Astronomy 16 – Modern Astrophysics

Fall 2014

Homework 1

due: Tuesday, September 9, in class

It is very important to present your solutions neatly and clearly. Use units when appropriate, state where your numbers come from, explain what you're doing unless it's very obvious. Use sketches when you think they'd be useful. Quite a few of the questions are multi-part; make sure you answer each part. Your solution for a question that asks for a specific quantitative answer (e.g. #4 on this assignment) should include an explanation, not just a number.

Bring this short homework to class on Tuesday morning, where you'll hand it in. Usually you'll hand in homework in the box on the wall outside my office door. But not this time. I strongly recommend that you copy (Xerox; photograph and print out) your solutions so you can consult them during our class discussion, even after you've handed them in.

1. Ryden & Peterson problem 1.6 (p. 27). Only do part (a).

2. How far would a 100 Watt (W) light bulb have to be from you (in meters) so that it appeared to your eyes to be exactly as bright as the bright star Sirius? For this problem, you should assume that Sirius is 30 times as luminous as the Sun and that its parallax angle is 0.35 arc seconds (note: that's half the full parallax shift, by convention, as we discussed in class on Thursday). Note that in addition to the previously assigned reading and information in the class about parallax, you can read more about stellar parallax and the parsec on pp. 307-8.

3. Angular sizes of stars and planets:

    a. What is the angular size of a typical, nearby star and can we see this angular extent with a telescope? To answer this question, compute the angular diameter of a star identical to the Sun, at the distance of Proxima Centauri (1.3 parsecs), and comment on how it compares to the 1 arc second atmospheric limit of ground-based telescopes' resolution.

    b. And what is the angular size of Venus? Of course, Venus's distance from us changes depending on our relative positions in our respective orbits. So for this problem, take Venus to be at "maximum elongation" and compute its distance from the Earth at that point, using your knowledge of the angle of maximum elongation of Venus (mentioned in the text) and the orbital semi-major axis of Venus (you can find this value in the Appendix of your textbook, along with a value for the radius of Venus itself; you can assume both the Earth and Venus have circular orbits – then the "semi-major axis" is just the radius of the orbit; note that there is a figure in the textbook showing this Earth-Venus-Sun configuration at maximum elongation; I showed it in class on Thursday). Comment on the observability of Venus's size given that the resolution limit of the naked eye is about 1 arc minute.

4. If you see a first quarter Moon on the meridian (i.e. due South – the "meridian" is an imaginary line connecting the point on the horizon that's due South to the zenith), approximately what time of day must it be? Fig. 4.10 might help you think about this. Note that from the figure's view, above the northern hemisphere, the Earth's direction of rotation is counter-clockwise.