

Physics hour 08

1) Photonenantrieb

$$\text{Strahlungsdruck } p = \frac{\bar{F}}{A} = \frac{\bar{I}}{c} \rightarrow \bar{F} = \frac{\bar{I} \cdot A}{c} = \frac{P/A \cdot A}{c} = \frac{P}{c}$$

$$\text{mit } \bar{I} = \frac{P}{A} \quad = \frac{10^5 \text{ W}}{3 \cdot 10^8 \text{ m/s}} = \frac{1}{3} \cdot 10^{-3} \text{ N} = 0,33 \text{ mN}$$

2) Lichtgeschwindigkeit in Glasfaser

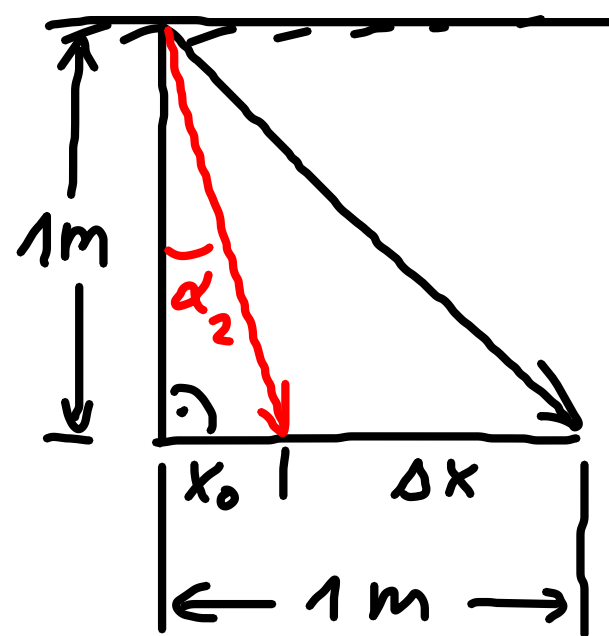
$$c_n = \frac{c}{n} = \frac{l}{T} \rightarrow T = \frac{l \cdot n}{c} = \frac{1000 \text{ m} \cdot 1,5}{3 \cdot 10^8 \text{ m/s}} = \frac{1}{2} \cdot 10^{-5} \text{ s} = 5 \cdot 10^{-6} \text{ s} = 5 \mu\text{s}$$

3) Brechung 1

$$n_1 \cdot \sin(\alpha_1) = n_2 \cdot \sin(\alpha_2)$$

$$\rightarrow \alpha_2 = \arcsin\left(\frac{n_1}{n_2} \cdot \sin(\alpha_1)\right) = 32,1^\circ$$

4) Brechung 2

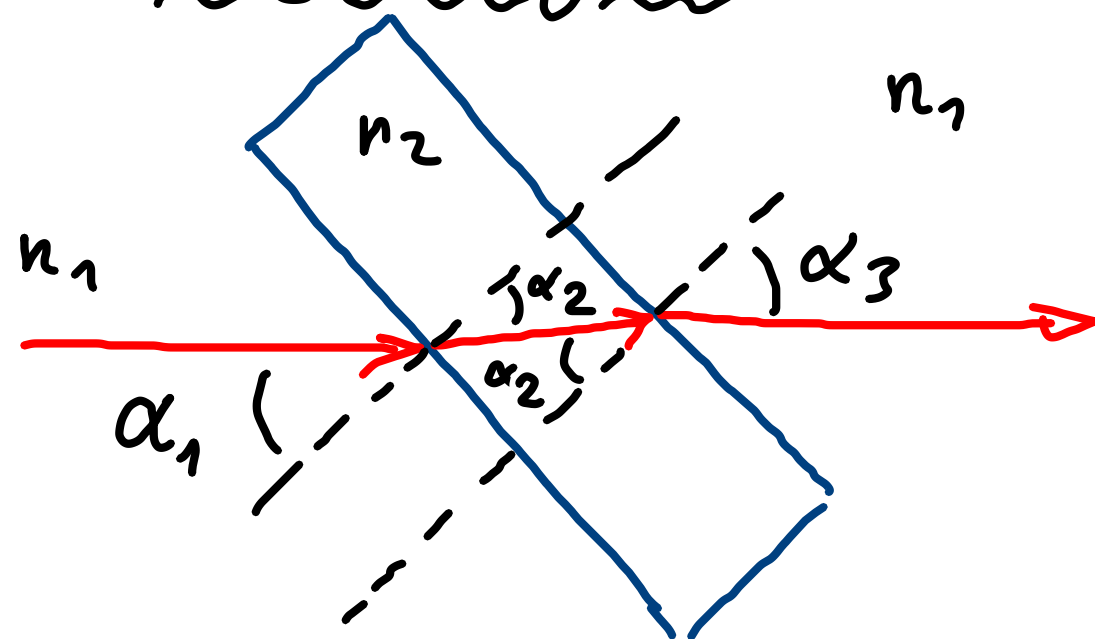


$$\Delta x + x_0 = 1m$$

$$\frac{x_0}{1m} = \tan(\alpha_2) \rightarrow x_0 = 1m \cdot \tan(32,1^\circ)$$

$$\rightarrow \Delta x = 1m - 1m \cdot \tan(32,1^\circ) = 1m (1 - \tan(32,1^\circ)) = 37 \text{ cm}$$

5) Brechung 3



$$n_1 \sin(\alpha_1) = n_2 \cdot \sin(\alpha_2)$$

$$n_2 \sin(\alpha_2) = n_1 \cdot \sin(\alpha_3)$$

$$\Rightarrow n_1 \sin(\alpha_1) = n_1 \cdot \sin(\alpha_3)$$

$$\Rightarrow \alpha_1 = \alpha_3$$

6) Totalreflexion in Glasfaser

$$\alpha_T = \arcsin\left(\frac{n_2}{n_1}\right) = \arcsin\left(\frac{1,44}{1,45}\right) = 83,3^\circ$$

7) Absorption in Glasfasern 1

$$P(x) = P_0 e^{-\mu x} \rightarrow \frac{P(x)}{P_0} = e^{-\mu x} = 0,1$$

$$e^{-\mu x} = 0,1 \quad | \ln$$

$$-\mu x = \ln(0,1) \quad ; \quad x = \frac{\ln(0,1)}{-\mu} = \frac{\ln(0,1)}{-3,6 \cdot 10^{-5}/m} = 64 \text{ km}$$

8) Absorption in Glasfasern 2

$$\frac{P_{\text{out}}}{P_{\text{in}}} = \frac{P(x)}{P_0} = e^{-\mu \cdot x} = e^{-3,6 \cdot 10^{-5}/m \cdot 5 \cdot 10^6 m} = e^{-180} \approx 10^{-79}$$