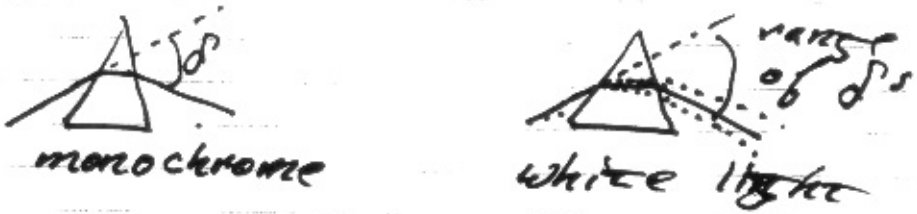
Dispersion + Prisms

→ index of refraction
- can vary w/ λ

$n = n(\lambda)$

→ e.g. Quartz varies by ~1% over visible wavelengths

"DISPERSION"
→ different λ's refracted to diff angles



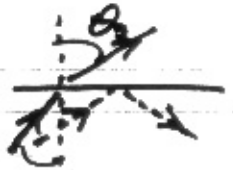
monochrome white light

→ will see violet light deviate most, red least

→ rainbow when between sun + rain shower

Total Internal Reflection

→ if $n_1 > n_2$



→ critical angle
→ refracted light @ $\theta_2 = 90°$
→ what is θ_1 here?

- shallower angles
→ obey law of reflection $\theta_i = \theta_o$
→ use Snell's Law:

$$n_1 \sin\theta_c = n_2 \sin 90° = n_2$$

$$\sin\theta_c = \frac{n_2}{n_1} \quad (\text{for } n_1 > n_2)$$

→ since $\sin\theta \leq 1$, $n_2 \geq n_1$
→ so to lower index of refraction

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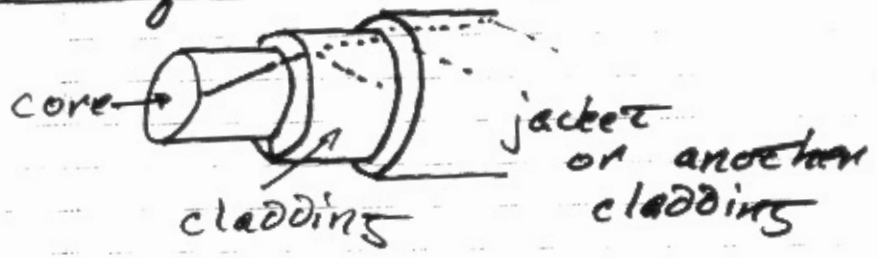
Optical fiber

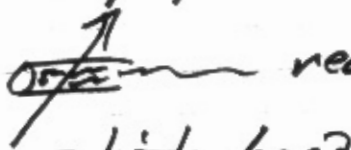


→ at each boundary: $n_{out} < n_{in}$

→ a θ_c → keep light in

→ cladding keeps more light

→ particle physics



→ phones → high bandwidth

→ cardiac catheterization

→ look at inaccessible locations

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Fermat's Principle

- when light ray travels between any two points, its path is the one that requires the smallest time interval