

**Physics 131: Survey of the Universe**  
**Spring 2003-2004**  
**Prof. Michael S. Vogeley**  
**Homework assignment 4**

Due at the beginning of class, 12:30 p.m. Thursday, April 29. Please write your work and answers on a separate sheet of paper, with your name at the top and all pages stapled together.

**1. Weighing Mars**

Deimos, one of Mars' moons, orbits Mars at a distance of 23,459km and goes around Mars once every 30 hours and 18 minutes.

- (a) What is the orbital velocity of Deimos?
- (b) Using the velocity from part (a) and the radius given, estimate the mass of Mars. (Be careful to use units for radius and velocity that are consistent with the units of G.)

**2. Eccentricity of Orbits**

In an elliptical orbit, *perihelion* is the smallest distance and *aphelion* the farthest distance from the Sun. Use the table on page 47 of the book and the "More Precisely" box 2.1 on page 46 to help you on this problem. For each of the following planets, compute the distance of both perihelion and aphelion.

- (a) Saturn
- (b) Neptune
- (c) Pluto

**3. Feeling Hot**

- (a) What determines the temperature at the surface of a planet? (Hint: there are at least two factors: one has to do with its location, the other is a property of the planet itself.)
- (b) Is the surface of the Moon hotter or colder than on Earth? Explain your answer.
- (c) Is the Sun brighter on Pluto or Neptune? (Hint: think carefully about their orbits.)

**4. Spacecraft Communication**

After the Mars rover "Spirit" landed and started exploring the surface of Mars, the scientists at NASA observed where it was going and what it saw. They were able to control its direction, observe the new location, then move it again. If the NASA controllers sent a signal to Sprit saying "turn left!", how much time would elapse before Spirit actually turned? (Hints: Think about the following: At what speed does a signal from Earth to Mars travel? How far is Mars from Earth?)

**5. Terrestrial vs. Jovian Planets**

What are the primary differences between the Terrestrial planets and the Jovian planets? List at least three.

## 6. Design a Planet

It's your job to design a planet that is hospitable to life. Describe the properties of the planet itself: (1) mass, (2) atmosphere, (3) rotation, (4) moons? Also describe (5) its location in a solar system and (6) any other useful properties of the solar system in which it orbits. You do not need to give numbers, just a qualitative description of your requirements.