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Astr 1020

Problem Set #1

(To be discussed in class!)

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1. What is the wavelength of radio waves broadcast by an AM radio station operating at 1590 kHz?

2. What is the frequency of microwave radiation of wavelength 3.0 cm?

3. The Great Red Spot of Jupiter is about $24,000$ km across. When Jupiter is at a distance of 4.5 AU from the Earth, what is the angular size of the Red Spot?

4. Suppose a star which is 25 light–years away from us has a planet which is orbiting it at a distance of 5.20 AU (this is the distance of Jupiter from our own Sun). What is the largest angular separation we could observe for the star and the planet?

5. The Ring Nebula (M57) has an *angular* diameter of 74 arcseconds. We can determine that its distance is 1400 ly. What is its diameter (that is, its actual size)?

6. What is the resolving power of a telescope with mirror diameter of 50 inches, assuming there is no atmospheric distortion? Could this telescope possibly resolve the star and planet in Problem 4?

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$1 \text{ AU} = 1.50 \times 10^{11} \text{ m}$ $1 \text{ light year} = 9.46 \times 10^{15} \text{ m}$ $c = 3.00 \times 10^8 \frac{\text{m}}{\text{s}}$

$\pi \text{ radians} = 180 \text{ degrees}$ $1 \text{ deg} = 60 \text{ min}$ $1 \text{ min} = 60 \text{ sec}$

$\lambda f = v$ $\theta = \dfrac{d}{D}$ (θ is in radians; units of d and D are the same!)

$\alpha = \dfrac{11.6}{D}$ with α in sec, D in cm

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