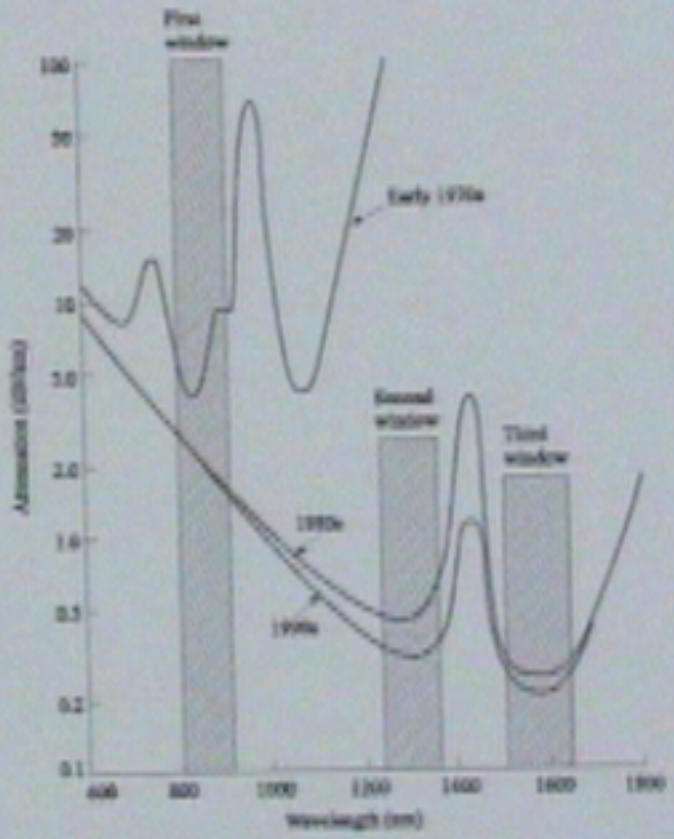
History of attenuation

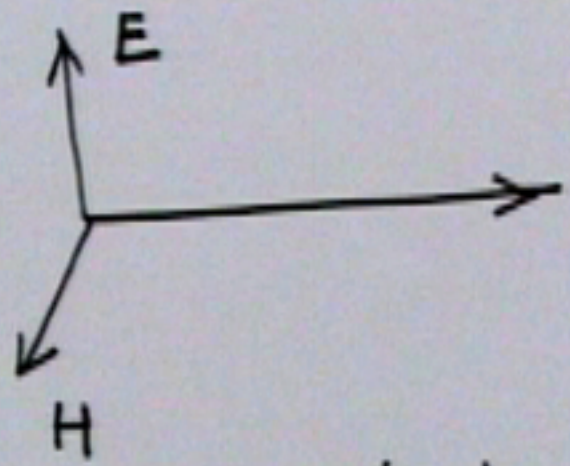


Advantages of Optical Communication

- Ultra high bandwidth (THz)
- Low loss (0.2 dB/Km)
- Low EMI
- Security of transmission
- Low manufacturing cost
- Low weight, low volume
- Point to Point Communication

Characteristics of light

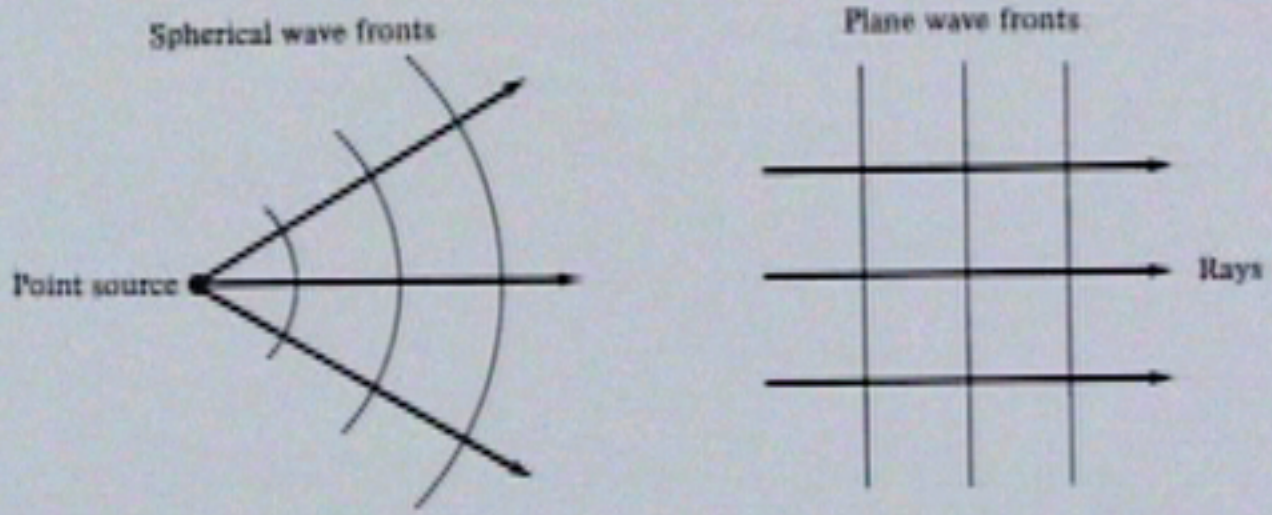
- Intensity
- Wavelength (Color)
- Spectral width (purity of color)
- Polarization
  - Linear
  - Circular
  - Elliptical
  - Random



$$\frac{|E|}{|H|} = \eta = \text{Intrinsic Impedance}$$

$$= \sqrt{\frac{\mu}{\epsilon}}$$

Spherical and plane wave fronts



Wave Function

- $\Psi(x, t) = A \exp(\omega t - \beta x) j$

- A: Amplitude of the wave
- ω: Angular frequency of the wave (rad/s)
- β: Phase constant (rad/m)

Refractive index

$$n = \frac{c}{v}$$

Effective Ref. index

$$n_{eff} = \frac{c}{v}$$

800 nm 1300 nm 1550 nm

$1\ nm = 10^{-9}\ m$

$$\lambda = \frac{v}{f} \Rightarrow f = \frac{3\times10^{8}}{1000\times10^{-9}} = 3\times10^{14}\ Hz$$

$$\Delta\lambda = -\frac{v}{f^2}\Delta f$$

$$= -\frac{v}{f}\cdot\frac{\Delta f}{f}$$

$$\frac{\Delta\lambda}{\lambda} = -\frac{\Delta f}{f}$$

$$\frac{100}{1000} = 0.1 = -\frac{\Delta f}{f} \Rightarrow \Delta f = 3\times10^{13}\ Hz$$

Single fiber structure