

**15.** It is claimed that some professional baseball players can see which way the ball is spinning as it travels toward home plate. One way to judge this claim is to estimate the distance at which a batter can first hope to resolve two points on opposite sides of a baseball, which has a diameter of 0.0738 m. **(a)** Estimate this distance, assuming that the pupil of the eye has a diameter of 2.0 mm and the wavelength of the light is 550 nm in vacuum. **(b)** Considering that the distance between the pitcher's mound and home plate is 18.4 m, can you rule out the claim based on your answer to part (a)?

$$\theta_{\text{minimum}} = \frac{1.22 \lambda}{D} \approx \frac{y}{L}$$

Solving for distance L

$$L = \frac{yD}{1.22 \lambda} = \frac{(0.0738 \text{ m})(2.0 \times 10^{-3} \text{ m})}{1.22(550 \times 10^{-9} \text{ m})} = 2.20 \times 10^2 \text{ m} = 220 \text{ m}$$

As the distance away decreases, the angle subtended increases. This means if someone is observing the two spots closer than this distance, they will be able to resolve the two spots at least from diffraction conditions. Since  $220 \text{ m} \gg 18.4 \text{ m}$ , clearly the claim cannot be ruled out!

$L = 220 \text{ m}$   
**No, you cannot rule out the claim based on this calculation !**

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