

PTYS/ASTR 416/516: Asteroids, Comets and KBOs

Summary:

Asteroids, Comets and Kuiper Belt Objects are the remnants of the process whereby small bodies formed in the protoplanetary disk and accumulated to become the Dwarf, Terrestrial, and Jovian planets. They are effectively time machines with physical characteristics and orbital properties that allow us to constrain the temperature, density, composition, and organization of the disk and provide insight into the timing and regions of planetary formation. In the final stage of planetary formation, a combination of gravitational scattering and migration dissipated most of the primordial planetesimal population, with the remaining objects confined to small number of stable reservoirs. In this course we will explore how studies of the study of small bodies as a function of composition, location, source region, impact history, and evolutionary state are employed to disentangle their complex dynamical history and connect to the earliest epoch in the history of our planetary system.

Class: Tuesday/Thursday 12:30-1:45 pm in Kuiper Space Sciences 312

Instructors: Prof. Walt Harris

office: Kuiper Space Sciences 221

email: wharris@lpl.arizona.edu (putting PTYS/ASTR 416/516 in the subject line is appreciated)

phone: 520-621-6971

office hours: Mondays 11:00-12:00 pm in Kuiper 221 (or by appointment)

Teaching Assistant: John Noonan

Office: Kuiper Space Sciences 316

Email: noonan@lpl.arizona.edu

Phone: 520-621-7274

Office hours: Wednesdays 12:30-1:30 pm

Graded Effort:

Homework (40%): Outside homework exercises will be assigned based on the concepts and techniques described in lecture.

Observing (15%): All students are required to participate in observations of a comet or asteroid using the RAPTORS telescope on the roof of the Kuiper Building.

Analysis (30%): All students will participate in a reduction and calibration project using either new data obtained from RAPTORS or archived measurements obtained from a comet or asteroid. Students in the 516 section will apply supplemental enhancement or modelling approaches to their reduced data to derive physical characteristics of the target.

Final Presentation (15%): On December 18, 2019, from 1-3 PM students will present the results of their observations and reduction projects.

Grading Scale for the Course

A — 90-100%

D — 60-70%

B — 80-90%

E — 0-60%

C — 70-80%

This scheme may be subject to a *downward* curve, but the above represents the minimum grade you will be assigned for the listed scores (e.g. a score of 80% guarantees *at least* a B).

Web site: Course materials will be posted on a shared box drive directory.

Required Texts: None. Referenced reading (texts, journals, media) will be shared on the box drive.

Course Topics:

- 1 Introduction (topics and project)
- 2 Ground based observing techniques
- 3 Formation and composition of protoplanetary disks
- 4 Mechanisms of planetesimal formation
- 5 Planetary migration and planetesimal scattering
- 6 Population statistics and observational bias
- 7 Asteroid organization, composition, and evolution
- 8 Icy planetesimal reservoirs and orbital evolution
- 9 Volatiles, isotopes, and planetary formation
- 10 Comet activity and outburst behaviors
- 11 Data analysis and interpretation

Course Changes: The workload and course requirements are subject to change at the discretion of the instructor with proper notice to the students.

Academic Integrity: Integrity and ethical behavior are expected of every student in all academic work. This Academic Integrity principle stands for honesty in all class work, and ethical conduct in all labs and clinical assignments. This principle is furthered by the student Code of Conduct and disciplinary procedures established by ABOR Policies 5-308 through 5-404 (see chapter 5), all provisions of which apply to all University of Arizona students. This Code of Academic Integrity (hereinafter "this Code") is intended to fulfill the requirement imposed by ABOR Policy 5-403.A.4 and otherwise to supplement the Student Code of Conduct as permitted by ABOR Policy 5-308.C.1. (See also <http://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity>)

Disability Resources: At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation.

Inclusiveness: Excellence is a fundamental part of the University of Arizona's strategic plan and culture. As part of this initiative, the institution embraces and practices diversity and inclusiveness. These values are expected, respected and welcomed in this course.

Absences: Absences for any sincerely held religious belief, observance, or practice will be accommodated where reasonable. Absences pre-approved by the UA Dean of Sciences (or designee) will be honored. Absences for outside coursework or research related activities will be excused where reasonable. The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

Behavior and Non-discrimination: This course follows the UA Threatening Behavior by Students policy, which prohibits threats of physical harm to any member of the University community. (See also <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>) The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status,

sexual orientation, gender identity, or genetic information. The University encourages anyone who believes he or she has been the subject of discrimination to report the matter immediately as described in the section below, "Reporting Discrimination, Harassment, or Retaliation." All members of the University community are responsible for participating in creating a campus environment free from all forms of prohibited discrimination and for cooperating with University officials who investigate allegations of policy violations. (See also <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>)

The information contained in this course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor. This particularly applies to the tentative course schedule and due dates below.