$$\text{mean free path } L \quad = \quad \frac{1}{n_H \ \sigma}$$

$$\begin{aligned} \text{optical depth } \tau \quad &= \quad \text{number of mean free paths through slab} \\ &= \quad \frac{D}{L} \end{aligned}$$

$$I \quad = \quad I_0 \, e^{-\tau}$$