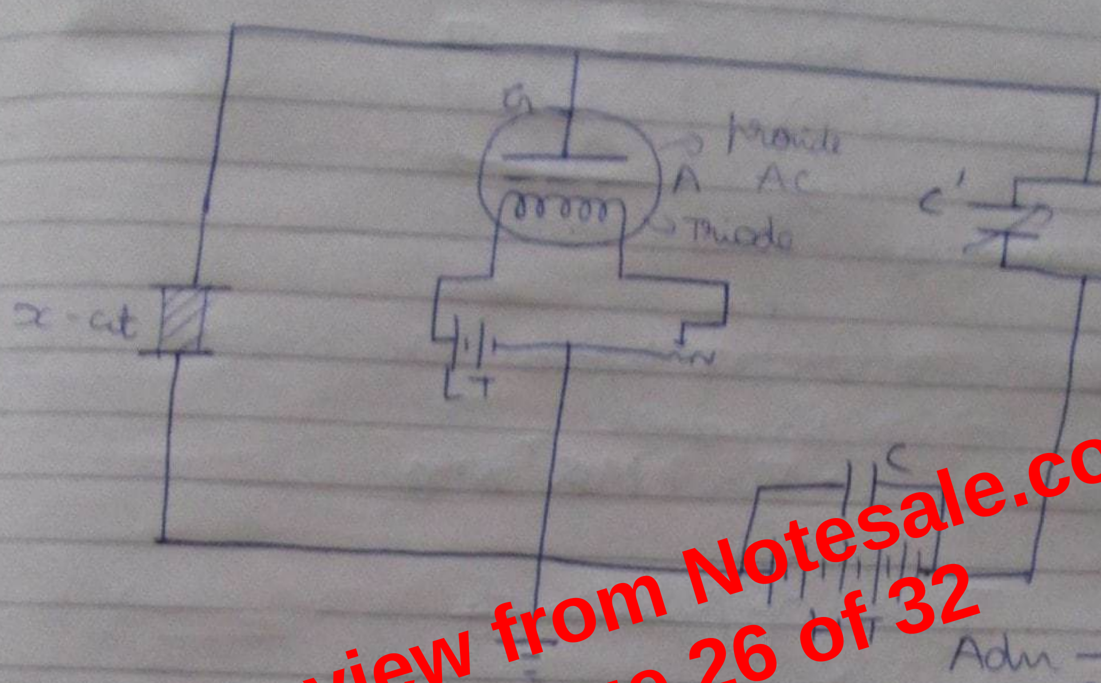
→ Principle of prop^n - TIR



should not be bent (otherwise no TIR)

- we use thick slabs & higher order - better than (than fundamental)
- If even harmonics - one left - either compression or rarefaction
→ Piezoelectric Generator -

x-cut = long
y-cut = transverse
so we don't use it.

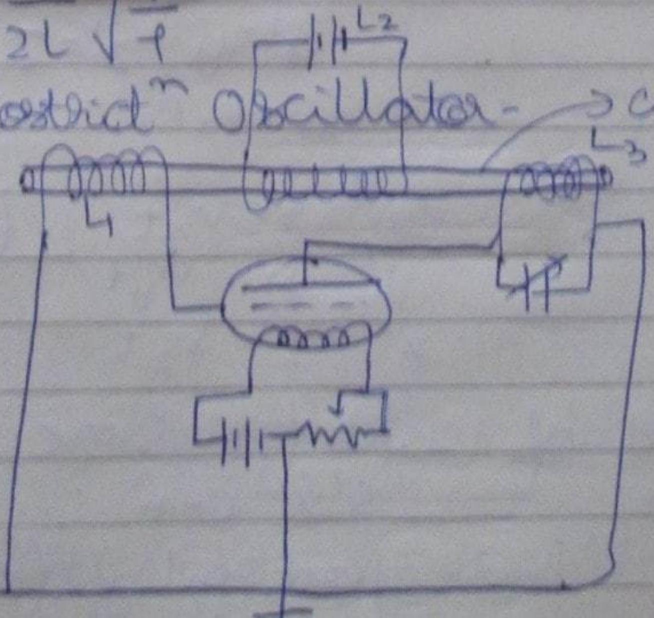


(changes ν)
→ $\nu = \frac{1}{2\pi\sqrt{LC}}$

Adv — • 500 MHz
• wide range
Disadv - • high cost
• tedious cutting

→ Magnetostriction Method - (in ferromagnetic only)
- when mag field applied, ferro. changes length
- common alloys - iron, nickel, cobalt
- $\nu_r = \frac{1}{2L}\sqrt{\frac{Y}{\rho}}$

→ Magnetostriction Oscillator - → change length



L_1, L_2 & L_3 causes change in length ✓

• Adv - • cheap • simple
• Disadv - • low ν upto 3 MHz
• depends on temp