Ge/Ay 103 Syllabus Spring term 2010

We will closely follow the book *Planetary Sciences* (Cambridge University Press, 2001) by de Pater and Lissauer. Read the descriptive parts and study the figures. We will skip a lot of the math, but if equations are covered in class, you should read those sections.

There will be weekly homework assignments except during mid-term week, when there will be an exam. There will be two 15-minute oral exams – mid-term and final, based mostly on figures in the book and others shown in class. Such exams generally test qualitative understanding of the basic concepts, so I urge you to focus on that part of the course. The homework will be from problems in the book, which mainly test how well you can manipulate and understand the formulas.

You may discuss the homework with each other, but you must write up the solutions by yourselves. Grading will be 20% homework, 30% mid-term, 30% final, 20% attendance and class participation. I welcome questions during class.

Instructor: Andy Ingersoll, api@gps.caltech.edu, 395-6167, 150a South Mudd

Week of March 29: Ch 1. Introduction. The tables are important – lots of interesting features. Sec 2.1.1 - 2.1.4 and Fig. 1. Orbit geometry, Lagrangian points, and resonances. Derive the important formulas for circular orbits only. Also read Sec 2.2, 2.3 and 2.4; for these sections, it's OK to skip the math. Study Figs. 2.2, 2.3, 2.5, and 2.8. Sec 2.2.3 and 2.6. Tides, tidal evolution, and the Hill sphere. We will derive Eqs. (2.40) and (2.22) in class. Study Figs. 2.9, 2.10, and 2.11. Read Sec 11.1 for more on tidal forces and the Roche limit, which is closely related to the Hill sphere.

Week of April 5: Sec 2.7. Dissipative forces and orbits of small bodies. Try to understand the concepts, including Eqs. (2.45)-(2.47) and (2.49b). Sec 3.1 and 3.2.2.4. Heat transport by electromagnetic radiation. Study Figs. 3.1 - 3.3 and Eq. (3.17). We will talk about Eqs. (3.44) - (3.48) in class. Sec 3.3.2, 4.3.1 and 4.3.3. Greenhouse effect. Try to understand Eqs. (3.87) - (3.90b), but don't worry about the derivation. Atmospheric spectra and composition, including Tables 4.1-4.5. Pay special attention to Figs. 4.3, 4.6, 4.7, 4.11, and 4.13.

Week of April 12: Sec 3.2.3, 3.3.2, 4.1, 4.2. Hydrostatic equilibrium, ideal gas law, adiabatic lapse rate, greenhouse effect, vertical structure (Fig. 4.1). Terrestrial planets and Titan, giant planets. Sec 4.5.5, Atmospheric dynamics: Terrestrial planets, giant planets. Sec 4.8 and 4.9 (text only). Atmospheric escape and evolution. Venus, Earth, Mars, Titan

Week of April 19: Sec 5.3 and 5.4. Cratering in the solar system, absolute dating of the lunar surface. In class, we will discuss more intuitive forms for Eqs. (5.26a) and (5.26b). Sec 5.5.1 -5.5.4. Surfaces of the terrestrial planets, volcanism. Atmosphere-surface interaction: Titan, Mars, Io.

Week of April 26: Sec 5.5.5 -5.5.9 Surfaces of outer planet satellites, tectonics. Sec 6.1, 6.3. Gravity and topography, isostacy, terrestrial planet interiors. Sec 6.4. Oblateness and rotation, interior structure of giant planets. **Mid-term exam**

Week of May 3: Sec 8.1 and 8.2. Meteorite classification. Sec 8.5 - 8.7. Meteorite dating and clues to solar system formation. Sec 9.1 and 9.2. Asteroid classification.

Week of May 10: Sec 9.4 - 9.6. Asteroid composition, structure, origin and evolution. Sec 10.1 - 10.2 and 10.3.5. Comets - orbits and composition. Sec 10.4, 10.6 - 10.8. Comets - nucleus and formation.

Week of May 17: Sec 11.1 - 11.3. Planetary rings - gross structure and particle properties. Sec 11.4 - 11.8. Ring-moon interactions, origin and evolution of rings. Sec 12.1 - 12.4. Planetary formation, the Solar Nebula.

Week of May 24: Sec 12.5 (read lightly), Sec 12.6 - 12.12. Formation of terrestrial planets, giant planets, satellites, and small bodies. Ch 13. Extrasolar planets. **Last day of classes.**

June 2, 3, or 4. **Final exam**.