

ASTR 121: Homework 6

Due Thursday, October 15th, 2009

For problems of a mathematical nature, show all work for full credit (including multiple choice responses).

- (10 pts)** Which of the following is **NOT** an advantage to using a reflecting telescope?
 - Mirrors reflect all wavelengths of light the same way.
 - Supporting large mirrors is easier than supporting large lenses.
 - Spherical aberration does not plague mirrors as it does with lenses.
 - The material that composes a mirror may contain imperfections; a lens must be perfect throughout.
- (10 pts)** Which series of telescopes are used for ground-based observations?
 - ROSAT, CGRO, HST, VLA.
 - Kitt Peak National Observatory, VLA, VLT, Keck I
 - JWST, Kitt Peak National Observatory, VLA, Keck II
 - VLA, Keck I, Keck II, CGRO
- (15 pts)** List **3** problems ground-based observatories face with regards to collecting sharp images.
- (10 pts)** Why can radio telescopes be made of wire mesh rather than a solid mirror like optical telescopes?
- (15 pts) Refracting Telescopes:** *Try these without a calculator!*
 - How is the light gathering power of a refracting telescope affected if you triple the diameter of its objective lens?
 - What is a telescope's magnification if it makes a distant object in the sky that has an angular size of 0.5° look to be 4° ?
 - What is a telescope's magnification if the focal length of its objective lens is 1 m and the focal length of its eyepiece is 5.0 cm?

6. (15 pts) **Angular Resolution.** We denote the diffraction-limited angular resolution with θ . (a) Find the ratio of θ 's when observing light at $\lambda = 400$ nm to when observing light at 700 nm. (b) Find the ratio of θ 's when observing the same wavelength using a telescope with a diameter of 10 m to when observing with one that has diameter of 8 m. (c) Find θ in arc seconds when observing light of $\lambda = 500$ nm with a telescope that has an objective diameter $D = 5$ m. (Note: to find the ratio of **a** to **b**, divide **a** by **b**: $\frac{a}{b}$.)
7. (25 pts) **James Webb Space Telescope (JWST):**
- (a) JWST is a:
- (a) Galilean refractor.
 - (b) Cassegrain reflector.
 - (c) Newtonian reflector.
 - (d) Coudé reflector.
- (b) When JWST is launched, it will be at a distance $d = 1.5 \times 10^6$ km from the Earth, in a direction that is *away* from the Sun: that is, JWST will have a distance of 1 AU *plus* 1.5×10^6 km from the Sun. Find the ratio of the force on JWST exerted by the Sun to the force exerted by the Earth. Based on your result, should JWST orbit the Sun or the Earth? Assume that the Sun, the Earth, and JWST form a straight line.