



Our Moon

From Imagination to Exploration

Fall 2019 (3 credits)

Instructor Info —



Viranga Perera, Ph.D.



Pronouns: he/him/his



Office Hours: TBD



Office: Olin 201



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Course Info —



Prerequisites: None



Mondays & Wednesdays



Times: 1:30–2:45 or 4:30–5:45 pm



Location: Olin Hall 145



ourmoon.space

Overview

The Moon is a fascinating planetary body that be considered from a number of traditionally distinct academic disciplines. When I first encountered the Moon as a child, it was solely a place to be visited because I was introduced to it by stories of the Apollo program. Thus, for me the Moon fit into engineering, which is the reason why I studied aerospace engineering as an undergraduate student. Over the years I have come to appreciate that the Moon has much more to offer us. For instance, it is amazing that most human beings who have ever lived have experienced the very object in the night sky over approximately the 300,000 years we homo sapiens have been around. It would have meant something different for each of them and in this course I want to explore the Moon in several avenues. In addition to giving the Moon its proper place in the global human experience, I hope that you will find at least one aspect that is really interesting to you.

Learning Objectives

By the end of this course, you will be able to:

1. Describe how the Moon was perceived over time in mythology, art, literature, music, and motion pictures
2. Summarize historical and current motivations for exploring the Moon
3. Identify current and past challenges of exploring the Moon
4. Summarize important scientific findings about the Moon

Course Expectations

You are expected to attend each class, participate in class discussions and complete all projects. Active lectures will be used during the class, which means that short lectures will be followed by questions and opportunities for class and peer discussions. You are expected to be respectful towards all students and the instructor.

Learning

An aspect of learning is changing how we think and behave in response to new information. Our brain does not just accept information like a computer. Instead, our brain processes new information in relation to what it already knows and tries to fit new information to old information. Think about how difficult it is to try to convince someone who believes in a conspiracy theory...there is a reason for that. Of course this varies from person to person but our brains nevertheless are all pretty stubborn. It is important to recognize this since we come to the classroom with our own prior experiences and knowledge. Some of them will help us with our learning, while others will not. Please watch the 20-minute video called *A Private Universe* ([link](#)), which nicely demonstrates how difficult it is to change misconceptions. But we must try! Our goal is to improve our understanding of ourselves and the world.

It is ok if we do not know something and if we make mistakes while learning. It is part of the process of learning. However, it is difficult to admit when we do not know and when we make mistakes. It is my responsibility as the instructor to create a classroom environment where everyone feels comfortable enough to treat learning as a process.

Mental Health

If you are struggling with anxiety, stress, depression or other mental health related concerns, please consider visiting the JHU Counseling Center. If you are concerned about a friend, please encourage that person to seek out their services. The Counseling Center is located at 3003 North Charles Street in Suite S-200 and can be reached at 410-516-8278 and online at <http://studentaffairs.jhu.edu/counselingcenter/>

Students with Disabilities

Any student with a disability who may need accommodations in this class must obtain an accommodation letter from Student Disability Services, 385 Garland, (410) 516-4720, studentdisabilityservices@jhu.edu.

Diversity and Inclusion

One of the main objectives of this course is to have broad participation of students from different backgrounds. It took nearly 400,000 people working together in the mid-20th century to put humans on the Moon and as such, it is important for all students to recognize that they have a place in the exploration of our Moon. Unfortunately, the history of the Moon also involves discrimination and active exclusion of certain people (e.g., by gender and race). Going forward we need to take responsibility to be informed, vigilant, and active in welcoming all students into the university learning environment and to be participants of the future exploration of the Moon. Any discrimination based on a person's race, ethnicity, disability, place of birth, biological sex, gender, sexual orientation, age, religion, or level of prior knowledge will not be tolerated.

Ethics

The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. If you notice any violations of this policy, please let the instructor know. Students can find more information about university misconduct policies on the web at this website:

<http://e-catalog.jhu.edu/undergrad-students/student-life-policies/>

Absence from Class Due to Illness

The Health and Wellness Center does not provide documentation for students who miss individual classes. In these cases, students should communicate directly with the instructor. If a student experiences an extended illness or hospitalization that causes the student to miss a significant number of classes or major academic assignments, the student can provide a physician's documentation of illness to the instructor. Students who have prolonged illnesses that interfere with their ability to meet their academic obligations are encouraged to seek treatment at the Student Health and Wellness Center and to confer with a Case Manager in the Student Life Office for assistance. Students should also notify the instructor when they are not able to complete work due to illness. Falsely reporting an illness or injury is a violation of the code of student conduct and is subject to disciplinary action.

Policies for Class Cancellation

If class is cancelled for any reason, students will be informed by email at least a day in advance whenever possible. Course material that was to be covered will be covered in the next class period.

Material

Required

All course material will be made available on the course website at <https://ourmoon.space/>.

Grading

Your final grade will be based on 3 small projects and a final project. Scores will not be curved. As such it is possible and highly encouraged for everyone to obtain the highest scores on all projects. You will be given a rubric with each project so that you know what is expected. Grades will follow the standard scale: A = 89.5-100%; B = 79.5-89.4%; C = 69.5-79.4%; D = 60-69.4%; F <60%.

Small Projects (60%)

You will be asked to work on 3 small projects (each being 20% of your final grade, 2% for project proposal, 15% for project product, 3% for class presentation). You are free to work on a topic that is interesting to you, of course as long as it has to do with the Moon. I encourage you to try out a topic or a skill that you are not familiar with since you may find that you really enjoy it. I ask that you work on these small projects individually. One of these projects could be developed further into a final project. For each of these small projects, I expect you to work on it for about 10 hours outside of class since you will generally

have 2 weeks for each project. The due dates are listed below. Please note that I will ask you to present your work to the class on the due dates (about 5 minutes per person).

Project 1 is due: September 25th, 2019

Project 2 is due: October 9th, 2019

Project 3 is due: October 23rd, 2019

Final project (40%)

You have the option of either developing one of your 3 small projects into a final project or working on something entirely different. You can work on the final project either individually or as part of a group. Following from the small projects, I expect you to each work on the final project for about 20 hours outside of class. The due date is shown below and again I will ask you to present your work in class on that day (about 12 minutes per person).

Final projects are due: December 2nd, 2019 (presentations will take place on December 2nd and 4th)

Class Schedule

Class 1	Introduction	
Class 2	Mythology & Religion	Topics: Rabbit (or hare) on the Moon, Chang'e, Kaguya & Chandra
Class 3	Earthrise with some context	Topics: Lucian of Samosata's <i>A True Story</i> , events of 1968 (Tet Offensive, Orangeburg, Phong Nhi, Phong Nhât, Hà My, My Lai Massacres, death of Yuri Gagarin, killing of Edson Luís de Lima Souto, assassination of Martin Luther King, Jr., death of Jim Clark, death of Helen Keller, assassination of Robert Kennedy, Warsaw Pact invasion of Czechoslovakia, Democratic Party National Convention, Zond 5, Apollo 7, Summer Olympics, Apollo 8, James "Frankie" Boyce, Carl Sagan's <i>Pale Blue Dot</i> & Lucian of Samosata's <i>Icaromenippus</i>
Class 4	The Moon & Religion	Topics: Simon Bourgin's letters to Frank Borman, Madalyn Murray O'Hair's Apollo 8 lawsuit, Buzz Aldrin taking communion during Apollo 11, Easter (Christianity), splitting of the Moon (Islam), Ramadan (Islam), Diwali (Hinduism, Jainism, Sikhism & Buddhism), Vesak (Buddhism), Rosh Hashanah (Judaism), Mid-Autumn Festival, phases of the Moon & lunar calendar
Class 5	Lunar Reconnaissance Orbiter	Guest lecture by Michael Pryzby (Lead Spacecraft Systems Engineer)
Class 6	Lunar Data	Exploring data of the Moon using ASU's QuickMap
Class 7	Formation of the Moon	Topics: capture model, co-accretion model, fission model, angular momentum of the Earth-Moon system, the Moon's volatile depletion, anorthosites, canonical giant impact model, isotopes, 'hit and run' model, 'equal mass' model, 'fast spinning earth' model, 'multiple impacts' model, 'synestia' model, 'terrestrial magma ocean' model, hafnium-tungsten dating & early timeline of the Moon
Class 8	Project 1 Due	Class Presentations
Class 9	Evolution of the Infant Moon	Topics: Lunar Magma Ocean, gravitational binding energy, Apollo samples, remote sensing, europium anomaly, types of lunar anorthosites, dating lunar samples & alternative models
Class 10	Introduction to Rockets	Topics: Long Serpent rockets from 13th century China, Indian Mysorean rockets, British Congreve rockets, Konstantin Tsiolkovsky, Robert Goddard, Wernher von Braun, Saturn IB, Saturn V, solid-fueled rockets, liquid-fueled rockets & Apollo 11 flight path

Class 11	Rocket Science	Topics: X-15 airplane, liquid-fueled rockets, pressure-fed cycle engines, gas-generator cycle engines, F-1 engine ignition, Saturn V thrust buildup & pogo oscillations
Class 12	Project 2 Due	Class Presentations
Class 13	The Cold War & the Space Race	Topics: End of World War II, Operations Paperclip & Osoaviakhim, Wernher von Braun, Sergei Korolev, Sputnik, Sputnik 2 & Laika, Vanguard, Explorer 1, NASA & Luna 1, 2, 3
Class 14	The Cold War & the Space Race	Topics: Mercury Seven, Redstone & Atlas rockets, Mercury-Atlas 1, Korabl-Sputnik 2, Mercury-Redstone 1, Mercury-Redstone 2 & Ham, Vostok 1 & Yuri Gagarin, Mercury-Atlas 3, Mercury-Redstone 3 & Alan Shepard, John F. Kennedy's speech to Congress, Mercury-Redstone 4 & Gus Grissom, Mercury-Atlas 6 (John Glenn & Katherine Johnson), Lovelace's Women in Space Program (Mercury Thirteen), Jerrie Cobb & Ed Dwight
Class 15	The Cold War & the Space Race	Topics: Vienna Summit, Vostok 3 & 4, John F. Kennedy's speech at Rice University, Vostok 6 & Valentina Tereshkova, John F. Kennedy's speech at the United Nations, assassination of John F. Kennedy, Nikita Khrushchev to Leonid Brezhnev, Voskhod 1, Voskhod 2 & Alexei Leonov, Gemini 4 & Ed White, Gemini 6A & 7, death of Sergei Korolev, Luna 9, Gemini 8 & Luna 10
Class 16	Project 3 Due	Class Presentations
Class 17	The Cold War & the Space Race	Topics: Apollo 1, Soyuz 1, Soyuz 11, N1 rocket, Direct Ascent, Earth Orbit Rendezvous, Lunar Orbit Rendezvous (Yuri Kondratyuk, Tom Dolan & John C. Houbolt), Luna 15 vs. Apollo 11, fallen astronauts & cosmonauts, fallen workers at Cape Canaveral & Apollo-Soyuz Test Project
Class 18	Who Owns the Moon?	Topics: Outer Space Treaty (1967), Rescue Agreement (1968), Space Liability Convention (1972), Registration Convention (1975), Moon Treaty (1979), International Waters, Law of the Sea (1994) & Antarctic Treaty System
Class 19	The Moon in Cinema	Movies: <i>A Trip to the Moon</i> (1902), <i>It's a Wonderful Life</i> (1946), <i>2001: A Space Odyssey</i> (1968), <i>E.T. the Extra-Terrestrial</i> (1982), <i>The Right Stuff</i> (1983), and <i>Superman IV: The Quest for Peace</i> (1987)
Class 20	The Moon in Cinema	Movies: <i>Apollo 13</i> (1995), <i>Independence Day</i> (1996), and <i>From the Earth to the Moon</i> (1998): Part 2 (<i>Apollo 1</i>), Part 3 (<i>We have cleared the tower</i>), and Part 5 (<i>Spider</i>)
Class 21	The Moon in Cinema	Movies: <i>Back to the Future III</i> (1990), <i>From the Earth to the Moon</i> (1998): Part 6 (<i>Mare Tranquillitatis [sic]</i>), Part 7 (<i>That's all there is</i>), Part 10 (<i>Galileo was right</i>), and Part 11 (<i>The Original Wives' Club</i>)
Class 22	The Moon in Cinema	Movies: <i>October Sky</i> (1999), <i>Despicable Me</i> (2010), <i>Mune: Guardian of the Moon</i> (2014), <i>Hidden Figures</i> (2016), and <i>First Man</i> (2018)
Class 23	<i>From the Earth to the Moon</i>	Book: <i>From the Earth to the Moon</i> (1865) by Jules Verne. Topics: escape velocity, orbit of the Moon, 28th parallel & Florida, egg shape of the Moon & Apollo 11

Class 24	Lunar Water & Future Exploration	Topics: Shackleton crater, permanently shadowed craters, extremely cold temperatures, electrolysis of water, Lunar Prospector, Chandrayaan-1 & the Moon Mineralogy Mapper, electromagnetic spectrum, solar spectrum, Lunar Reconnaissance Orbiter, Apollo 17 orange soil, LADEE, origins of water on the Moon, future exploration, NASA's Artemis & Space Launch System, ROSCOSMOS, China National Space Administration & #dearMoon project
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Class 25	Final Projects	Class Presentations
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Class 26	Final Projects	Class Presentations
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