ASTRO 301 (50405) : HOMEWORK 2

Assigned on Th Sep 28/06. Due on Th Oct 5 at 11 am in class

Instructions:
(1) The number of points for each question is indicated in brackets. **In order to get full credit, you must show the method that you used to derive the answer**. See the class website (*http://www.as.utexas.edu/~sj/a301-fa06/*) for the grading policy.
(2) See Appendix A of your textbook for the value of constants. A few are are listed here: 1 AU $\sim 1.5 \times 10^{11}$ m; 1 $M_\odot \sim 2 \times 10^{30}$ kg; Gravitational constant G in Newton's law of gravity $\sim 6.7 \times 10^{-11}$ N m^2 kg^{-2}; Mass of a proton $\sim 1.7 \times 10^{-27}$ kg; Constant k in Coulomb's law $\sim 9 \times 10^9$ N m^2 Coul^{-2}; Charge of a proton $\sim 1.6 \times 10^{-19}$ Coul.

1. The electric force of repulsion between positively charged protons in a nucleus tries to 'unbind' the nucleus. Two counter forces try to keep the nucleus bound: the force of gravity between protons and neutrons, and the strong force between protons and neutrons. We stated in class that it is the strong force that keeps the nucleus bound because the force of gravity is much weaker than the electric force. In this question, you will convince yourself of the latter statement through a simple exercise.

(a) Calculate the magnitude of the attractive force of gravity between two protons separated by 1.0×10^{-15} m. **[10 pts]**

(b) Calculate the magnitude of the electric force of repulsion between two protons separated by 1.0×10^{-15} m. **[10 pts]**

(c) What is the ratio of the magnitudes of the two forces ? **[10 pts]**

2a. Describe how the geocentric model of Ptolemy tries to account for the apparent retrograde motion of Mars. You can complement your text answer with a sketch if you wish, but your answer should be clearly stated in words. **[5 pts]**

2b. Repeat the exercise for the heliocentric model of Copernicus. **[5 pts]**

3. What is the period of rotation of a planet whose elliptical orbit around the Sun has a semi-major axis of 1.5×10^{12} meters? **[10 pts]**

END OF ASSIGNMENT