Course Description: This course is an in-depth look at the Moon and lunar exploration. We will cover lunar composition, geology and geophysics, and will discuss lunar evolution. Students will gain a broad introduction to the lunar literature and datasets and have a chance to spend time specifically delving into topics relevant to their research interests. We will also discuss lunar exploration, including current plans by NASA and commercial space. Assignments will include student presentations, paper review discussions, and a final team-based project to develop a mission/instrument concept that could be used to advance our understanding of the Moon. The class is 4 credit hours to support student work on the final project.

Instructors:

- Prof. Lynn Carter, lmcarter@arizona.edu, Kuiper Space Sciences, Room 533A. LPL web page: https://www.lpl.arizona.edu/faculty/lynn-carter
- Prof. Jessica (Jess) Barnes, jjbarnes@arizona.edu, Kuiper Space Sciences, Room 540. LPL web page: https://www.lpl.arizona.edu/faculty/jessica-barnes

Office hours can be scheduled on an as needed basis, just email Lynn and Jess.

Course Website: Course materials will be uploaded to the PTYS 595B-003 course page on D2L (https://d2l.arizona.edu/d2l/home/924333, NetID login is required) as the semester progresses.

Course Objectives: The objective of this course is to provide students with an in-depth understanding of the scientific value of the Moon as well as past and future lunar exploration. We will approach this topic from both remote sensing and petrological points of view.

Expected Learning Outcomes: At the end of the course, students should be able to:

- Demonstrate an understanding of the methods used to remotely study the lunar surface/interior.
- Demonstrate an understanding of the laboratory methods used to study lunar materials.
- Use remote and laboratory-derived datasets to address science problems.
- Describe and discuss some of the current major science questions about the Moon.
- Present and lead a discussion on peer-reviewed lunar science journal articles.
- Participate in a group activity designed to develop skills relevant to planning scientifically motivated lunar missions.

Schedule of Topics:

Week #	Topic
1	Introduction and history of lunar exploration
2	Moon formation
3	Thermal Evolution of the Moon
4	Interior structure of the Moon
5	Practical techniques for studying the Moon
6-7	Lunar impact record
8	Early lunar magmatism
9-10	Lunar volcanism
11	Space weathering and regolith formation
12	Lunar atmosphere
13	Lunar volatiles
14	Current and future lunar exploration
15	Presentations/flex time
16	Presentations and course summary

Class Modality: We intend to operate via the mode 'flex in-person' but as the pandemic changes we must be ready to adapt. We ask that you remain flexible and patient this semester. Below are the modes in which we will learn beginning with remote learning. If we make the move to in-person meetings, this will be communicated in preceding online classes, on D2L, and via email.

> ***(a) Meeting times for remote teaching:*** We will be meeting remotely until we decide to commence with in-person meetings. We will meet Monday and Wednesday from 11:00 AM to 12:40 PM by Zoom. Classes will be held synchronously. Classes will be recorded to facilitate asynchronous learning and participation.
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> ***(b) Meeting times and patterns for in-person teaching:*** When the COVID-19 situation permits safe teaching and learning on campus, we will meet in room 312 in the Kuiper Space Sciences building on Monday and Wednesday from 11:00 AM to 12:40 PM. Again, we will communicate this to everyone. We will continue to record classes even if we move to in-person mode to facilitate synchronous remote learning and asynchronous learning for those not returning to campus.

Remote/Online Only After Thanksgiving: After the Thanksgiving holiday, we are scheduled to move to remote learning. That means that we will meet under circumstances described above in paragraph ***(a) Meeting times for remote teaching.***

Structure: We will aim to present lecture style presentations for approximately the first hour of each class. The remaining 40 mins of each class will be composed of activities including guest speaker presentations (including informal Q&A), student-led paper discussions, virtual laboratory activities, and instruction/discussion of the group project. All course materials will be made available online on D2L as the semester progresses. Lecture material including recordings will be found under the 'content' tab.

Performance Metrics:

Task	**% final grade**
Class participation	10
Lab components:	20
Moon rock chemistry	*10*
Remote sensing	*10*
Paper discussions/presentations:	20
Round 1	*10*
Round 2	*10*
Final group project:	50
Notice of Interest (NOI)	*10*
Presentation of proposal	*20*
Written proposal	*20*

Grading Scale (%):

A	≥ 90
B	80 to 89
C	70 to 79
D	60 to 69
E	< 60

Textbook: There is no formal textbook assigned for the course, however, students will be required to read on average 1 or 2 papers per week as assigned in class. Resources like e-books, review papers, papers for in-class discussion, etc will be made available on D2L under the 'resources' tab.

Recording Classes: We intend to record and distribute class sessions via D2L. D2L is secure and requires UA NetID to access. Students will be able to download the Zoom recordings from D2L or play them directly on D2L by selecting the 'View Topic' option beside each video. Such class recordings are for instructional purposes only and students are prohibited from sharing these with anyone outside of the PTYS 595B-003 class. *Please note that students may not modify content or re-use content for any purpose other than personal educational reasons. All recordings are subject to government and university regulations. Therefore, students accessing unauthorized recordings or using them in a manner inconsistent with UArizona values and educational policies are subject to suspension or civil action.*

Equipment and Software Requirements: For this class you will need daily access to the following hardware: laptop or web-enabled device with webcam and microphone; regular access to reliable internet signal; ability to download and run the following software: Zoom, web browser, Adobe Acrobat, etc.

Virtual and In-Person Classroom Attendance:

- If you feel sick or may have been in contact with someone who is infectious, stay home. Except for seeking medical care, avoid contact with others and do not travel.
- Notify your instructors if you will be missing an in person or online course.
- Campus Health is testing for COVID-19. Please call (520) 621-9202 before you visit in person.
- Visit the UArizona COVID-19 page for regular updates.

Face Coverings are Required in Our Classroom: Per UArizona's Administrative Directive, face coverings that cover the nose, mouth, and chin are required to be worn in all learning spaces at the University of Arizona (e.g., in classrooms, laboratories and studios). Any student who violates this directive will be asked to immediately leave the learning space, and will be allowed to return only when they are wearing a face covering. Subsequent episodes of noncompliance will result in a Student Code of Conduct complaint being filed with the Dean of Students Office, which may result in sanctions being applied. The student will not be able to return to the learning space until the matter is resolved.

Physical Distancing is Required in Our Classroom: During our in-person class meetings, we will respect CDC guidelines, including restricted seating to increase physical distancing and appropriately-worn face coverings. Per UArizona's Administrative Directive, face coverings that cover the nose, mouth, and chin are required to be worn in all learning spaces at the University of Arizona (e.g., in classrooms, laboratories and studios). Any student who violates this directive will be asked to immediately leave the learning space, and will be allowed to return only when they are wearing a face covering. Subsequent episodes of noncompliance will result in a Student Code of Conduct complaint being filed with the Dean of Students Office, which may result in sanctions being applied. The student will not be able to return to the learning space until the matter is resolved.

- The Disability Resource Center is available to explore face coverings and accessibility considerations if you believe that your disability or medical condition precludes you from utilizing any face covering or mask option. DRC will explore the range of potential options as well as remote course offerings. Should DRC determine an accommodation to this directive is reasonable, DRC will communicate this accommodation with your instructor.

Life/Academic Challenges: If you are experiencing unexpected barriers to your success in your courses, or have questions about this class, please contact the instructors as soon as possible and we will work to sort something out. Your faculty mentor and/or advisor will also be happy to talk with you about an issues that may arise during the semester; we understand this is a challenging time for everyone.

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.

Academic Integrity Policy: The Student Code of Academic Integrity prohibits plagiarism: deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity.

Nondiscrimination and Anti-Harassment Policy: Please see University Policy 200E on prohibited behaviors: http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

Threatening Behavior Policy: The UA policy on threatening behavior prohibits threats of physical harm to any member of the University community: policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Disclaimer: 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.