

Astronomy 2020: Space Astronomy and Space Exploration
Professor Jack Burns, Ph.D.

Department of Astrophysical & Planetary Sciences

Office: Stadium 120B (enter Stadium between Gates 3 and 4)

Office Hours: Tuesday, 3-4 pm, Wednesday 1-2 pm, or by appointment

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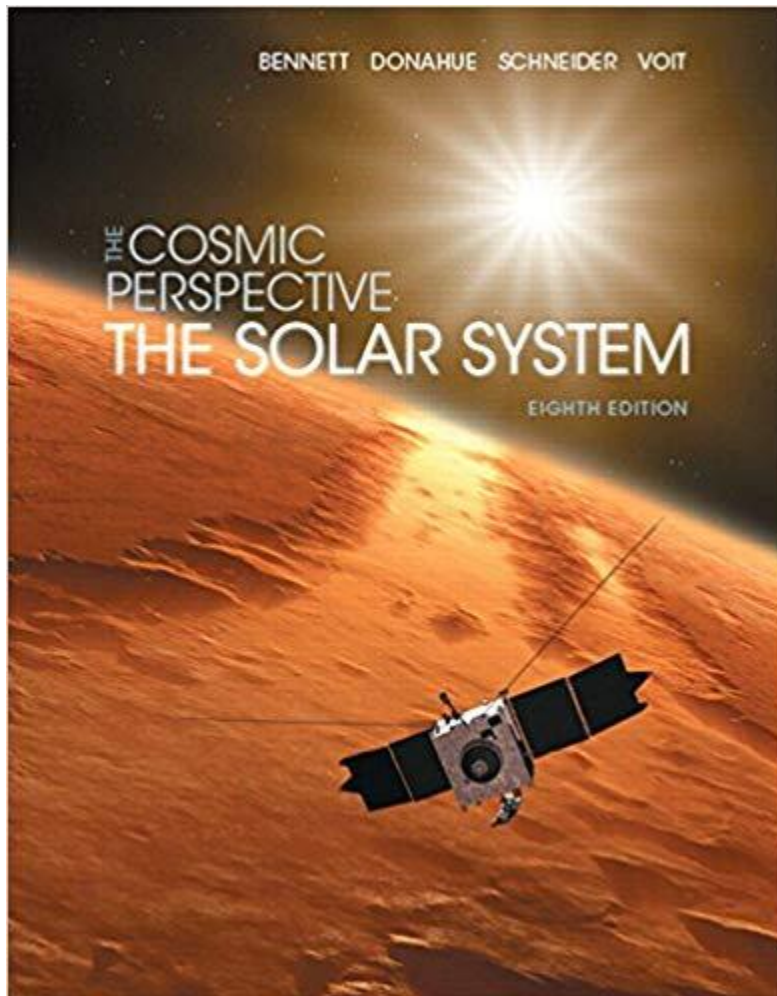
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Class Textbook:



Cosmic Perspective: The Solar System

by J. Bennett, M. Donahue, N. Schneider, M. Voit, 2017, ISBN 0-134-05906-9

Course Description:

Astronomy 2020: Space Astronomy and Space Exploration covers physical principles of performing astronomy and human exploration in space. The basic design of launch vehicles and spacecraft, orbital dynamics, and instruments will be described in the context of specific space missions (e.g., Hubble Space Telescope, Mars rovers, other planetary probes) as well as prospects for future space observatories in orbit and on the Moon. The balance between technology and science, humans and robots, as well as near-term and long-term exploration destinations will be discussed. *Astronomy 2020* is an excellent introduction to space science and space engineering for first or second year undergraduates. This class is approved for the campus Space Minor and for the Arts and Sciences core curriculum: natural science.

Course Prerequisites:

None.

Course Objectives:

1. How do we explore space with humans and robots?
2. How does the U.S. history in space with the Apollo program, the Space Shuttle, and the International Space Station prepare us for further space exploration?
3. How will robotic and human spacecraft travel to the Moon and Mars? What are the challenges of living on an alien, hostile world? Where else might we explore in the solar system?
4. What will we learn about the cosmos from the Hubble Space Telescope, the James Webb Space Telescope, X-ray observatories, and low frequency telescopes on the farside of the Moon?

Strategies for Reaching the Objectives:

- **Come to class!** Plan on attending every meeting of this class. If you miss a class, you will lose points.
- Stay up with the reading. There will be assigned reading from the textbook or from webpages before each class.
- Take the homework assignments and class discussion seriously. They will represent important parts of your grade. Exam questions will come from homework, reading assignments, class clicker and short-answer questions, and class discussion.
- Discuss the class and homework with other students, and then turn in your own work. Testing your ideas against others is an important way to learn.
- Take advantage of office hours to ask questions.

Class Web page:

<http://lunar.colorado.edu/~jaburns/astr2020>

Homework Assignments:

There will be regular homework assignments based upon the assigned reading, class lecture, and class discussion. The assignments will be mainly short answers. Both essay and calculation problems will be assigned. **Late homeworks will be accepted but only 50% maximum credit can be earned for the late assignment.**

Exams:

There will be 3 in-class mid-term exams and a Final Comprehensive Exam during the semester. The exams will be a combination of multiple choice and short answer questions. The lowest of the 3 midterms will be dropped. **As a result NO make-up exams will be given.**

The exams will be closed book. However, students may bring one sheet of paper (front and back) with notes for each exam.

In-Class Participation, Short Answer Questions & Clickers:

Regular individual participation in class discussion is a critical part of this class. Each student will have a wireless student response system ("iClicker"). **You must bring your clicker to each class!** Several times each class, you will be asked questions designed to get you to think carefully about some of the concepts that we are discussing in class. You will respond either in writing with a short answer or via a multiple-choice clicker system. You will be asked to talk with your neighbors before answering, so you can help each other to figure out the correct answer. Use of the clickers and response to written, short-answer questions:

- Improves your grades (everyone's grades!). When you discuss & debate with others, your knowledge improves.
- Gives YOU immediate feedback on what you do and do not understand.
- Tells your instructor what the class doesn't understand.
- Greatly improves class participation.

We will sometimes start class with a clicker or short-answer question based upon the assigned reading. So, do your reading before class!

You are entitled to 2 "free" days where your lowest clicker or short answer scores will be dropped. If you are sick for a day, have a family emergency, or your clicker stops working, this should cover you. You can miss up to 2 classes without it hurting you.

You will need to register your clicker to get credit for your answers. Instructions on registration of your iClicker are simple. Just go to MyCUinfo (<https://portal.prod.cu.edu/MyCUInfoFedAuthLogin.html>), to the "student" tab, and then to button

that says "CUClicker Registration". Enter your clicker ID where it says to register clickers. Please do this as soon as you purchase your clicker. **Buy extra batteries for your clicker now!**

Each student will have a wireless student response system ("clicker"). You must bring your clicker to each class! About 2-3 times each class, you will be asked questions designed to get you to think carefully about some of the concepts that we are discussing in class. Often, you will be asked to talk with your neighbors before answering, so you can help each other to figure out the correct answer. Use of the clickers:

- * Improves your grades (everyone's grades!). When you discuss and debate with others, your knowledge improves.
- * Gives YOU immediate feedback on what you do and do not understand.
- * Tells your instructor what the class doesn't understand.
- * Greatly improves class participation.

We will sometimes start class with a clicker question based on the assigned reading. *So, do your reading before class!*

*You are entitled to 5 "free clicker" days where your lowest clicker scores will be dropped. *If you are sick for a day, have a family emergency, or your clicker stops working, this should cover you. You can miss up to 5 classes without it hurting you.

You will need to register your clicker to get credit for your answers.

Instructions on registration of your iClicker are simple. Just go to MyCUinfo , to the

"student" tab, and then to button that says "CUClicker Registration".

Enter your clicker ID where it says to register clickers. Please do this as soon as you purchase your clicker.

Buy extra batteries for your clicker now!

Class PowerPoint Lecture Notes

Class PowerPoint presentations will be placed on the Astr 2020 website AFTER each lecture. The format will be PDF with 6 slides per page so you can easily print out the notes. A link to each PowerPoint presentation can be found in the drop-down menu "Schedule" under the date of the lecture.

Fiske Planetarium

We will conduct a number of classes this semester at the Fiske Planetarium (near Regent Drive and Kittridge Loop Drive).

In addition, the Planetarium has FREE (show your student ID) shows every Thursday night. You can gain extra credit points by attending these shows! By attending a show during the semester and writing a one-page summary, you will be awarded 5 extra points on one of your mid-term exams.

Schedule of Planetarium shows is at <http://fiske.colorado.edu/>.

***Space in the News* Extra Credit**

Each Thursday, there will be an opportunity for one student to present a summary and then lead a brief discussion of an on-line article about recent developments in Space Science and Human Space Exploration. This presentation will be worth up to 5 extra credit points (depending upon the quality of the presentation) on one of your mid-term exams. Volunteers will be solicited regularly via E-mail and in class. Possible sources of on-line news include space.com, spacedaily.com, [the spacereview.com](http://the.spacereview.com) and <http://science.nasa.gov>.

Religious Observances:

Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please contact me in advance of the religious observation to make arrangements. See details at <http://www.colorado.edu/policies/observance-religious-holidays-and-absences-classes-andor-exams>.

Discrimination and Harassment:

The University of Colorado Boulder (CU Boulder) is committed to maintaining a positive learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct, discrimination, harassment or related retaliation against or by any employee or student. CU's Sexual Misconduct Policy prohibits sexual assault, sexual exploitation, sexual harassment, intimate partner abuse (dating or domestic violence), stalking or related retaliation. CU Boulder's Discrimination and Harassment Policy prohibits discrimination, harassment or related retaliation based on race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Individuals who believe they have been subject to misconduct under either policy should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127. Information about the OIEC, the above referenced policies, and the campus resources available to assist individuals regarding sexual misconduct, discrimination, harassment or related retaliation can be found at the [OIEC website](#).

Classroom Behavior:

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester.

so that I may make appropriate changes to my records. For more information, see the policies on [classroom behavior](#) and the [Student Code of Conduct](#).

Academic Integrity:

The Boulder campus has an [Academic Integrity Policy](#) and a [student Honor Code](#). I will follow the approved procedures should violations be perceived. The campus has been working diligently to make this process work better and to provide guidance on 'gray areas' at the [Honor Code website](#).

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to [the academic integrity policy](#). Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, resubmission, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code Council as well as academic sanctions from me. Additional information regarding the academic integrity policy can be found at the [Honor Code Office website](#).

When in doubt about plagiarism, paraphrasing, quoting, or collaboration, consult with me.

Disability Services:

If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and www.colorado.edu/disabilityservices. Disability Services' letters for students with disabilities indicate legally mandated reasonable accommodations. Answers to Frequently Asked Questions can be found at www.colorado.edu/disabilityservices. If you have a temporary medical condition or injury, see [Temporary Medical Conditions](#) under the Students tab on the Disability Services website and discuss your needs with me.

Email:

I will be communicating weekly with you via email on class assignments, homework, *Space in the News* articles, etc. It is essential that you log onto your official CU email account at least twice weekly to read these communications!

Grading:

Your final grade will be based upon:

- 10% on "clicker questions" and student class exercises conducted each class session. Clicker and short-answer questions will be graded 1 point for any answer and 2 points for the correct answer. Your 2 lowest Clicker and short-answer score days will be dropped.

- 25% on homework.
- 35% for mid-term exams (total of 3 midterms will be given but the lowest will be dropped).
- 30% on the comprehensive Final Exam.



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