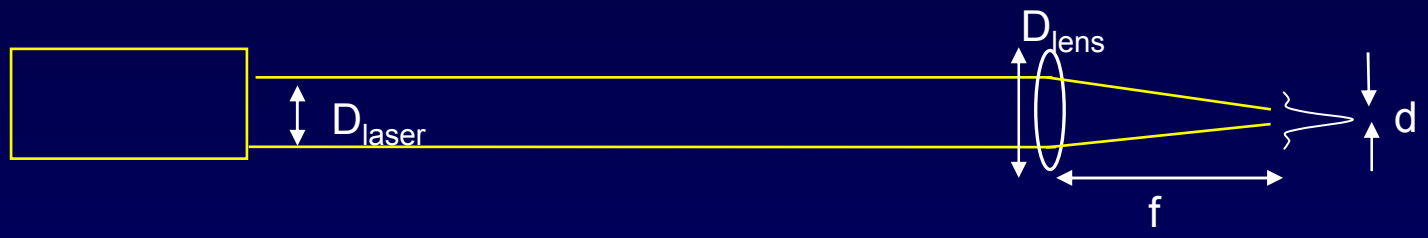
Solution

There are many times you would like to focus a laser beam to as small a spot as possible. However, diffraction limits this.



The circular aperture of a laser (λ = 780 nm) has D_{laser} = 5 mm.
What is the spot-size d of the beam
after passing through a perfect lens with focal length f = 5mm
and diameter D_{lens} = 6 mm?

The angular spread of the beam is determined by the smaller of D_{laser} and D_{lens}. Here, it's D_{laser}.

$$\theta_o = 1.22\lambda / D_{laser}$$

Light at this angle will intercept the focal plane at d/2 ~ f θ_o.

$$d \approx 2\theta_o f = 2.44\lambda f / D_{laser}$$

$$= 2.44(0.78\mu m)(5mm)/(5mm) = 1.9\mu m$$