PHYS 480/581 Homework #4

Fall 2024 Due Monday, November 4 at class time

1) Problem 6.15 (a and b) from the **second** edition of *Planetary Sciences* (de Pater & Lissauer). Hint for b): solve separately for the contributions to the pressure from the core and from the mantle.

2) Use the equation for gravitational acceleration, what you have learned from question 1) above, and (if you wish) sketches of internal radial profiles to show that it is not possible to derive a unique radial mass distribution of a spherically symmetric planet from the observed surface value of the gravity field alone. Discuss - in a few sentences - the implications of this in the context of constraining the interior structure of small/terrestrial exoplanets, given what we have learned in class about which properties of exoplanets are currently measurable.

3) Problem 9.1 (a and b) from the **second** edition of *Planetary Sciences* (de Pater & Lissauer). To help with this problem, sketches are encouraged though not mandatory.

4) A comet's perihelion distance is 1 AU, and its aphelion distance is 15 AU. In the following, we make a very crude calculation of the average rate of shrinkage of the comet.
a) Calculate the comet's orbital period.
b) Estimate how many meters of ice the comets will lose each time it orbits the Sun. Assume typical value of cometary density.

5) **Essay question.** In class we discussed how some types of meteorites have not been altered since the very beginning of the solar System. These meteorites encode nucleosynthetic anomalies that allow astrophysicists to study stellar processes in the solar neighborhood prior to solar system formation. Research and discuss how analyzing isotope ratios in these primitive meteorites can help us learn about nucleosynthesis processes and the origin of the heavy elements in our Solar System.
Write approximately 1 page (single-spaced, Times fontsize 11, 1 inch margins), **plus** references.

6) Read Journal Club paper 7, and submit four questions you have about the paper.
IMPORTANT: please type these questions and send them by email (dragomir@unm.edu) directly to me.