

Ch. 4 Prob. 57

- a) Find The minimum angular spread of 633 nm light going through a 1.00 mm diameter opening.

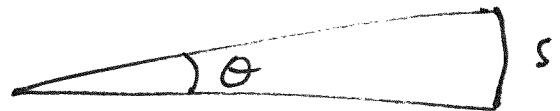
Using The Rayleigh criterion gives

$$\theta = 1.22 \frac{\lambda}{D} = 1.22 \left(\frac{633 \times 10^{-9} \text{ m}}{1.0 \times 10^{-3} \text{ m}} \right)$$

$$\theta = 7.72 \times 10^{-4} \text{ rad}$$

- b) How big a spot will exist on a mountain cliff 15.0 km away.

$$r = 15 \times 10^3 \text{ m}$$



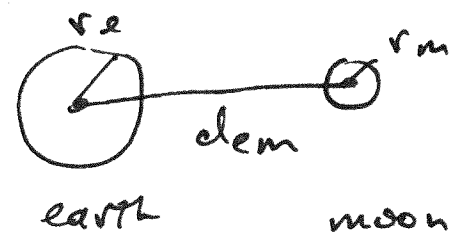
$$S = r \cdot \theta = (15 \times 10^3 \text{ m}) (7.72 \times 10^{-4} \text{ rad})$$

$$S = 11.6 \text{ m} \Rightarrow 23.2 \text{ m} = \text{Diameter}$$

x2

- c) How big a spot will form on The moon?

The distance between the earth's surface + the moons surface is



$$r = d_{em} - r_e - r_m = 0.386 \times 10^9 - 6.38 \times 10^7 - 3.48 \times 10^6$$

$$r = 3.19 \times 10^8 \text{ m}$$

$$S = r \theta = (3.19 \times 10^8 \text{ m}) (7.72 \times 10^{-4} \text{ rad}) = 2.46 \times 10^5 \text{ m} = 246 \text{ km}$$

Diameter = 1100 km