

Basics of Space Flight

ASTRONOMY 0087_SEC1070_LEC10903
Syllabus **Fall 2024** (2251)



"ANYONE WHO SITS ON TOP OF THE LARGEST HYDROGEN-OXYGEN FUELED SYSTEM IN THE WORLD, KNOWING THEY'RE GOING TO LIGHT THE BOTTOM, AND DOESN'T GET A LITTLE WORRIED, DOES NOT FULLY UNDERSTAND THE SITUATION."

NASA ASTRONAUT JOHN YOUNG, AFTER BEING ASKED IF HE WAS NERVOUS ABOUT MAKING THE FIRST SPACE SHUTTLE FLIGHT IN 1981.

Class Dates: August 26, 2024 – December 10, 2024

(No Class Meeting on: 11/28 – Thanksgiving Day)

Lecture Class: Tu, Th, 2:30-3:45 pm, 102 Thaw Hall

Instructor:

Dr. John G. Radzilowicz

(he, him, his)

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812 Alumni Hall

412.624.6596



Office Hours: Office hours will be held in 812 Alumni Hall on Tuesdays and Thursdays (on days classes are held) from 1:30-2:00 pm, and by appointment – either in person or on Zoom - as needed. The Zoom link can be found in Canvas. **Please schedule appointments on Zoom, or in person either before or after class, or by email.**

Textbook: **There is no required text to purchase for this course.** Instead, lectures are based, in part, on two OERs (Open Educational Resources – available FREE online):

First, “**Basics of Spaceflight**” (2016), a text designed specifically for this course, by Professor Emeritus Regina E. Schulte-Ladbeck. Dr. Schulte-Ladbeck taught this course at Pitt for many years. Her book is available [online here](#).

Second, we will make use of the NASA-JPL Tutorial, “**Basics of Space Flight**,” that is available [online here](#).

Readings will be assigned, as appropriate, through Canvas.

Course Notes and Other Materials: The course Syllabus, PowerPoint lecture files, external links, assigned readings, and any other relevant course materials will be found posted on Canvas. Students should also consult Canvas regularly for announcements or updates. **Please be sure you have notifications turned ON.**

Attendance Policy: **Lecture attendance is NOT required. However, students are responsible for all material discussed in the lectures.** If you miss a class, ask a fellow student for the notes!

Course Description: This is a self-contained course for students not majoring in the physical sciences. The course focuses on identifying and understanding the general concepts associated with space flight. The course explores the history and technology of space flight, including both human and robotic missions. The course is conceptual and descriptive in nature but, since physics and astronomy are quantitative sciences, some of the lectures will make use of simple arithmetic, algebra, and geometry.

Topics covered include: an introduction to the nature of scientific inquiry, a brief overview of the Universe and the solar system, the history of space flight, U.S. and foreign space policy, gravitation and mechanics, rocket propulsion, human and robotic exploration, the Moon landings (Apollo and upcoming Artemis), interplanetary trajectories and interplanetary travel, remote sensing, interstellar space travel, and life in the universe.

Specific examples of orbital and planetary space missions (both human and robotic) and their scientific instruments, goals and results will be discussed. Particular emphasis will be placed on current missions. At the end of the course the students will have a deeper understanding of space flight, its goals and purposes, its difficulties, and its inherent dangers and benefits.

This course fulfills the Physical Science requirement for Dietrich School students. It forms an appropriate sequence with Astronomy 0089 (Stars, Galaxies, and the Cosmos), Astronomy 0088 (Stonehenge to Hubble), Physics 0081 (Space and Time, Light and Matter) or Physics 0089 (Physics and Science Fiction).

Major Content Areas/Modules:

- I. The Nature and Process of Science.
- II. Our Place in the Cosmos – Size, Structure, and Motion of the Earth-Moon System, the Solar System, and the Universe.
- III. The History and Development of Rocket Science.
- IV. Astrodynamics – the Physics of Space Flight and Interplanetary Travel.
- V. Applications, Benefits, and Dangers – Communication, Research and Exploration.
- VI. Politics and Space Policy.
- VII. Robotic and Human Space Flight past and present.
- VIII. The Future: Deep Space, Life in the Universe, and Interstellar Exploration.

Course Learning Objectives:

By the end of this course, students will be able to...

1. Identify and describe the key components, major steps, and unique processes of scientific inquiry.
2. Describe the basic features – such as size, shape, structure, and motion – of space from the local to galactic scales and explain our physical place in the Universe.
3. Relate the overall history of rocket science in broad outline, and identify the key stages in its development, including modern space policy.
4. Apply the basic laws of physics to understand and solve fundamental problems in astrodynamics.
5. Analyze the applications, benefits, and dangers of robotic and human spaceflight - past, present, and future.

Course Grading Policy: In this course, I apply the principles of a system known as “Ungrading.” In this system, the focus is on **effort, engagement, learning, and understanding**, NOT on grades. In order to achieve this focus, traditional summative grades are NOT assigned for any work in this class. Instead of grading, we will engage in assessment. Assessment is about reflecting on what you have done, how you have engaged with the materials, other students, and the instructor, and an honest appraisal of what you have learned and what you still need to learn.

The process of course assessment will occur through self-reflection, class discussions, participation in assessment activities, and instructor feedback.

In the end, **YOU** will propose your Final Grade through this process, as detailed below. **The instructor** will remain the **final arbiter** of what grades are assigned to each student. However, any divergence from the student recommended grade will be rare and fully explained. **Failure to submit a proposed grade will leave the student’s final grade to be decided completely at the instructor’s discretion.**

Course Assessment Activities:

The following assessment strategies will be used in this course.

1. Quizzes:

There will be very brief quizzes given during each class (with some exceptions) or assigned as homework after each class (with some exceptions), starting on Thursday, August 29th. All quiz answers will be discussed in detail in class. **Taking the quiz and participating in the quiz discussion are a combined activity. The number of correct answers/total questions will be indicated. This is NOT a grade – it is formative assessment ONLY.**

2. Threaded online discussion participation:

Each student is expected to post a minimum of two substantial comments for each week’s / module’s discussions. A substantial comment adds to the discussion by providing new insights, offering opinions supported by evidence, and demonstrating the poster’s familiarity with the assigned readings and the comments posted by me and other students. Posters may respond to threads or start a new thread relevant to the module. **Your primary audience is EACH OTHER.** I will read all posts, but respond only as needed to provide

feedback, highlight information, make corrections, or raise points. There will be significant opportunities to post, so there may be more than two prompts in each week. Therefore, you may choose the topics you wish to respond to from the prompts posted each week. **Posts will be marked as completed or not.**

3. Final Self-Assessment

Each student will submit a Final Course Assessment at the end of the semester. This will be due by end of day on **Monday, December 16, 2024**. **In this self-assessment, you will propose a Final Course Grade for yourself.** You will then justify your proposed grade based on a discussion of the three factors below. The questions are meant to guide your thought process and reflection.

- A. Assessment Activities:** How many Quizzes did you complete? How well did you do on them? Did you review material in preparation for taking/discussing the quizzes? Did you participate in the quiz discussions? Did you post the expected two (2) discussion posts per week? Did you post more than that? Were your posts thoughtful and complete and according to guidelines?
- B. Course Engagement:** Did you regularly attend class, ask questions, review slides, watch videos, complete readings, participate in class and online discussions, and otherwise engage with the course material and your classmates, as well as the instructor?
- C. Amount Learned:** How much did you learn? Did you reflect on the ideas discussed? Did you understand the content? Were you gaining knowledge, perspective, and understanding? Do you feel you can now talk intelligently about Space Flight and its implications for humanity?

Your self-assessment submission should be at least two full pages, APA format (12 pt., doubled-spaced, Times New Roman). **It should be clear, honest, and address all relevant issues.** It is unlikely, but not impossible, that I will not accept your suggested grade. However, if you do not submit a grade, I will have no choice but to assign it based on my own interpretation of the guidelines above.

The final course grade will be determined in accordance with the School of Arts & Sciences Policies, and the PHYAST departmental guidelines. Letter Grades will be assigned as follows.

| | | |
|-----------|------|--------------------|
| A+ | 4.00 | Superior |
| A | 4.00 | |
| A- | 3.75 | |
| B+ | 3.25 | Meritorious |
| B | 3.00 | |
| B- | 2.75 | |
| C+ | 2.25 | Adequate |
| C | 2.00 | |
| C- | 1.75 | |
| D+ | 1.25 | Minimal |
| D | 1.00 | |
| D- | 0.75 | |
| F | 0.0 | Failure |

Other Important Course Policies and Guidelines

Diversity and Inclusion:



I consider this classroom – i.e. both our shared physical and digital spaces - to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sex, sexual orientations, ability – and other visible and nonvisible differences. Students in this class are encouraged to speak up, share their ideas, and participate during class meetings, and in online forums and assignments. All members of this class are also expected to conduct themselves in a professional manner that contributes to a respectful, welcoming, and inclusive environment for every other member of the class. **If you would like to share your pronouns, or you have a preferred name not listed in the roster, please email me, and consider adding them to NameCoach.**

Disability Resources:



If you have a disability that requires special testing accommodations or other classroom modifications, please notify both me and the Disability Resources and Services no later than the 2nd week of the term. You may be asked to provide documentation of your disability to determine the

appropriateness of accommodations. To notify Disability Resources and Services, call 648-7890 (Voice or TTD) to schedule an appointment. The Office is located in 216 William Pitt Union. **All students will be given all needed help to successfully learn in this course.**

Academic Integrity Policy:



Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity. Any student suspected of violating this obligation, for any reason, during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity.

Sexual Misconduct, Required Reporting, and Title IX:



The University is committed to combatting sexual misconduct. As a result, you should know that University faculty and staff members are required to report any instances of sexual misconduct, including harassment and sexual violence, to the University's Title IX office so that the victim may be provided appropriate resources and support options. **What this means is that as your professor, I am required to report any incidents of sexual misconduct that are directly reported to me, or of which I am somehow made aware.**

There are two important exceptions to this requirement about which you should be aware:

1. Designated University employees who, as counselors and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found [here](#).
2. An important exception to the reporting requirement exists for academic work. Disclosures about sexual misconduct that are shared as part of an academic project, classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX office. If you are the victim of sexual misconduct, Pitt encourages you to reach out to these resources:

IX

Title IX Office: 412-648-7860

SHARE @ the University Counseling Center: 412-648-7930 (8:30 A.M. TO 5 P.M. M-F) and 412-648-7856 (AFTER BUSINESS HOURS)

If you have safety concerns, please contact the **University of Pittsburgh Police, 412-624-2121**. Other reporting information is available [here](#).

E-mail Communication Policy:



Each student is issued a University e-mail address (username@pitt.edu) upon admittance. This e-mail address may be used by the University for official communication with students. Students are expected to read e-mail sent to this account on a regular basis. Failure to read and react to University communications in a timely manner does not absolve the student from knowing and complying with the content of the communications. The University provides an email forwarding service that allows students to read their e-mail via other service providers (e.g., Hotmail, AOL, Yahoo). Students that choose to forward their e-mail from their pitt.edu address to another address do so at their own risk. If e-mail is lost as a result of forwarding, it does not absolve the student from responding to official communications sent to their University e-mail address. To forward e-mail sent to your University account, go to <http://accounts.pitt.edu>, log into your account, click on Edit Forwarding Addresses, and follow the instructions on the page. Be sure to log out of your account when you have finished. (For the full E-mail Communication Policy, go to [here](#).)

Classroom Recording Policy:



This course will adhere to the University's Senate Educational Policy Committee recommendation on classroom recording of May 4, 2010:

To ensure the free and open discussion of ideas, students may not record classroom lectures, discussions, recitations, and/or other activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

Generally, classes will NOT be recorded. This may change due to University policies on Covid or other accommodations. Students will be notified if a class will be recorded. No student will appear in a recording without their informed consent.

Intellectual Property Policy:

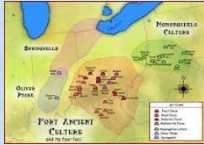


Per the University's [policies regarding copyright and intellectual property](#), the instructor retains the rights to all original course materials – including, but not limited to, lectures, lecture notes, Power Point or other presentations, assignments, quizzes, exams, papers, diagrams, etc. – and none of this material may be used, shared, or reproduced in any way, for other than a **student's own private educational use.**

In addition, legal rights for all third-party materials, whether used by direct permission or under the Fair Use educational rules, is fully retained by the original

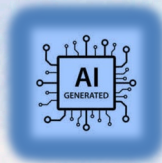
authors. None of this material may be used, shared, or reproduced in any way, for other than a student's own private educational use, **unless permission is granted by the original authors or sources.**

University of Pittsburgh Land Acknowledgement:



We recognize that the University of Pittsburgh occupies the ancestral land of the [Adena culture](#), [Hopewell culture](#), and [Monongahela peoples](#), who were later joined by refugees of other tribes (including the Delaware, Shawnee, and Haudenosaunee), driven here from their homelands by colonizers. We honor these traditional Native inhabitants of this place and uplift their historic, unique, and enduring relationship with this land, which is their ancestral territory. We pay our respects to their Elders and their past, present, and future people, community, and culture. While we cannot change the past, we commit to continued gratitude for the gifts of nature, along with ongoing respect, care, and stewardship of the land, each other, and future generations. [Learn More About Pitt's Land Acknowledgement.](#)

Use of Generative AI Permitted/Encouraged Within Specified Guidelines:



Generative AI is a new and exciting tool for doing scholarly work. The ability to use this tool will be an important skill for the 21st century. Therefore, the use of Generative AI tools, including ChatGPT, is encouraged/permitted in this course for students who wish to use them. You may choose to use AI tools to help brainstorm assignments or projects or to revise existing work you have written, or to compare answers and reasoning. However, there are risks as well as benefits to this new tool. In order to adhere to scholarly values, students must cite any AI-generated material that informed their work (this includes in-text citations and/or use of quotations, and in your reference list). Using an AI tool to generate content without proper attribution qualifies as academic dishonesty.

“Exploration is in our nature. We began as wanderers, and we are wanderers still. We have lingered long enough on the shores of the cosmic ocean. We are ready at last to set sail for the stars.”

~ Carl Sagan, Cosmos (1980)