

PHYS 321: PROBLEM SET 1

Due Jan 29, 2018 @ 11:30 am

Solve the problems listed below, and write up your answers clearly and completely. Do not turn in rough work – instead, make a clean copy after checking your calculations. Use English sentences and phrases to explain your solution and describe your answers step by step. Even if you did not get the correct answer, you may get partial credits for these steps!

1. (2 credits) The parallax angle for Sirius, the brightest star in the night sky (the “Dog Star” in constellation Canis Major), is $0.379''$,
 - (a) Find the distance to Sirius in units of i) parsecs; (ii) light-years; (iii) AU; (iv) m.
 - (b) Determine the distance modulus for Sirius.
2. (2 credits) The brightest star in the sky is our star, the Sun, with an apparent magnitude of $m_{\odot} = -26.83$, located at a distance of $1 \text{ AU} = 4.848 \times 10^{-6} \text{ pc}$. The apparent magnitude of Sirius is $m_{\text{sirius}} = -1.47$. If we were to place the Sun at the same distance of Sirius A (which you already know from the previous question):
 - (a) What is the apparent magnitude of the Sun?
 - (b) Does the Sun appear to be brighter or fainter than Sirius A? By how many times?
3. (4 credits) As seen from Earth, the Sun and the full Moon have apparent magnitudes of $m_{\odot} \approx -26.83$ and $m_{\text{Moon}} \approx -12.7$, respectively.
 - (a) Look up the numbers for solar luminosity L_{\odot} , the average Sun-Earth distance (well, 1 AU), as well as the radius of the Earth R_E . Calculate the **total power** from the Sun received on Earth in Watts. This is the maximum “solar power” we can possibly get!
 - (b) What is the corresponding power coming from the full Moon (in Watts)? Is “lunar power” likely to be a successful technology? Why?
 - (c) Imaging a star which has the same luminosity as the Sun and the same apparent magnitude as the moon. How far away would it be (in pc)?
4. (2 credits) A certain globular cluster has a total of 10^4 stars; 100 of them have visual magnitude $M_V = 0.0$ and the rest have $M_V = +5.0$. What is the integrated visual magnitude of the cluster?