LUNAR & PLANETARY LABORATORY

PTYS 549 – Radar Remote Sensing of Planetary Surfaces

Kuiper Space Sciences Building, Room 330

Time/Location: Lectures 12:30-1:45 Mon/Wed Kuiper Room 330, Lab Friday 10:00-12:50 Kuiper 330 (Some labs may be in a different location)
Instructors: Lynn Carter, lmcarter@arizona.edu, Jack Holt, jwholt@arizona.edu, Stefano Nerozzi, nerozzi@arizona.edu
Office Hours: By appointment

Course Description: This graduate course will focus on the use of radar remote sensing for studies of planetary surfaces, including rocky and icy objects. It will cover the basics of how radar works including SAR and sounding (ground penetrating) radar, the use of different frequencies, an introduction to electromagnetic wave propagation including polarimetry, radar data processing, and the use of radar field equipment. The course will include a discussion of some of the past, current and future radars included on spacecraft and their design and science results. The course will be focused on geosciences; in particular, applications relevant to planetary processes such as regolith development, volcanism, cratering, fluvial deposits etc. This class includes 3 hours/week lecture plus a lab and fieldwork component.

Prerequisites: Students should have some prior undergraduate background coursework in physical sciences such as astronomy, geology, physics, chemistry, or planetary science. Students will need to use mathematical analyses, and should be familiar with basic calculus. Some introductory experience with computer programming may be helpful, but is not required. The course is intended for graduate students in the physical sciences; undergraduates may enroll with permission of the instructor.

Course Learning Objectives:

- Students will expand their knowledge of how radars work through discussion of relevant physics theory, practical data analysis experience, and case studies from past, current and future spacecraft missions.
- Students will learn how radar data is processed to form images.
- Students will apply theoretical understanding of surface and subsurface scattering to the assessment of radar performance and the interpretation of data.
- Students will perform fieldwork using commercial ground-penetrating radars and will analyze the data.
- Students will develop an understanding of how science goals lead to design requirements for radar experiments, and the factors that are driving current state-of-the-art instrument development projects.
- Students will complete a final project that is suited towards their individual radar remote sensing interests.

Course Learning Outcomes: Upon completion of the course, students will be able to explain how different types of radars work. They will be able to perform simple processing of radar data and will be

able to use the radar equation and scattering models to assess radar performance and interpret data. They will be able to use radar field instruments and analyze the data. They will be able to describe some past and current radar systems and their science results. They will learn how to employ the basics of radar data processing and analysis in a small research project to perform scientific investigations on Earth and/or other planetary bodies.

Field/Laboratory Component: This class is a 3-hour lecture class with a 1-unit field and laboratory component. The 1 unit lab/fieldwork component will consist of 45 contact hours in addition to the scheduled lecture component. The lab contact hours will include field work, laboratory demonstrations, work on in-lab radar equipment, testing, and field preparations. The field component will involve using ground penetrating radar and possibly other geophysical remote sensing instruments to investigate subsurface stratigraphy at relevant sites, including one longer field trip. Dates for this field trip will be established at the beginning of the class to work around as many schedule conflicts as possible, and is expected to have a duration of about one long weekend.

Final Project: Instead of a final exam, students will conduct original research and prepare a final paper on a topic that interests them. Projects must have approval of the instructors, and can include geoscience analysis using existing radar data, comparison of radar data with other types of remote sensing data, analysis of field data acquired during the course, or relevant instrument development or engineering projects.

Grading Scale and Policies:

The course components will have the following weights:

Homework	20%
In-class participation, including presentations	20%
Laboratory/Field Work	30%
Final Project	30%
Total	100%

This class uses standard ABCDE grades. Final letter grades will be assigned as follows:
A: 90% or higher
B: 80 – 89%
C: 70 – 79%
D: 60 – 69%
E: Below 60%

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively.

Issues Related to missing class:

- Please notify us if you will be missing class because you are sick - if needed we can arrange for rescheduling of your in-class presentations or make up activities for lab.
- It's common for grad students to have other activities (observing, conference, field trip, etc.) that cause them to miss class. This is fine, but please let us know well in advance so we can find a time for your presentations and any make-up work/labs.

Physical and mental-health challenges: If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520-621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.

University Policies:
All other university policies related to a syllabus are available at:
https://academicaffairs.arizona.edu/syllabus-policies.

Subject to Change Statement:
Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.