

Astronomy 201
Cosmology (Tier II Natural Sciences)
(Fall 2020)

LECTURES

12:30 PM - 1:45 PM TuTh online at <https://arizona.zoom.us/j/91838307354>

INSTRUCTOR

Prof. Vasileios (Vasilis) Paschalidis

Email: vpaschal@email.arizona.edu

Prof. Paschalidis' Office hours and zoom link: Friday 11:00am - 12:30pm,

<https://arizona.zoom.us/j/97159511909>

TEACHING ASSISTANT

Haowen Zhang

Email: hwzhang0595@email.arizona.edu

Haowen Zhang's office hours and zoom link: Tuesday 9:00am-10:30am,

<https://arizona.zoom.us/j/99758204497>

COURSE DESCRIPTION

- This class is scheduled to be taught in the LIVE ONLINE modality.
- Cosmology is the study of the origin and evolution of the Universe. We will cover modern knowledge of stars, black holes, galaxies, and spacetime, as well as the human stories of discovery behind this knowledge. We will also review common scientific approaches to understanding the world, and how they are relevant to decision-making on Earth.

PREREQUISITES

There are no formal prerequisites for this class.

LEARNING OUTCOMES

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

- describe human motivations to do science, including cosmology;
- describe approaches that helped us understand the Universe, and the relevance of those approaches to your life;
- list major components of the Universe (e.g., planets, stars, galaxies, dark matter, dark energy) and draw relationships between them;
- describe relationships between mass, energy, space, and time;
- describe the future of the Universe and the Solar System;
- improve your ability to speak and write about your knowledge;

- improve your consciousness of and control over how you think.

These learning outcomes will be met through the attendance of lectures, in-class writing, out-of-class guided calculations, an out-of-class letter-writing project, and a final exam.

LECTURES

Students attending lectures are expected to devote their full attention to learning. **You may use a cell phone or laptop to connect through zoom, but may not use a device other than the one you use to connect during class, unless you have specific accommodation from the Disability Resource Center.** Students disobeying this rule will lose participation points for the day, and in case of multiple infractions may be administratively withdrawn from the class.

IN-CLASS WRITING

Many class lectures will contain an in-class writing session, which will give participation points for completion. The general topic (but not the specific prompt) will be posted at the beginning of class, so that you can better direct your attention during lectures. Grading will be on a 1-point scale: 1 point for making a reasonable effort to answer the question, and 0 points otherwise. **Up to three missed or 0-point in-class writing assignments will be automatically excused.** These writing assignments will contribute 25% of your final grade.

GUIDED CALCULATIONS

Science can provide deeper insights into questions that then shape our decisions about the future. We will have weekly homeworks containing guided calculations, partially to help you understand concepts better, and partially to show how science can help with decision-making. Homeworks are due in class on the date indicated on each assignment. If an assignment is turned in late within the same week as the due date (i.e., by Friday 5pm), 10% will be deducted from the assignments grade. If the assignment is turned in during the following week, 50% will be deducted from the assignments grade. No points will be given to assignments turned in later than the following week. These homeworks will contribute 25% of your final grade.

OFFICE HOURS

Office hours will occur every week, and we strongly encourage you to take advantage of them. **We both want you to succeed!** We also strongly encourage you to join a group of other students. While all work must be your own, it is a very helpful learning process to compare with other's results and to explain to others why you got the answers you did. Each time you attend office hours and participate, we will increase your average homework grade by 1%, up to a maximum of 10%.

LETTER

As part of the course, you will be asked to write and send electronically a letter to an important non-family member (e.g., former teacher, coach, pastor, etc.) to describe a scientific advance of your choice and how it has impacted your life. This letter should be at least three single-spaced pages (1500 words) and contain:

- An introduction: why you are writing the letter (“My cosmology class requires us to. . .”).

- The history of the scientific advance: when and how it was discovered.
- An explanation of how the advance or technology works.
- How the world as a whole was different before and after the advance. You should provide *numerical* examples: e.g., 100,000 lives saved per year.
- The impact of the advance on you, personally: explain how your life would have been much different without the advance.
- Conclusion: thank the teacher/principal for their time spent reading the letter, as well as for their time spent teaching you.

We will give you both a 10% bonus on the letter as well as feedback to help you improve if you give us a draft by October 22nd. The letter will contribute 15% of your final grade and will be due on November 5th.

IN-CLASS QUIZZES

Several short, in-class quizzes will occur throughout the semester. These will be announced in class, at least a week in advance. You will not be asked to calculate numerical answers on the quizzes, but you may be asked to write paragraph-length responses, label features on graphs, draw connections between topics, and other quantitative questions that do not involve direct calculation. These in-class quizzes will contribute 20% of your final grade; your lowest quiz grade will be automatically dropped.

FINAL EXAM

The final exam will have two essay questions and one drawing/short-answer question. Here are some examples of what final exam questions **may be like**:

- In what way did this course change the way you think about your own life? Provide specific examples.
- Imagine that you were given Supreme Control of everything except Planet Earth (i.e., the other planets in the Solar System, the Sun, the rest of the Milky Way galaxy, etc.) and could move or change anything you wanted. What could you do to make life on Earth better?
- Draw pictures of an ant, an atom, a black hole, the Earth, a galaxy, a human, a neutron star, the Sun, and the entire Universe, **in order of smallest to largest**. For each adjacent pair of pictures, write how many times larger are the sizes of the larger objects (as in distances: e.g., a humans height is X times larger than an ants). For each of these numbers, write down something on Earth that has the same numerical value within a factor of 10 (e.g., if one object is 100 times larger than another, you could say The average weight of a human is 137 pounds, which has a similar numerical value.).

The final exam will make up 15% of your grade and take place on December 7th from 12:30pm-14:30pm. You will be allowed one page (front and back) of notes, which you will have to turn in with your exam. The exam will be proctored on zoom. Each student will be assigned their own breakout room and the student web-cam will need to be activated.

The student laptop/phone should be sufficiently far away from the student so that the view covers the student and their worksheets.

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: [web browser, Adobe Acrobat, zoom plug-in]. To upload your work on D2L you will also need a device to scan your writings, solutions etc. Taking a picture with your phone can work well. If you have multiple pages of solutions/writings for a given activity, you may take multiple pictures, but please make sure you upload one document on D2L (preferably in pdf format).

COURSE WEBSITE

We will be using D2L for the course. All answers to quizzes, homeworks and the final exam will be uploaded on D2L under the Assignments Tab.

CLASS RECORDINGS

For lecture recordings, which are used at the discretion of the instructor, students must access content in D2L only. 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.

SCHEDULE

- August 25, 27: Syllabus, History of Human Connection to the Sky; Reading Chapter 1
- September 1, 3: History of Modern Cosmology; Reference Frames; Reading Chapter 2
- September 8, 10: Stars; Reading Chapter 16
- September 15, 17: Supernovae, Neutron Stars, Black Holes; Reading Chapter 23
- September 22, 24: General Relativity and Spacetime; Reading Chapter 24
- September 29, October 1: Gravitational Waves; Reading Chapter 24
- October 6, 8: Galaxies and The Expanding Universe; Reading Chapter 26
- October 13, 15: The Big Bang and Nucleosynthesis; ; Reading Chapter 29
- October 20, 22: **Letter draft due (10/22)**; Dark Matter and Dark Energy; Reading Chapter 25
- October 27, 29: Fate and Future of the Universe
- November 3, 5: Effect of Cosmology on Life; **Letter due (11/5)**; Reading Chapter 30

- November 10, 12: Higgs Boson and Particle Physics
- November 17, 19: Quantum Gravity and Theories of Everything
- November 24, December 1: Time Warps and Worm Holes, Remaining Q's
- December 5: Course Review
- December 7: Final Exam (12:30pm-14:30pm)

GRADING

The correspondence between average course grade and letter grades will be:
A:85%–100%; **B:**70%–84.99%; **C:**60%–69.99%, **D:**50%–59.99%; **F:** less than 50.00%.

If you feel like you are working hard in the course but are not getting at least a C, please talk to us! We don't want you to struggle in silence. As a reminder, the grading weights are: in-class writing (25%), guided calculations (25%), letter (15%), quizzes (20%), and final exam (15%).

Incomplete/Withdrawal: Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

TEXTS

There is no official text for this course. The optional textbook is free to download: [OpenStax Astronomy](#).

ATTENDANCE

Students are expected to attend all lectures. Please turn off cell phones during class if using a laptop to connect, and refrain from extraneous talking, distracting/discourteous behavior

The UA policy concerning Class Attendance, Participation, and Administrative Drops is available at:

<http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>.

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment>

Due to the covid-19 pandemic always keep in mind

- 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.

CODE OF ACADEMIC INTEGRITY

Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

UA NONDISCRIMINATION AND ANTI-HARASSMENT POLICY

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment>

ACCESSIBILITY AND ACCOMMODATIONS

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, <https://drc.arizona.edu/>) to establish reasonable accommodations.

ACADEMIC ADVISING

If you have questions about your academic progress this semester, or your chosen degree program, please note that advisors at the **Advising Resource Center** can guide you toward university resources to help you succeed.

LIFE CHALLENGES

If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of **Students Office** can be reached at 520-621-2057 or DOS-deanofstudents@email.arizona.edu.

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.

SUBJECT TO CHANGE STATEMENT

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.