PHYS 480/581 Homework #5

Fall 2024 Due Monday, November 18 in class

1) A planet is embedded in a disk made of small planetesimals. All solid bodies are rocky and have the same mean density ρ, but differ in size: the planet has radius 500 km and the small planetesimals have radius 10 km. If the interparticle velocity in the small planetesimals system is equal to the escape speeds from their surfaces, what is the gravitational focusing factor b/R of a big body, and how many times larger is its growth rate than in the case of no gravitational bending of trajectories (assuming perfect sticking of encountered bodies)?

2) ***(****Mandatory for PHYS 581 students; optional for* ***PHYS 480 students, who may choose to do this question for bonus points.)*** Compare a hypothetical planetary system that formed in a disk with the same size as the solar nebula but only half the surface mass density, with our solar system. Assume that the star's mass is 1 M_{Sun} and that it does not have any stellar companions. Concentrate on the final number, location and sizes of the planets. Explain your reasoning. Quote formulas and be quantitative when possible.

3) Problem 13.9 (a and b) from the **second** edition of *Planetary Sciences* (de Pater & Lissauer).

4) **Essay question.** Research and discuss the links between the compositions of protoplanetary disk and interstellar clouds. You could start with this paper (section 3 in particular) and see also some of the research that came since it was published by exploring papers that cite it.
Write approximately 1 page (single-spaced, Times fontsize 11, 1 inch margins), **plus** references.

5) Read Journal Club paper 8, 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.