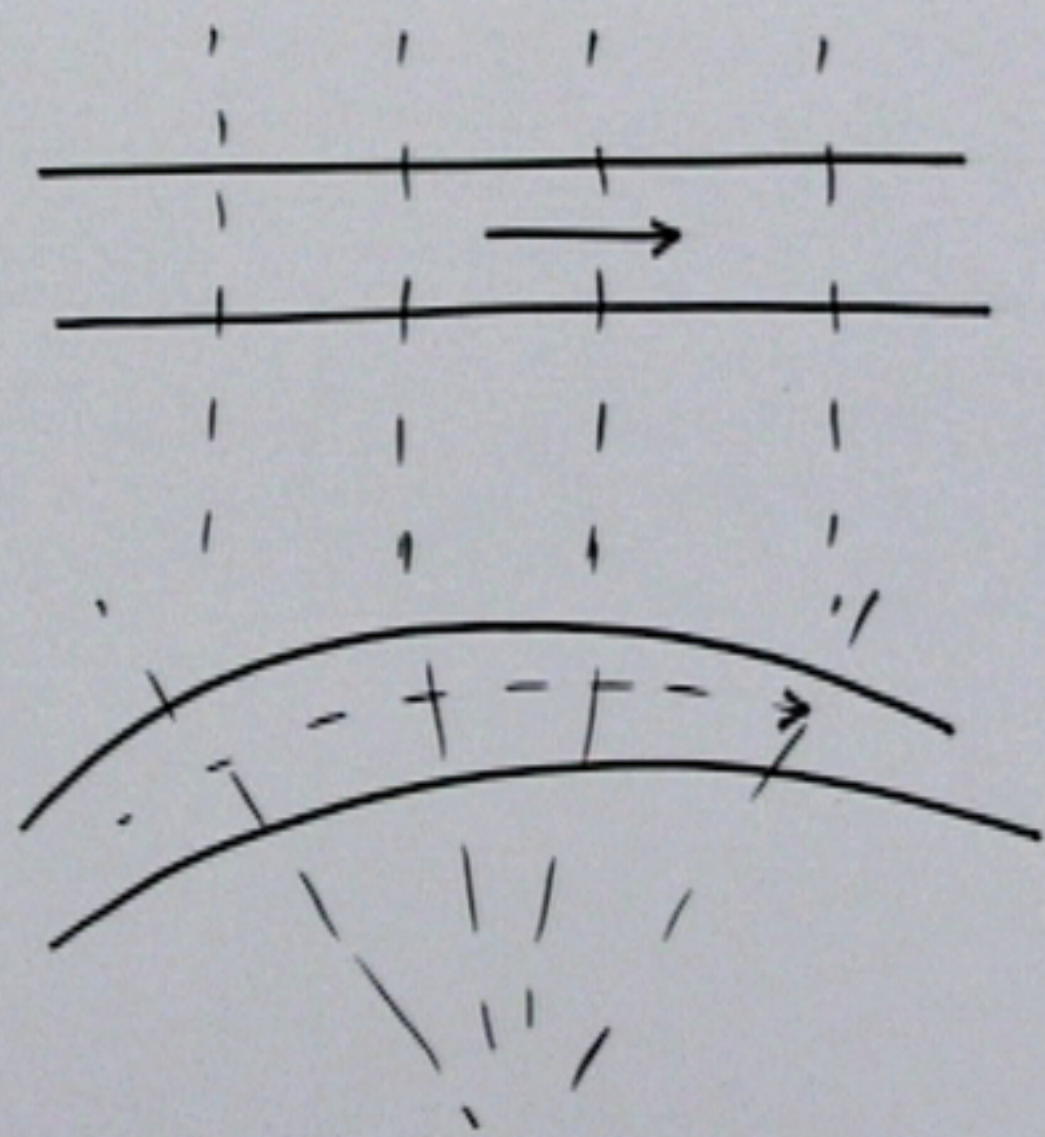
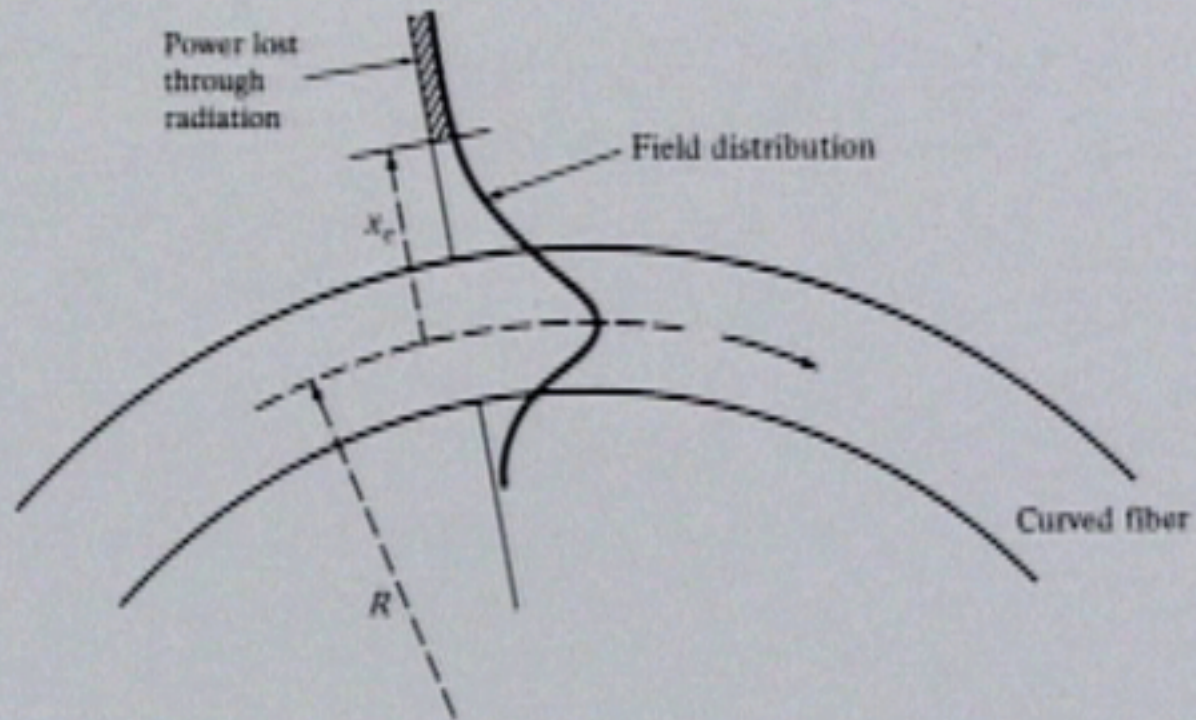


# Signal Distortion

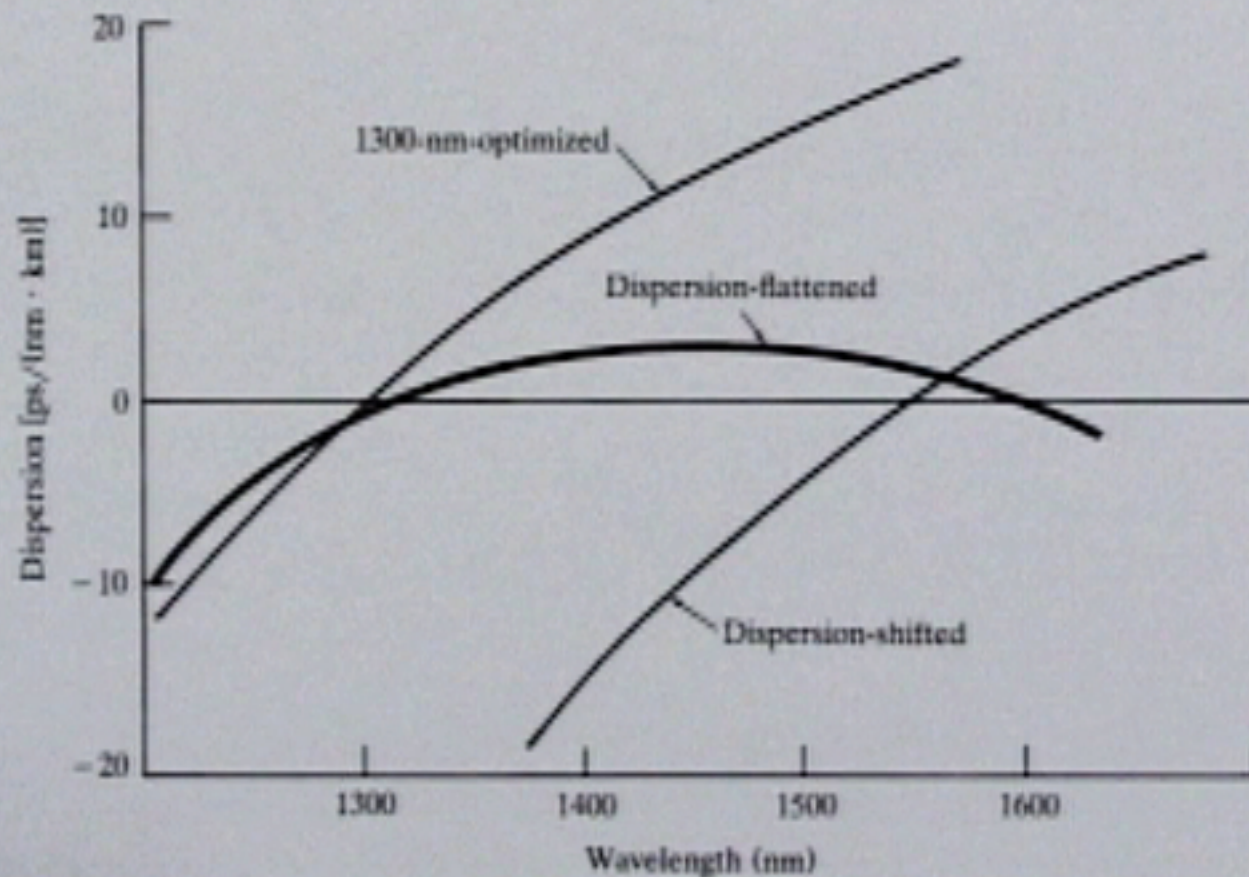
- **Dispersion**
  - Material
  - Intramodal
  - Intermodal  
( Multi-mode only)
- **Attenuation** (10.9 Hz)
  - Material
    - Absorption
    - Scattering  $\sim \lambda^{-4}$
  - Micro-bending
  - Radiation  
(Macro-bending)



## Power loss in a curved fiber

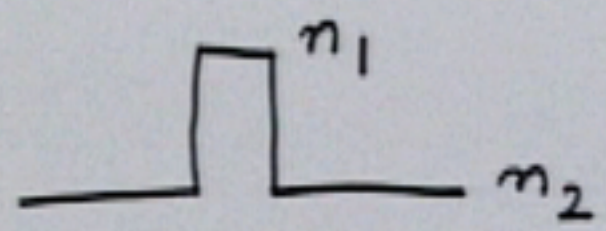


## SM-fiber dispersions

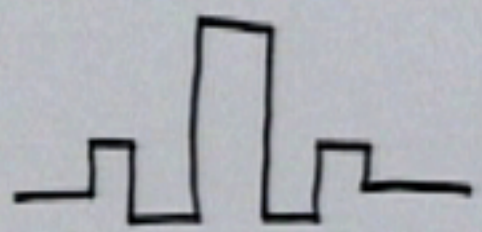


(b)

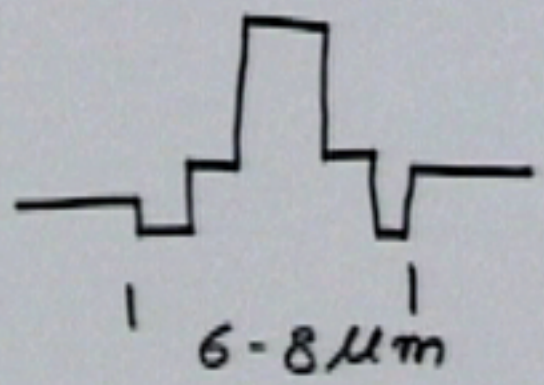
SM

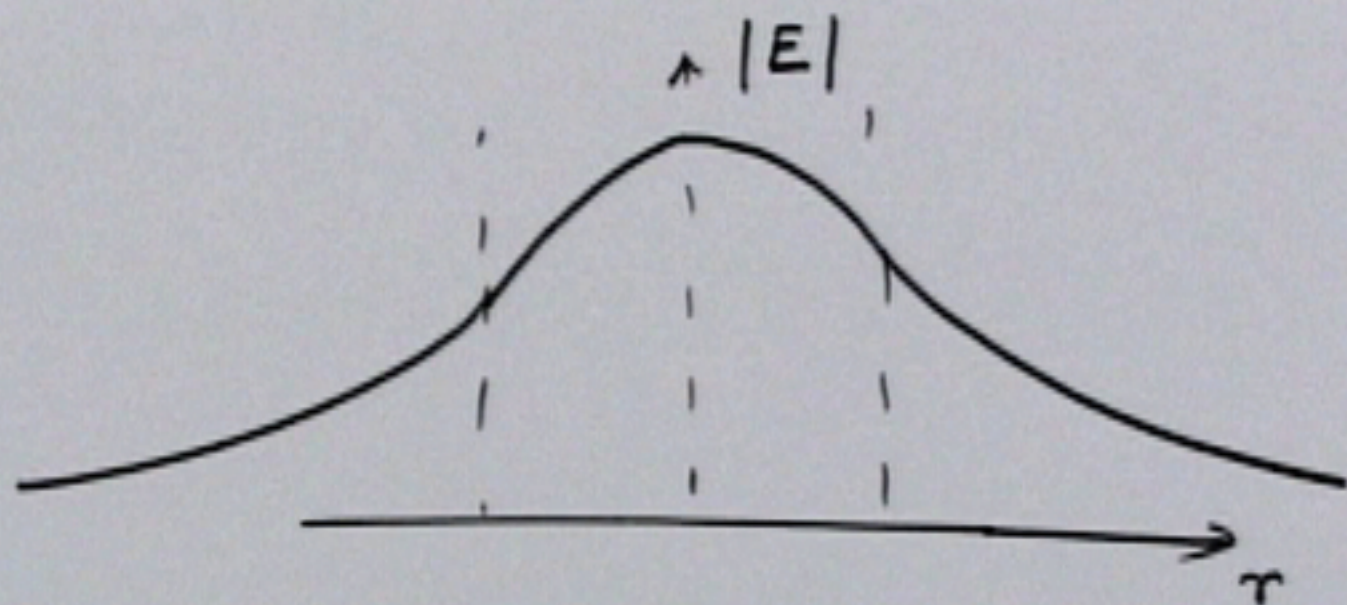


DS



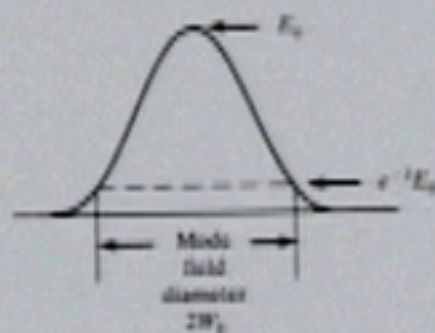
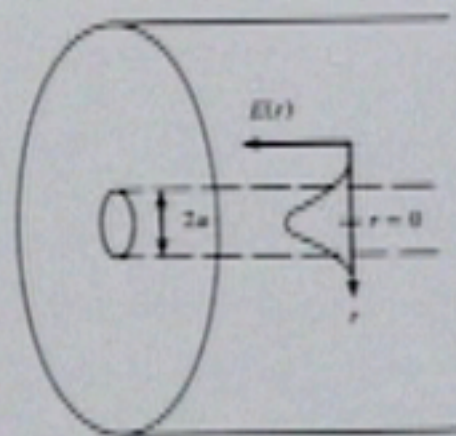
DF





$LP_{01}$

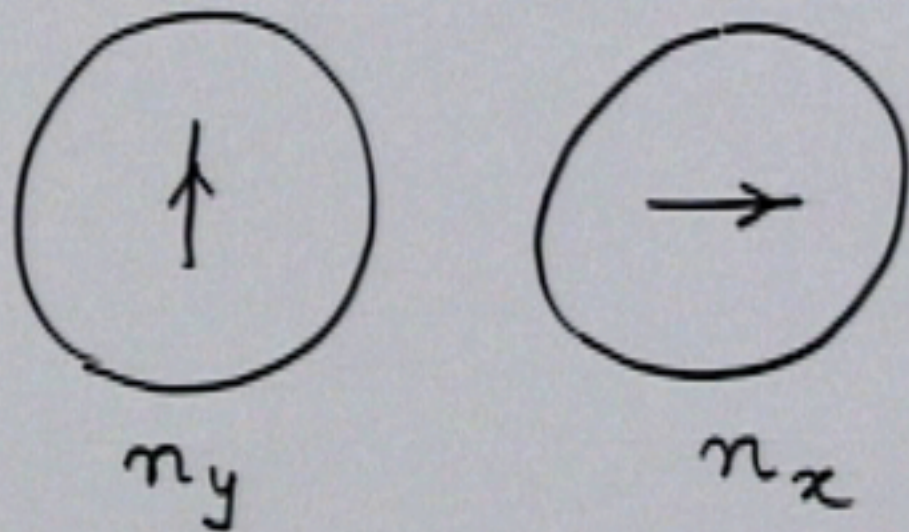
Mode-field diameter



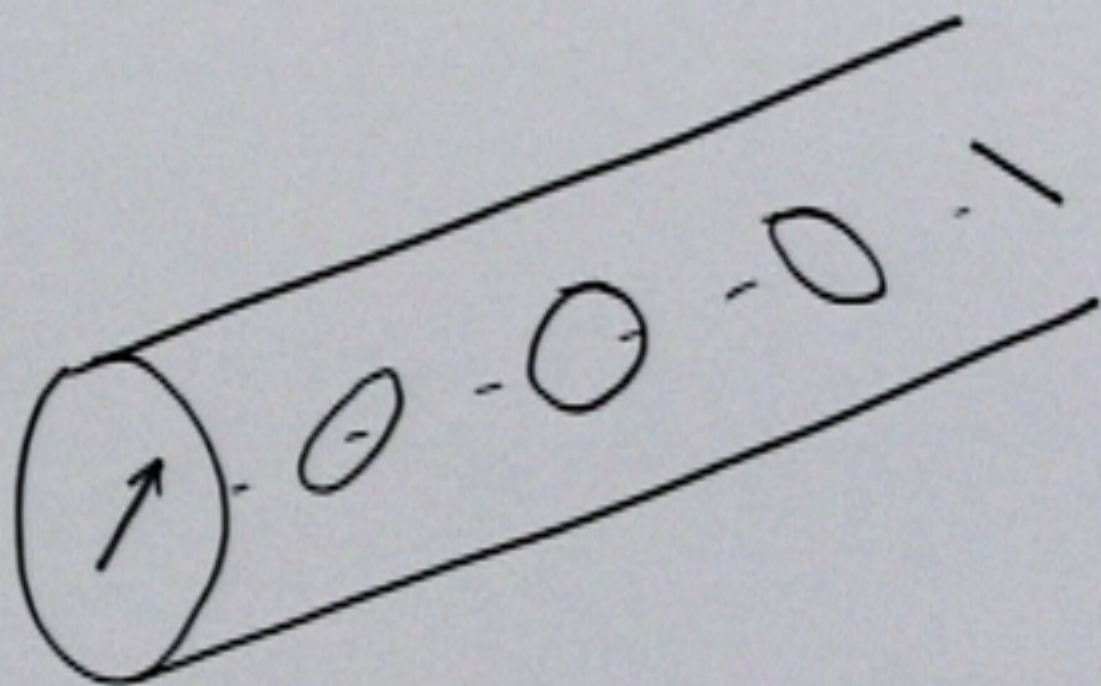
$$\text{LOSS} = \log_{10} \left\{ \frac{2}{\left( \frac{\text{MFD}_1}{\text{MFD}_2} \right) + \left( \frac{\text{MFD}_2}{\text{MFD}_1} \right)} \right\}$$



Birefringence of a fiber.



$$B_f = n_y - n_x$$



$$\text{Beat length} = \frac{2\pi}{\beta_0 (n_y - n_x)}$$

## Polarization mode dispersion

