PTYS 495: ***Observational Campaigns: (Fall, 2018)***

Summary: Observational campaigns are often assembled around astronomical events of significance such as a favorable comet apparition or as 'under-flight' for mission events. Campaigns can take various forms that focus on a combination of cadence, continuous coverage, or coordinating multiple observational techniques, all with the aim of developing a more integrated understanding of the phenomenon being studied. In this course, students will participate in an existing campaign by becoming involved in the planning of observations, their execution, and the reduction of the data obtained. Interwoven with these activities the, students will be introduced to the scientific questions being studied with the campaign and how the various instrumental tools are combined to address them. Field-observations, primarily using the telescopes of the Steward Observatory, will be a required activity.

Topic: During the period from February 2017 through January of 2019 three comets in the Jupiter Family have or will have experienced a close approach with Earth. Comparable close encounters have occurred at a rate of approximately once per decade during the modern astronomical era, making this convergence of events an exceptional opportunity to study comets up close. The significance of these encounters is further magnified by the 35-year gap in short period close-approaches that follows. The Lunar and Planetary Lab is the lead institution of a NASA-supported program to study inner coma of these comets from ground based optical, radio, and radar observatories. Two of these comets, 45P/Honda-Mrkos-Pajdusakova (HMP) and 41P/Tuttle Giacobini-Kresak (TGK) were observed during their respective close approaches in February and April of 2017, during which a large dataset was acquired. This course will focus on the observational and theoretical techniques used to study comets, an exploration of data obtained from HMP and TGK as a tool for understanding the formation, evolution, and activity of comets, and on the observational study of the third of these comets, 46P/Wirtanen as it approaches Earth in November-December 2018.

Instructor: Walter Harris, Rm. 221 Kuiper, Ph. (520) 621-6971, wharris@lpl.arizona.edu

Logistics: Meeting times: Lecture Tu/Th 2:15-3:30, room 312 Kuiper.
Required field observations TBD.

Course Topics:

1	Introduction (topics and project)
2	Ground based observing techniques
3	Comet origins and activity patterns
4	Production of volatiles and dust
5	Remote sensing diagnostics of comets (imaging, spectroscopy, and radar)
6	Reduction and interpretation of comet observations
7	Theoretical approaches to data analysis
8	Enhancement Techniques

Expectations: Students are expected to attend lecture sessions except as excused, with class participation being a portion of the final grade. All enrolled students will be expected to participate in field observations of one or both comet targets in a support capacity, with the *option* to become

trained to operate a telescope independently. Costs to travel to and from observing sites will be compensated. Individual students will be assigned a processing and analysis task using the data obtained. Student groups will be assigned analysis and interpretation tasks leading to final presentations.

Grading: The course will be graded following a traditional letter formation (A = equiv. to 90-100%, B = equiv. to 80-08%, etc.) with a curved score based on written homework, class participation, field work, and the final report. There will be no formal exams.

Prerequisites: Students are expected to have a scientific and math background to understand conceptual presentations of astronomical techniques, including basic optics, the interaction of light and matter, and charge states in atoms/molecules. The ability to use or write programs (in IRAF, IDL, Python, Matlab, etc.) for data analysis is required.

Resources: Web site: Course materials and supplemental reading will be posted at D2L (https://d2l.arizona.edu)

Required Texts: *None.*

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: Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/academic-integrity/students/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.

Behavior and Non-discrimination: The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy.