

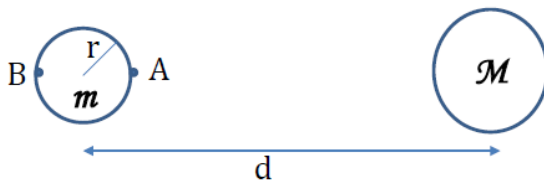
Introduction to Astronomy

HW20141030

due in 2 week

1. Find out where the “center of mass” is for the Earth-Moon system. Do the same for the Sun-Earth system. What is the speed with which the Earth orbits around the Earth-Moon system? What is the speed with which Jupiter orbits around the Sun-Jupiter system?

2.



- Two celestial objects with mass M and m respectively, are separated with a distance of d , and experience the mutual gravitational pull. The object m has a radius of r . (a) Compute the difference of the gravitational force from object M between point A, i.e., the nearest point on m to M , and point B, i.e., the furthest point on m . (b) Assuming object m is held together solely by its own self-gravity, what is the closest distance d_{\min} that m can approach M before m is torn apart? How does d_{\min} depend on the bulk density of m ?
3. The *Large Zenith Telescope* (LZT) in British Columbia, Canada, uses a 6-m liquid mirror made of mercury. From the web, investigate this technology. How can a liquid metal be formed into the necessary shape for a telescope mirror? What are the advantages of a liquid mirror? What are the disadvantages? Describe a concept to build a liquid mirror telescope on the Moon.
 4. The *Hubby-Eberly Telescope* (HET) at the *McDonald Observatory* in Texas has a spherical mirror, which is the least expensive shape to grind. Consequently, the telescope has spherical aberration. Check out what is the main functionality of the HET? Explain why spherical aberration does not affect the usefulness of the HET.
 5. The *James Webb Space Telescope* (JWST) is the next-generation space telescope, optimized in the infrared wavelengths. Compare the light collecting power and optical diffraction limit of JWST to the *Hubble Space Telescope* (HST) currently in orbit.
 6. A few major next-generation ground-based optical telescopes are being planned. These include the *Giant Magellan Telescope* (GMT), the *Thirty-Meter Telescope* (TMT), and the *European Extremely Large Telescope* (E-ELT). Describe the size of the telescope, potential site, countries/organizations involved, and the current status of each of these projects.
 7. What is active optics? What is adaptive optics? Why are they useful? Would either of these be a good feature to include on an astronomical telescope to be placed in orbit?