Astronomy 2110 Homework #8

Spring 2024 Due Thursday, April 4 in class.

For full credit you must write your solutions neatly and include all work. Do not forget the units.

1) In the maria, the lunar regolith is about 2 to 8 meters deep. In the lunar highlands, by contrast, it may be more than 15 m deep. Explain how the different ages of the two regions can account for this fact.

2) Calculate the round-trip travel time for a pulse of laser light that is fired from a point on Earth nearest the Moon, hits a reflector at the point on the Moon nearest the Earth, and returns to its point of origin. Assume that the Earth and Moon are at their average distance from each other.

3) No Apollo mission landed on the far side of the Moon. Why do you suppose this was? What would have been the scientific benefits of a mission to the far side?

4) Explain why Mercury does not have a substantial atmosphere – hint, calculate the escape velocity and compare it to the average speed of a hydrogen atom.

5) (a) Mercury has a 58.646-day rotation period. What is the speed at which a point on the planet's equator moves due to this rotation? (b) Use your answer from part (a) to determine the broadening in wavelength observed in the return signal for a radar aimed at Mercury at a wavelength of 12.5cm.

6) If Mercury is the closest planet to the Sun and has such a high average surface temperature, how is it possible that ice can exist on the surface? What is the evidence for ice on Mercury?

7) Suppose all of Venus's volcanic activity suddenly stopped. (a) How would this affect Venus's clouds? (b) How would this affect the overall Venusian environment?

8) (a) Why is Mars red? (b) Why is the Martian sky the color of butterscotch?

9) Mariner 10 is in orbit about the Sun. The orbital period of Mariner 10 is twice that of Mercury. Use this fact to calculate the length of the semimajor axis of the spacecraft's orbit.

10) (a) At what wavelength does Venus's surface emit the most radiation? (b) Do astronomers have telescopes that work at this frequency? (c) Why can't we use such telescopes to look at the surface of Venus? That is, why did Mariner 2 use radiation at 2 cm to map the surface?