



Introduction to Spaceflight

NCPH 108-501 / Class number 21447

Course Syllabus – Spring 2016

Non-credit/face-to-face format

Instructor: Edward Murphy
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Instructor Bio: Edward Murphy is an Associate Professor in the Department of Astronomy at the University of Virginia. He teaches introductory astronomy to non-science majors, evening personal enrichment classes at McCormick Observatory, summer workshops for teachers, and seminars for graduate students and first year undergraduates. His research interest is studying the interstellar medium (the gas between the stars) using an orbiting satellite, the Far Ultraviolet Spectroscopic Explorer, and radio telescopes in West Virginia. As the coordinator for the education and public outreach program in the Department of Astronomy, he runs the public night program and can be found at McCormick Observatory at almost every public night. He has produced the course "Our Night Sky" with the Teaching Company, which introduces people to the stars and other objects in the night sky, including the constellations and their myths.

Dates/Times: Tuesdays, February 16 to April 19 (no class on March 8 or April 5), 7:00-9:00 p.m.

Location: University of Virginia's McCormick Observatory, 600 McCormick Road, Charlottesville at the top of Observatory Hill. Be careful with online mapping programs. Not all programs have the Observatory in the correct location.

Course Description: Every day our lives are impacted by the space program, from the satellites that transmit our television signals to the electronics in our consumer devices. In this new course, students explore the history and future of manned and robotic space exploration. Topics include the basics of spaceflight (gravity, laws of motion, weightlessness), orbits, the space environment, and spacecraft and launch vehicle design and operations. Discussions focus on the purpose, design, and history of specific human spaceflight programs including the Mercury, Gemini, Apollo, Space Shuttle, International Space Station, and Soyuz. In addition, lectures highlight the robotic exploration of our Earth, solar system, and Universe by studying specific missions including Landsat, Pioneer, Viking, Voyager, Galileo, Cassini, Mars Exploration Rovers, and the Hubble Space Telescope. Finally, the class culminates with speculation on the future of space exploration and the possibility of eventually reaching the nearby stars.

Course Objectives/Learning Outcomes: Students will gain an overall appreciation for spaceflight and the design and construction of launch vehicles and spacecraft through discussions of a variety of space missions.

Required Texts: None

Suggested texts, materials, helpful websites, etc.:

- *A Man on the Moon* by Andrew Chaiken (If you have time to read only one book on the Apollo program, read this one. It is the definitive history of the Apollo program).
- *To a Rocky Moon: A Geologists View of Lunar Exploration* by Don E. Wilhelms
- *Lost Moon: The Perilous Voyage of Apollo 13* by Jim Lovell and Jeffrey Kluger
- *Exploring the Moon: The Apollo Expeditions* by David Harland
- *Dragonfly: NASA and the Crisis Aboard Mir* by Bryan Burrough
- *The High Frontier: Human Colonies in Space* by Gerard O'Neill
- *Understanding Space: An Introduction to Astronautics* by Jerry Jon Sellers
- A good planisphere, such as the Miller Planisphere or the Chandler Planisphere
- NASA Astronomy Picture of the Day <http://apod.nasa.gov/>
- Heaven's Above, a website for tracking satellites, <http://heavens-above.com/>
- SkyMaps.com has an excellent monthly star chart, <http://www.skymaps.com/>
- SpaceflightNow.com provides daily news about spaceflight, <http://www.spaceflightnow.com/>
- Space.com also provides daily news about spaceflight, <http://www.space.com/>
- *Our Night Sky*, a DVD course from The Great Courses by Edward Murphy
- *The New Patterns in the Sky: Myths and Legends of the Stars* by Julius D. W. Staal

SCPS Inclement Weather/Emergency Hotline: 434-924-4364

This line will be updated in the event that ALL SCPS classes are cancelled or if all UVa classes are cancelled (this applies to evening classes as well). Individual SCPS class cancellations due to weather or other instructor issues will likely NOT be included on this phone line, but will be communicated to students via email as soon as a decision has been made. Email your instructor and/or Buzzoni@virginia.edu if you are uncertain as to a class' status. We consider personal safety a priority, so please use your best judgment if travel conditions are questionable.

Class Instruction & Activities: Most evenings will consist of lecture and discussion including question and answer sessions. On some clear nights, we will be outside looking at the night sky and/or using the historic 26-inch McCormick Telescope. Please bring a warm jacket on those evenings since it can be cool or even cold in the dome. After class, it will be dark at the Observatory and there is very limited outdoor lighting. Please consider bringing a flashlight.

Class Expectations: Please feel free to ask questions at any time! I will use your questions and comments to adjust the content of the course based on your interests.

Class Schedule:

Date	Topic(s)
Feb 16	<ul style="list-style-type: none"> • Discussion of course goals. • Tour of the Universe. • What's Happening in Space Now <ul style="list-style-type: none"> ○ Review of 2015 ○ Preview of 2016
Feb 23	<ul style="list-style-type: none"> • Space Environment <ul style="list-style-type: none"> ○ Gravity ○ Earth's Atmosphere ○ Vacuum ○ Radiation ○ Space Debris • Law's of Motion <ul style="list-style-type: none"> ○ Newton's Laws of Motion ○ Newton's Law of Gravity <ul style="list-style-type: none"> ▪ Freefall (weightlessness) ○ Conservation Laws ○ Kepler's Laws
Mar 01	<ul style="list-style-type: none"> • Laws of Motion/Orbits <ul style="list-style-type: none"> ○ Orbits <ul style="list-style-type: none"> ▪ Low Earth ▪ Equatorial ▪ Geosynchronous/geostationary ▪ Polar ▪ Direct (prograde) ▪ Indirect (retrograde) ▪ Ground track ○ Changing Orbits <ul style="list-style-type: none"> ▪ Hohmann Transfers ▪ Rendezvous ▪ Perturbations ○ Launch Windows ○ Reentry
Mar 15	<ul style="list-style-type: none"> • History of Spaceflight <ul style="list-style-type: none"> ○ Early Pioneers <ul style="list-style-type: none"> ▪ Konstantin Tsiolkovsky ▪ Robert Goddard ○ Rocket Equation ○ Propulsion/rocket engines ○ Launch vehicles
Mar 22	<ul style="list-style-type: none"> • History of Manned Spaceflight

		<ul style="list-style-type: none"> ○ Soviet ○ Mercury ○ Gemini ○ Apollo ○ China
Mar	29	<ul style="list-style-type: none"> • History of Robotic Exploration <ul style="list-style-type: none"> ○ Voyager ○ Hubble Space Telescope ○ Current Missions <ul style="list-style-type: none"> ▪ Mars Opportunity ▪ Mars Curiosity ▪ New Horizons Pluto
Apr	08	<ul style="list-style-type: none"> • Optional Fan Mountain Public Night
Apr	12	<ul style="list-style-type: none"> • The Space Shuttle and International Space Station <ul style="list-style-type: none"> ○ Skylab ○ The Space Shuttle ○ Mir ○ The International Space Station <ul style="list-style-type: none"> ▪ Animation of the construction of the ISS ▪ Tour of the ISS by Suni Williams
Apr	19	<ul style="list-style-type: none"> • Future of Space Exploration <ul style="list-style-type: none"> ○ Commercial Space Flight ○ NASA Space Launch System ○ NASA Multipurpose Crew Vehicle ○ Space-X Dragon ○ Back to the Moon ○ Mars ○ Interplanetary Travel

Communication: I try to respond to email within 24-48 hours. If you do not hear back from me in that time, please write again. You are also welcome to call my office (434) 924-4890 during regular business hours.

Resources: Resources will be posted in the course Collab site under the Resources tab.

Grading: A grade of “N” for “non-credit” will be recorded by the instructor in SIS at the completion of the course.